# Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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where:

x the first digit:

1 presented to TSG for information;

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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

**shall** indicates a mandatory requirement to do something

**shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

**should** indicates a recommendation to do something

**should not** indicates a recommendation not to do something

**may** indicates permission to do something

**need not** indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

**can** indicates that something is possible

**cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

**will** indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**will not** indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**might** indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

**might not** indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

**is** (or any other verb in the indicative mood) indicates a statement of fact

**is not** (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

# 1 Scope

The present document specifies requirements for support of Radio Resource Management for the FDD and TDD modes of Evolved UTRA. These requirements include requirements on measurements in UTRAN and the UE as well as requirements on node dynamical behaviour and interaction, in terms of delay and response characteristics.

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

● References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

● For a specific reference, subsequent revisions do not apply.

● For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TS 36.304: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) procedures in idle mode"

[2] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC) protocol specification".

[3] 3GPP TS 36.213: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures"

[4] 3GPP TS 36.214: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer; Measurements"

[5] 3GPP TS 36.101: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception"

[6] 3GPP TS 25.302: "Services provided by the Physical Layer".

[7] 3GPP TS 25.331: "RRC Protocol Specification".

[8] 3GPP TS 45.008: "Radio subsystem link control".

[9] 3GPP TS 45.005: "Radio transmission and reception".

[10] 3GPP TS 45.010: "Radio subsystem synchronization".

[11] 3GPP2 C.S0024-B: "cdma2000 High Rate Packet Data Air Interface Specification".

[12] 3GPP2 C.S0002-D: "Physical Layer Standard for cdma2000 Spread Spectrum Systems - Release A".

[13] 3GPP2 C.S0033-B: "Recommended Minimum Performance Standards for cdma2000 High Rate Packet Data Access Terminal".

[14] 3GPP2 C.S0011-C: "Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Mobile Stations".

[15] 3GPP2 C.S0005-D: Upper Layer (Layer 3) Signaling Specification for cdma2000 Spread Spectrum Systems

[16] 3GPP TS 36.211: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation”

[17] 3GPP TS 36.321: "Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification".

[18] 3GPP TS 25.133: "Requirements for Support of Radio Resource Management (FDD)".

[19] 3GPP TS 25.123: "Requirements for Support of Radio Resource Management (TDD)".

[20] 3GPP TS 25.214: "Physical layer procedures (FDD)".

[21] 3GPP TS 36. 212 "Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding".

[22] 3GPP TS 36.302: "Evolved Universal Terrestrial Radio Access (E-UTRA); Services provided by the physical layer".

[23] 3GPP TS 36.521-3: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 3: Radio Resource Management conformance testing".

[24] 3GPP TS 36.355: "Evolved Universal Terrestrial Radio Access (E-UTRA); LTE Positioning Protocol (LPP)".

[25] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2"

[26] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[27] 3GPP TS 37.320: "Universal Terrestrial Radio Access (UTRA) and Evolved Universal Terrestrial Radio Access (E-UTRA); Radio measurement collection for Minimization of Drive Tests (MDT); Overall description; Stage 2"

[28] 3GPP TS 36.423: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 Application Protocol (X2AP)".

[29] 3GPP TS 25.101: "UE Radio transmission and reception (FDD)".

[30] 3GPP TS 36.104: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception".

[31] 3GPP TS 36.306: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio access capabilities".

[32] IEEE Standard 802.11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications.

[33] 3GPP TS 23.303: "Technical Specification Group Services and System Aspects; Proximity-based services (ProSe); Stage 2".

[34] 3GPP TS 24.008: "Mobile radio interface Layer 3 specification; Core network protocols; Stage 3".

[35] 3GPP TS 36.171: " Requirements for Support of Assisted Global Navigation Satellite System (A-GNSS)".

[36] 3GPP TS 36.305: " Stage 2 functional specification of User Equipment (UE) positioning in E-UTRAN".

[37] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in idle mode".

[38] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

[39] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[40] 3GPP TS 37.340: “Evolved Universal Terrestrial Radio Access (E-UTRA) and NR; Multi-connectivity”, Stage 2.

[41] 3GPP TS 38.101: "NR; User Equipment (UE) radio transmission and reception".

[42] 3GPP TS 38.211: "NR; Physical channels and modulation”.

[43] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".

[44] 3GPP TS 38.212 "NR; Multiplexing and channel coding".

[45] 3GPP TS 38.202: "NR; Physical layer services provided by the physical layer".

[46] 3GPP TS 38.300: "NR; Overall description; Stage-2".

[47] 3GPP TS 38.423: "NG-RAN; Xn Application Protocol (XnAP)".

[48] 3GPP TS 38.104: "NR; Base Station (BS) radio transmission and reception".

[49] 3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities".

[50] 3GPP TS 38.133: "NR; Requirements for support of radio resource management "

[51] 3GPP TS 38.214: " New Radio (NR); Physical layer procedures".

[52] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[53] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".

[54] 3GPP TS 38.101-3: "NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".

[55] 3GPP TS 38.101-4: "NR; User Equipment (UE) radio transmission and reception; Part 4: Performance requirements".

[56] 3GPP TS 24.368: "Non-Access Stratum (NAS) configuration Management Object (MO)"

[57] 3GPP TS 37.213: "Physical layer procedures for shared spectrum channel access"

[58] 3GPP TS 38.215: "NR; Physical layer measurements".

[59] 3GPP TS 37.355: "LTE Positioning Protocol (LPP)"

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [26] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [26].

**Any Cell Selection state**: as defined in TS 36.304 [1]

**Asynchronous Dual Connectivity:** As defined in TS 36.331 [2].

**Carrier aggregation:** aggregation of two or more component carriers in order to support wider transmission bandwidths TS 36.104 [30].

**Dual Connectivity:** As defined in TS 36.331 [2].

**EN-DC:** E-UTRA-NR Dual Connectivity as defined in TS 37.340 [41, Section 4.1.2].

**en-gNB**: As defined in TS 37.340 [41].

**Extended IDLE-mode DRX:** extended DRX cycles in IDLE mode as specified in TS 24.008 [34], where one extended DRX cycle is a time period between two first paging occasions within two consecutive PTWs.

**Extended CONNECTED-mode DRX:** extended DRX cycles in CONNECTED mode as specified in TS 36.331 [2].

**FeMBMS/Unicast mixed cell:** an MBMS/Unicast cell performing MBMS transmissions as defined in TS 36.300 [25].

**Frame Structure 3**: frame structure type 3 as defined in TS 36.211 [16]

**gNB**: as defined in TS 38.300 [46]

**High operating band:** an operating band with a higher downlink frequency with respect to another, low, operating band.

**Inter-band carrier aggregation:** carrier aggregation of component carriers in different operating bands TS 36.104 [30].

**Intra-band contiguous carrier aggregation:** contiguous carriers aggregated in the same operating band TS 36.104 [30].

**Intra-band non-contiguous carrier aggregation:** non-contiguous carriers aggregated in the same operating band TS 36.104 [30].

**IDC autonomous denial subframes:** The maximum number of uplink subframes in which the UE is allowed not to transmit E-UTRAN signals when configured with IDC autonomous denial (TS 36.331 [2]).

**IDC autonomous denial validity:** It is the period over which the autonomous denial subframes are counted (TS 36.331 [2]).

**IDC solution:** This refers to DRX or IDC autonomous denial configured by eNodeB in response to receiving InDeviceCoexIndication from the UE (TS 36.331 [2]).

**Low operating band:** an operating band with a lower downlink frequency with respect to another, high, operating band.

**Master Cell Group:** As defined in TS 36.331 [2].

**Master eNB:** As defined in TS 36.300 [25].

**MBSFN ABS:** ABS configured in MBSFN-configurable subframe.

**NB-IoT Cell**: A cell for NB-IoT.

**NB-IoT**: As defined in TS 36.331 [2].

**ng-eNB**: As defined in TS 38.300 [46].

**NE-DC**: NR-E-UTRA Dual Connectivity as defined in clause 4.1.3.2 of TS 37.340 [41].

**NGEN-DC**: NG-RAN E-UTRA-NR Dual Connectivity as defined in clause 4.1.3.1 of TS 37.340 [41].

**Non-MBSFN ABS**: ABS configured in any downlink subframe.

**Normal Performance Group:** For UE which supports Increased UE carrier monitoring UTRA or E-UTRA the group of inter-frequency carriers or inter-RAT carriers is divided into two groups. The groupwhich has a better delay performance compared to the other group is refered to as the normal performance group.

**Paging Time Window:** As defined in TS 24.008 [34].

**Primary Cell**: As defined in TS 36.331 [2].

**ProSe Direct Communication**: As defined in TS 23.303 [33]

**ProSe Direct Discovery**: As defined in TS 23.303 [33]

**Primary SCell:** As defined in TS 36.331 [2].

**Primary Secondary Timing Advance Group**: Timing Advance Group containing the PSCell.

**Primary Timing Advance Group**: Timing Advance Group containing the PCell.

**Reduced Performance Group:** For UE which supports Increased UE carrier monitoring UTRA or E-UTRA the group of inter-frequency carriers or inter-RAT carriers is divided into two groups. The groupwhich has worse delay performance compared to the other group is refered to as the reduced performance group

**Secondary Cell**: As defined in TS 36.331 [2].

**Secondary eNB**: As defined in TS 36.300 [25].

**Serving Cell**: As defined in TS 36.331 [2].

**Secondary Cell Group:** As defined in TS 36.331 [2].

**Secondary Timing Advance Group**: As defined in TS 36.331 [2].

**SSB:** SS/PBCH block as defined in TS 38.211 [42, section 7.4.3].

**sTTI** : A transmission time interval (TTI) of either one slot or one subslot transmission duration as defined in TS 36.211 [16] on either uplink or downlink.

**Synchronous Dual Connectivity:** As defined in TS 36.331 [2].

**TDD-FDD carrier aggregation:** Carrier aggregation of component carriers in E-UTRA TDD and E-UTRA FDD operating bands TS 36.104 [30].

**Timing Advance Group**: As defined in TS 36.331 [2].

**WLAN RSSI:** As defined in TS36.214 [4].

**x\_RA**: x-to-RS EPRE ratio for the channel or physical signal x in all transmitted OFDM symbols not containing RS.

**x\_RB**: x-to-RS EPRE ratio for the channel or physical signal x in all transmitted OFDM symbols containing RS.

## 3.2 Symbols

For the purposes of the present document, the following symbols apply:

[…] Values included in square bracket must be considered for further studies, because it means that a decision about that value was not taken.

BWChannel Channel bandwidth, defined in TS 36.101 subclause 3.2

CPICH\_Ec Average energy per PN chip for the CPICH

CPICH\_Ec/Io The ratio of the received energy per PN chip for the CPICH to the total received power spectral density at the UE antenna connector.

Ec Average energy per PN chip.

Ês Received energy per RE (power normalized to the subcarrier spacing) during the useful part of the symbol, i.e. excluding the cyclic prefix, at the UE antenna connector

Io The total received power density, including signal and interference, as measured at the UE antenna connector.

Ioc The power spectral density (integrated in a noise bandwidth equal to the chip rate and normalized to the chip rate) of a band limited noise source (simulating interference from cells, which are not defined in a test procedure) as measured at the UE antenna connector.

Iot The received power spectral density of the total noise and interference for a certain RE (power integrated over the RE and normalized to the subcarrier spacing) as measured at the UE antenna connector

NSCH\_RP Received (linear) average power of the resource elements that carry Narrowband synchronisation signal, measured at the UE antenna connector

 The power spectral density of a white noise source (average power per RE normalised to the subcarrier spacing), simulating interference from cells that are not defined in a test procedure, as measured at the UE antenna connector

 Number of consecutive downlink positioning subframes as defined in clause 6.10.4.3 in TS 36.211

 Physical Resource Block number as defined in clause 3.1 in TS 36.211.

 Timing offset between uplink and downlink radio frames at the UE, as defined in clause 3.1 in TS 36.211.

 Fixed timing advance offset, as defined in clause 3.1 in TS 36.211.

 Configured UE transmitted power as defined in clause 6.2.5 in TS 36.101.

 Configured UE transmitted power on a serving cell *c* as defined in clause 6.2.5A in TS 36.101.

PRP Received (linear) average power of the resource elements that carry E-UTRA PRS, measured at the UE antenna connector.

S Cell Selection Criterion defined in TS 36.304, subclause 5.2.3.2 for E-UTRAN

SCH\_Ec/Ior The ratio of the transmit energy per PN chip of the SCH to the total transmit power spectral density at the UTRA Node B antenna connector

SCH\_RP Received (linear) average power of the resource elements that carry E-UTRA synchronisation signal, measured at the UE antenna connector

Srxlev Cell selection RX level, defined in TS 36.304, subclause 5.2.3.2

Squal Cell selection quality, defined in TS 36.304, subclause 5.2.3.2

Sintersearch Defined in TS 25.304, subclause 5.2.6.1.5

Sintrasearch Defined in TS 25.304, subclause 5.2.6.1.5 for UTRAN and in TS 36.304 , subclause 5.2.4.7 for E-UTRAN

Snonintrasearch Defined in TS 36.304 , subclause 5.2.4.7

SsearchRAT Defined in TS 25.304, subclause 5.2.6.1.5

Threshx, high Defined in TS 36.304 , subclause 5.2.4.7

Threshx, low  Defined in TS 36.304 , subclause 5.2.4.7

Threshserving, low Defined in TS 36.304 , subclause 5.2.4.7

 Cell-specific positioning subframe configuration period as defined in clause 6.10.4.3 in TS 36.211

TRE-ESTABLISH-REQ The RRC Re-establishment delay requirement, the time between the moment when erroneous CRCs are applied, to when the UE starts to send preambles on the PRACH.

Treselection Defined in TS 25.304, subclause 5.2.6.1.5

TreselectionRAT Defined in TS 36.304 , subclause 5.2.4.7

TreselectionEUTRA Defined in TS 36.304 , subclause 5.2.4.7

TreselectionUTRA Defined in TS 36.304 , subclause 5.2.4.7

TreselectionGERA Defined in TS 36.304 , subclause 5.2.4.7

Ts Basic time unit, defined in TS 36.211, clause 4

Tc Reference time unit, defined in TS 38.211, subclause 4.1

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [26] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [26].

1x RTT CDMA2000 1x Radio Transmission Technology

ABS Almost Blank Subframe

ARQ Automatic Repeat Request

AP Access Point

AWGN Additive White Gaussian Noise

BCCH Broadcast Control Channel

BCH Broadcast Channel

CA Carrier Aggregation

CC Component Carrier

CCA Clear Channel Assessment

CCCH SDU Common Control Channel SDU

CE Coverage Enhancement

CGI Cell Global Identifier

CPICH Common Pilot Channel

CPICH Ec/No CPICH Received energy per chip divided by the power density in the band

CRS Cell-specific Reference Signals

C-RNTI Cell RNTI

CSI Channel-State Information

CSI-RS CSI Reference Signal

DAPS Dual Active Protocol Stack

DC Dual Connectivity

DCCH Dedicated Control Channel

DL Downlink

DMTC Discovery signal Measurement Timing Configuration

DRX Discontinuous Reception

DTCH Dedicated Traffic Channel

DUT Device Under Test

E-CID Enhanced Cell-ID (positioning method)

ECGI Evolved CGI

eDRX\_IDLE Extended IDLE-mode DRX

eDRX\_CONN Extended CONNECTED-mode DRX

eNB E-UTRAN NodeB

EN-DC E-UTRA-NR Dual Connectivity

E-SMLC Enhanced Serving Mobile Location Centre

E-UTRA Evolved UTRA

E-UTRAN Evolved UTRAN

FDD Frequency Division Duplex

FS3 Frame Structure type 3

GERAN GSM EDGE Radio Access Network

GNSS Global Navigational Satellite System

GSM Global System for Mobile communication

HARQ Hybrid Automatic Repeat Request

HD-FDD Half-Duplex FDD

HO Handover

HRPD High Rate Packet Data

IDC In-Device Coexistence

IEEE Institute of Electrical and Electronics Engineers

LBT Listen before talk

LPP LTE Positioning Protocol

LWA LTE-WLAN Aggregation

MAC Medium Access Control

MCG Master Cell Group

MeNB Master eNB

MBMS Multimedia Broadcast Multicast Service

MBSFN Multimedia Broadcast multicast service Single Frequency Network

MBSFN ABS MBSFN Almost Blank Subframe

MDT Minimization of Drive Tests

MGRP Measurement Gap Repetition Period

MIB Master Information Block

MPDCCH MTC Physical Downlink Control Channel

NCSG Network Controlled Small Gap

NE-DC NR-E-UTRA Dual Connectivity

NG-RAN NG Radio Access Network

NGEN-DC NG-RAN E-UTRA-NR Dual Connectivity

NR New Radio

NSA Non-standalone

NPBCH Narrowband Physical Broadcast CHannel

NPDCCH Narrowband Physical Downlink Control CHannel

NPDSCH Narrowband Physical Downlink Shared CHannel

NPRACH Narrowband Physical Random Access CHannel

NPUSCH Narrowband Physical Uplink Shared CHannel

NPSS Narrowband Primary Synchronization Signal

NRS Narrowband Refernce Signal

NRSRP Narrowband Reference Signal Received Power

NRSRQ Narrowband Reference Signal Received Quality

NSCH Narrowband Synchronization Channel

NSSS Narrowband Secondary Synchronization Signal

OCNG OFDMA Channel Noise Generator

OFDM Orthogonal Frequency Division Multiplexing

OFDMA Orthogonal Frequency Division Multiple Access

OTDOA Observed Time Difference of Arrival

PBCH Physical Broadcast Channel

PCC Primary Component Carrier

P-CCPCH Primary Common Control Physical Channel

PCell Primary Cell

PCFICH Physical Control Format Indicator CHannel

PDCCH Physical Downlink Control CHannel

PDSCH Physical Downlink Shared CHannel

PHICH Physical Hybrid-ARQ Indicator CHannel

PLMN Public Land Mobile Network

PMCH Physical Multicast Channel

PRACH Physical Random Access CHannel

ProSe Proximity-based Services

PRS Positioning Reference Signal

PSBCH Physical Sidelink Broadcast CHannel

PSCCH Physical Sidelink Control Channel

PSCell Primary SCell

PSS Primary Synchronization Signal

PSSCH Physical Sidelink Shared CHannel

psTAG Primary Secondary Timing Advance Group

pTAG Primary Timing Advance Group

PTW Paging Time Window

PUCCH Physical Uplink Control CHannel

PUSCH Physical Uplink Shared Channel

RS-SINR Reference Signal Signal to Noise and Interference Ratio

RSCP Received Signal Code Power

RSRP Reference Signal Received Power

RSRQ Reference Signal Received Quality

RSSI Received Signal Strength Indicator

RSTD Reference Signal Time Difference

QAM Quadrature Amplitude Modulation

RACH Random Access Channel

RAT Radio Access Technology

RNC Radio Network Controller

RNTI Radio Network Temporary Identifier

RRC Radio Resource Control

RRM Radio Resource Management

RSS Resynchronization Signal

SCC Secondary Component Carrier

SCE Small Cell Enhancement

SCH Synchronization Channel

SCell Secondary Cell

SCG Secondary Cell Group

SCS Subcarrier spacing

SDU Service Data Unit

SeNB Secondary eNB

SFN System Frame Number

SI System Information

SIB System Information Block

SLSS SideLink Synchronization Sequence

SON Self Optimized Network

SPDCCH Short Physical Downlink Control channel

SPUCCH Short Physical Uplink Control channel

SRS Sounding Reference Signal

SS-RSRP Synchronization Signal based Reference Signal Received Power

SS-RSRQ Synchronization Signal based Reference Signal Received Quality

SS-SINR Synchronization Signal based Signal to Noise and Interference Ratio

SSB Synchronization Signal Block

SSS Secondary Synchronization Signal

SSTD SFN and subframe time difference

sTAG Secondary Timing Advance Group

TAG Timing Advance Group

TDD Time Division Duplex

TP Transmission Point

TTI Transmission Time Interval

UE User Equipment

UL Uplink

UMTS Universal Mobile Telecommunication System

UTRA Universal Terrestrial Radio Access

UTRAN Universal Terrestrial Radio Access Network

V2V Vehicle to Vehicle

V2X Vehicle to Everything

WLAN Wireless Local Area Network

WB-RSRQ Wide Bandwith RSRQ

## 3.4 Test tolerances

The requirements given in the present document make no allowance for measurement uncertainty. The test specification 36.521-3 [23] defines the test tolerances. These test tolerances are individually calculated for each test. The test tolerances are then added to the limits in this specification to create test limits. The measurement results are compared against the test limits as defined by the shared risk principle.

Shared Risk is defined in [ETR 273 Part 1 sub-part 2 clause 6.5].

## 3.5 Additional notation

### 3.5.1 Groups of bands

The intention with the band grouping below is to increase the readability of the specification.

Table 3.5.1-1: E-UTRA band groups

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Group | E-UTRA FDD | | E-UTRA TDD | | E-UTRA Frame Structure 3 | |
| Band group notation | Operating bands | Band group notation | Operating bands | Band group notation | Operating bands |
| A | FDD\_A | 1, 4, 6, 10, 11, 18, 19, 21, 23, 24, 32 Note 2, 67Note 2, 69Note 2, 70Note 7, 75 Note 2, 76 Note 2 | TDD\_A | 33, 34, 35, 36, 37, 38, 39, 40, 45, 50, 51, 53 | FS3\_A | - |
| B | FDD\_B1 | 65, 66 Note 5 | TDD\_B | - | FS3\_B | - |
| FDD\_B2 | 74Note 8 |
| C | FDD\_C | 9, 30 | TDD\_C | 42, 43, 48, 52 | FS3\_C | - |
| D | FDD\_D | 28, 68 | TDD\_D | - | FS3\_D | - |
| E | FDD\_E | 2, 5, 7, 27 | TDD\_E | 41, 44 | FS3\_E | - |
| F | FDD\_F | 26 Note 3 | TDD\_F | - | FS3\_F | - |
| G | FDD\_G | 3, 8, 12, 13, 14, 17, 20, 22, 29 Note 2, 71, 85 | TDD\_G | 47 Note4 | FS3\_G | 46 Note 2, 49 Note 2 |
| H | FDD\_H | 25 | TDD\_H | - | FS3\_H | - |
| I | FDD\_I | - | TDD\_I | - | FS3\_I | - |
| J | FDD\_J | - | TDD\_J | - | FS3\_J | - |
| K | FDD\_K | - | TDD\_K | - | FS3\_K | - |
| L | FDD\_L | - | TDD\_L | - | FS3\_L | - |
| M | FDD\_M | - | TDD\_M | - | FS3\_M | - |
| N | FDD\_N | 31, 72, 73, 87, 88 | TDD\_N | - | FS3\_N | - |
| NOTE 1: The bands within the same group have the same Io conditions in a corresponding requirement in this specification.  NOTE 2: This band is used only for E-UTRA carrier aggregation with other E-UTRA bands.  NOTE 3: The minimum Io condition for Band 26 is reduced by 0.5 dB when the carrier frequency of the assigned E-UTRA channel bandwidth is within 865-894 MHz.  NOTE 4: This band is used only for V2V operation.  NOTE 5: The range 2180-2200 MHz of the DL operating band 66 is restricted to E-UTRA operation when carrier aggregation is configured.  NOTE 6: Void  NOTE 7: The range 2010-2020 MHz of the DL operating band is restricted to E-UTRA operation when carrier aggregation is configured and TX-RX separation is 300 MHz The range 2005-2020 MHz of the DL operating band is restricted to E-UTRA operation when carrier aggregation is configured and TX-RX separation is 295 MHz  NOTE 8: The minimum Io condition for Band 74 is reduced by 0.5 dB when the carrier frequency of the assigned E-UTRA channel bandwidth is within 1475.9-1510.9 MHz. | | | | | | |

Table 3.5.1-2: Band groups for NB-IoT

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Group | E-UTRA/NR FDD | | E-UTRA/NR TDD | |
| Band group notation | Operating bands | Band group notation | Operating bands |
| A | NFDD\_A | - | NTDD\_A | - |
| B | NFDD\_B | - | NTDD\_B | - |
| C | NFDD\_C | - | NTDD\_C | - |
| D | NFDD\_D | - | NTDD\_D | - |
| E | NFDD\_E | - | NTDD\_E | - |
| F | NFDD\_F | - | NTDD\_F | - |
| G | NFDD\_G | 1, 2, 3, 4, 5, 7, 8, 11, 12, 13, 14, 17, 18, 19, 20, 21, 24, 25, 26, 28, 31, 65, 66, 70, 71, 72, 73, 74, 85, 87, 88, 103, n1, n2, n3, n5, n7, n8, n12, n14, n18, n20, n25, n28, n65, n66, n70, n71, n74 | NTDD\_G | 41, 42, 43, 48, n41, n90 |
| H | NFDD\_H | - | NTDD\_H | - |
| I | NFDD\_I | - | NTDD\_I | - |
| J | NFDD\_J | - | NTDD\_J | - |
| K | NFDD\_K | - | NTDD\_K | - |
| L | NFDD\_L | - | NTDD\_L | - |
| M | NFDD\_M | - | NTDD\_M | - |
| N | NFDD\_N | - | NTDD\_N | - |

Table 3.5.1-3: Band groups for Category 0

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Group | E-UTRA FDD | | E-UTRA TDD | |
| Band group notation | Operating bands | Band group notation | Operating bands |
| A | FDD-0\_A | 4 | TDD-0\_A | 39 |
| B | FDD-0\_B | - | TDD-0\_B | - |
| C | FDD-0\_C | - | TDD-0\_C | - |
| D | FDD-0\_D | - | TDD-0\_D | - |
| E | FDD-0\_E | 2, 5 | TDD-0\_E | 41 |
| F | FDD-0\_F | 26 Note 1 | TDD-0\_F | - |
| G | FDD-0\_G | 3, 8, 13, 20 | TDD-0\_G | - |
| H | FDD-0\_H | 25 | TDD-0\_H | - |
| I | FDD-0\_I | - | TDD-0\_I | - |
| J | FDD-0\_J | - | TDD-0\_J | - |
| K | FDD-0\_K | - | TDD-0\_K | - |
| L | FDD-0\_L | - | TDD-0\_L | - |
| M | FDD-0\_M | - | TDD-0\_M | - |
| N | FDD-0\_N | - | TDD-0\_N | - |
| NOTE 1: The minimum Io condition for Band 26 is reduced by 0.5 dB when the carrier frequency of the assigned E-UTRA channel bandwidth is within 865-894 MHz. | | | | |

Table 3.5.1-4: Band groups for Category M1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Group | E-UTRA FDD | | E-UTRA TDD | |
| Band group notation | Operating bands | Band group notation | Operating bands |
| A | FDD-M1\_A | 1, 4, 11, 18, 19, 21,24 | TDD-M1\_A | 39, 40 |
| B | FDD-M1\_B | 66 Note 2, 74 Note 3 | TDD-M1\_B | - |
| C | FDD-M1\_C | - | TDD-M1\_C | - |
| D | FDD-M1\_D | 28 | TDD-M1\_D | - |
| E | FDD-M1\_E | 2, 5, 7, 27 | TDD-M1\_E | 41, 42, 43, 48 |
| F | FDD-M1\_F | 26 Note 1 | TDD-M1\_F | - |
| G | FDD-M1\_G | 3, 8, 12, 13, 20, 85 | TDD-M1\_G | - |
| H | FDD-M1\_H | 25 | TDD-M1\_H | - |
| I | FDD-M1\_I | - | TDD-M1\_I | - |
| J | FDD-M1\_J | - | TDD-M1\_J | - |
| K | FDD-M1\_K | - | TDD-M1\_K | - |
| L | FDD-M1\_L | - | TDD-M1\_L | - |
| M | FDD-M1\_M | - | TDD-M1\_M | - |
| N | FDD-M1\_N | 31, 72, 73, 87, 88 | TDD-M1\_N | - |
| NOTE 1: The minimum Io condition for Band 26 is reduced by 0.5 dB when the carrier frequency of the assigned E-UTRA channel bandwidth is within 865-894 MHz.  NOTE 2: The range 2180-2200 MHz of the DL operating band 66 is restricted to E-UTRA operation when carrier aggregation is configured.  NOTE 3: The minimum Io condition for Band 74 is reduced by 0.5 dB when the carrier frequency of the assigned E-UTRA channel bandwidth is within 1475.9-1510.9 MHz. | | | | |

## 3.6 General

### 3.6.1 Applicability of requirements in this specification version

In this specification,

- ‘cell’, ‘PCell’, ‘PSCell’ and ‘SCell’ refer to E-UTRA cell, E-UTRA PCell, E-UTRA PSCell and E-UTRA SCell, respectively,

- NR cells are referred to as ‘NR cell’, ‘NR PCell’, ‘NR PSCell’ and ‘NR SCell’,

- ‘dual connectivity’ refers to Intra-E-UTRA dual connectivity,

- E-UTRA-NR dual connectivity or EN-DC refer to when E-UTRA is the master,

- NR-E-UTRA dual connectivity or NE-DC refer to when NR is the master.

- The requirements for TDD-FDD carrier aggregation are specified for two downlink and one uplink component carriers. The requirements are specified for both cases when the PCell belongs to TDD or FDD.

- All the requirements for intra-band contiguous and non-contiguous CA apply under the assumption of the same uplink-downlink and special subframe configurations [16] in the PCell and SCell.

- All the requirements for inter-band CA apply for the same uplink-downlink and special subframe configurations [16] in the PCell and SCell. Different uplink-downlink and special subframe configurations [16] in the PCell and SCell are supported for inter-band CA for UEs which:

- do not support simultaneous reception and transmission for inter-band TDD CA specified in TS 36.331 [2], and

- are compliant to the requirements specified in TS 36.101 for inter-band CA with uplink in one E-UTRA band and without simultaneous Rx/Tx.

- All the inter-frequency requirements and requirements for measurements on deactivated carrier apply for the same uplink-downlink and special subframe configurations [16] in the PCell and SCell. Different uplink-downlink and special subframe configurations [16] in the PCell and SCell are supported for inter-frequency for UEs which:

- do not support simultaneous reception and transmission for inter-band TDD CA specified in TS 36.331 [2], and are compliant to the requirements specified in TS 36.101 for inter-band CA with uplink in one E-UTRA band and without simultaneous Rx/Tx.

- Requirements for E-UTRA carrier aggregation are applicable for the CA capable UE which has been configured with at least one downlink SCell, but:

- up to four downlink CCs intra-band contiguous and up to three downlink CCs inter-band and one uplink CC for carrier aggregation, or

- up to three downlink CCs intra-band contiguous and up to four downlink CCs inter-band and one uplink CC for carrier aggregation, or

- up to four downlink CCs and up to two uplink CCs for inter-band carrier aggregation, or

- up to five downlink CCs and up to two uplink CCs for intra-band contiguous carrier aggregation, or

- up to four downlink CCs and one uplink CCs for inter-band carrier aggregation, or

- up to two downlink/uplink CCs intra-band contiguous and one downlink/uplink inter-band carrier aggregation, or

- up to two downlink CCs intra-band contiguous and up to three downlink inter-bands and up to two uplink CCs for inter-band carrier aggregation, or

- up to two downlink CCs intra-band non-contiguous and up to three downlink inter-bands and up to two uplink CCs for inter-band carrier aggregation, or

- up to three downlink CCs intra-band contiguous and one downlink intra-band non-contiguous and up to two uplink CCs intra-band contiguous for carrier aggregation, or

- two sub-blocks intra-band non-contiguous with two downlink CCs intra-band contiguous per sub-blocks and up to two uplink CCs intra-band contiguous for carrier aggregation, or

- two sub-blocks intra-band non-contiguous with two downlink CCs intra-band contiguous and three downlink CCs intra-band contiguous per sub-block and up to two uplink CCs intra-band contiguous for carrier aggregation, or

- two downlink CCs intra-band contiguous and three down link CCs inter-band and one uplink CC for carrier aggregation, or

- two downlink CCs intra-band contiguous and two downlink CCs intra-band contiguous and one downlink CC inter-band and one uplink CC for carrier aggregation, or

- up to two downlink CCs and up to two uplink CCs for intra-band non-contiguous carrier aggregation, or

- up to two downlink CCs and up to two uplink CCs for inter-band carrier aggregation, or

- up to two downlink CCs intra-band contiguous and one downlink inter-band and one uplink CC for carrier aggregation, or

- up to two downlink CCs intra-band non-contiguous and one downlink inter-band and one uplink CC for carrier aggregation, or

- up to two downlink CCs and one uplink CC for intra-band non-contiguous carrier aggregation.

- Requirements for E-UTRA carrier aggregation for discovery signal measurements are applicable for CA capable UE which has been configured with at least one downlink SCell, but:

- up to four downlink CCs intra-band contiguous and up to three downlink CCs inter-band and one uplink CC for carrier aggregation, or

- up to three downlink CCs intra-band contiguous and up to four downlink CCs inter-band and one uplink CC for carrier aggregation, or

- up to four downlink CCs and up to two uplink CCs for inter-band carrier aggregation, or

- up to five downlink CCs and up to two uplink CCs for intra-band contiguous carrier aggregation, or

- up to four downlink CCs and up to one uplink CCs for inter-band carrier aggregation, or

- up to two downlink/uplink CCs intra-band contiguous and one downlink/uplink inter-band carrier aggregation, or

- up to two downlink CCs intra-band contiguous and up to three downlink inter-band and up to two uplink CCs for inter-band carrier aggregation, or

- up to two downlink CCs intra-band non-contiguous and up to three downlink inter-band and up to two uplink CCs for inter-band carrier aggregation, or

- up to three downlink CCs intra-band contiguous and one downlink intra-band non-contiguous and up to two uplink CCs intra-band contiguous for carrier aggregation, or

- two sub-blocks intra-band non-contiguous with two downlink CCs intra-band contiguous per sub-blocks and up to two uplink CCs intra-band contiguous for carrier aggregation, or

- two sub-blocks intra-band non-contiguous with two downlink CCs intra-band contiguous and three downlink CCs intra-band contiguous per sub-block and up to two uplink CCs intra-band contiguous for carrier aggregation, or

- two downlink CCs intra-band contiguous and three down link CCs inter-band and one uplink CC for carrier aggregation, or

- two downlink CCs intra-band contiguous and two downlink CCs intra-band contiguous and one downlink CC inter-band and one uplink CC for carrier aggregation, or

- up to two downlink CCs and up to two uplink CCs for intra-band non-contiguous carrier aggregation, or

- up to two downlink CCs and up to two uplink CCs for inter-band carrier aggregation, or

- up to two downlink CCs intra-band contiguous and one downlink inter-band and one uplink CC for carrier aggregation, or

- up to two downlink CCs intra-band non-contiguous and one downlink inter-band and one uplink CC for carrier aggregation, or

- up to two downlink CCs and one uplink CC for intra-band non-contiguous carrier aggregation.

- Requirements for E-UTRA carrier aggregation, where the PCell is FDD PCell or TDD PCell and at least one downlink SCell follows the frame structure 3 and no UL SCell following the frame structure type 3 [16], are applicable for the CA capable UE, which has been configured with at least one downlink SCell but:

- up to four downlink CCs intra-band contiguous and up to three downlink CCs inter-band and one uplink CC for carrier aggregation, or

- up to three downlink CCs intra-band contiguous and up to four downlink CCs inter-band and one uplink CC for carrier aggregation, or

- up to five downlink CCs and up to two uplink CCs for inter-band carrier aggregation.

- Requirements for E-UTRA carrier aggregation, where the PCell is FDD PCell or TDD PCell, and at least one downlink SCell and one uplink SCell follow the frame structure type 3 [16], are applicable for the CA capable UE, which has been configured with at least one downlink SCell and at least one uplink SCell but:

- up to five downlink CCs and two uplink CCs for inter-band carrier aggregation.

- The requirements for UE configured with eDRX\_CONN cycle do not apply for CA requirements and dual connectivity requirements.

**-** The requirements for a UE category 0 are derived assuming UE category 0 [31] and a single antenna receiver.

- The requirements for UE category M1 are derived assuming: DL Category M1 and Uplink Category M1, operation in any LTE system bandwidth but with a channel bandwidth of 1.4 MHz and transmission bandwidth of 6 PRBs in downlink and uplink, and a single antenna receiver. DL UE category M1 and UL UE category M1 are defined in TS 36.306 [31].

- The requirements for normal coverage in idle mode shall apply provided the UE category M1 is with the radio condition that SCH Ês/Iot≥-6 dB and CRS Ês/Iot ≥-6 dB.

- The requirements for enhanced coverage in idle mode shall apply provided the UE category M1 is capable of ce-ModeB [2] and is with the radio condition that SCH Ês/Iot ≥ -15 dB and CRS Ês/Iot ≥ -15 dB.

- The requirements for CEMode A shall apply provided the UE category M1 is configured with CEMode A, SCH Ês/Iot ≥ -6 dB and CRS Ês/Iot ≥ -6 dB. The CEMode A and the number of repetition levels for different physical channels are defined in TS 36.213 [3].

- The requirements for CEMode B shall apply provided the UE category M1 is configured with CEMode B, SCH Ês/Iot ≥ -15 dB and CRS Ês/Iot ≥ -15 dB. The CEMode B and the number of repetition levels for different physical channels are defined in TS 36.213 [3].

- The requirements for CEMode B shall apply provided the UE category M1 is configured with CEMode A and capable of ce-ModeB [2], -15 dB ≤ SCH Ês/Iot ≤ -6 dB and -15 dB ≤ CRS Ês/Iot ≤ -6 dB.

- The requirement for UE category M2 are derived assuming downlink category M2 and uplink category M2, operation in any LTE system bandwidth but with a channel bandwidth not exceeding 5MHz, transmission bandwidth not exceeding 24RB in downlink and 5MHz in uplink, and a single antenna receiver. DL UE category M2 and UL UE category M2 are defined in TS 36.306 [31].

- The requirements for normal coverage in idle mode shall apply provided the UE category M2 is with the radio condition that SCH Ês/Iot ≥ -6 dB and CRS Ês/Iot ≥ -6 dB.

- The requirements for enhanced coverage in idle mode shall apply provided the UE category M2 is capable of ce-ModeB [2] and is with the radio condition that SCH Ês/Iot ≥ -15 dB and CRS Ês/Iot ≥ -15 dB.

- The requirements for CEMode A shall apply provided the UE category M2 is configured with CEMode A, SCH Ês/Iot ≥ -6 dB and CRS Ês/Iot ≥ -6 dB. The CEMode A and the number of repetition levels for different physical channels are defined in TS 36.213 [3].

- The requirements for CEMode B shall apply provided the UE category M2 is configured with CEMode B, SCH Ês/Iot ≥ -15 dB and CRS Ês/Iot ≥ -15 dB. The CEMode B and the number of repetition levels for different physical channels are defined in TS 36.213 [3].

- The requirements for CEMode B shall apply provided the UE category M2 is configured with CEMode A and capable of ce-ModeB [2], -15 dB ≤ SCH Ês/Iot ≤ -6 dB and -15 dB ≤ CRS Ês/Iot ≤ -6 dB.

- Unless explicitly defined the following additional requirements are applicable to UE category M2:

- Cell Selection and Re-selection Requirements in section 4.7

- Handover requirements in section 5.5 and 5.6

- Random access requirements in section 6.2.3

- RRC re-establishment requirements in section 6.7

- RRC connection release with redirection requirements in section 6.8

- Radio Link monitoring requreiements in section 7.19

- Timing advance requirements in section 7.28

- UE timer accuracy requirement in section 7.27

- E-UTRAN intra frequency measurement requirements in section 8.13.2.1 and 8.13.3.1

- E-UTRAN inter frequency measurement requirements in section 8.13.2.6 and 8.13.3.5

- UE measurement capability in section 8.13.2.7 and 8.13.3.6

- E-UTRAN E-CID measurements requirements in section 8.13.2.5.1, 8.13.2.5.2, 8.13.2.5.3, 8.13.2.5.4, 8.13.2.5.5, 8.13.2.5.6 and 8.13.3.4

- Measurement accuracy requirements in section 9.1.21.1 to 9.1.21.16.

- The requirements for non-BL CE UE are derived assuming: DL and UL category other than Category 0/M1/M2/NB1/NB2, operation in any LTE system bandwidth but with a channel bandwidth not exceeding 20MHz, transmission bandwidth not exceeding 96RB in downlink and 5MHz in uplink, and dual antenna receiver, when in RRC\_IDLE mode camped on a cell acquired using SIB1-BR, or in RRC\_CONNECTED configured with CE mode A/B. Non-BL CE UE is defined in [31].

- The Cat-M2 UE requirements for normal coverage in idle mode shall apply provided the UE is non-BL CE and with the radio condition that the serving cell SCH Ês/Iot ≥ -6dB and CRS Ês/Iot ≥ -6 dB, unless corresponding individual non-BL CE requirements are specified.

- The Cat-M2 UE requirements for enhanced coverage in idle mode shall apply provided the UE is non-BL CE capable of ce-ModeB [2] and with the radio condition that the serving cell -6dB ≥ SCH Ês/Iot ≥ -15dB and -6dB ≥ CRS Ês/Iot ≥ -15 dB, unless corresponding individual non-BL CE requirements are specified.

- The Cat-M2 UE requirements for CEMode A shall apply provided the UE is non-BL CE and is configured with CEModeA, the serving cell SCH Ês/Iot ≥ -6 dB and CRS Ês/Iot ≥ -6 dB, unless corresponding individual non-BL CE requirements are specified. The CEMode A and the number of repetition levels for different physical channels are defined in [3].

- The Cat-M2 UE requirements for CEMode B shall apply provided the UE is non-BL CE and is configured with CEMode B, the serving cell SCH Ês/Iot ≥ -15 dB and CRS Ês/Iot ≥ -15 dB, unless corresponding individual non-BL CE requirements are specified. The CEMode B and the number of repetition levels for different physical channels are defined in [3].

- Unless explicitly defined the following additional requirements are applicable to non-BL CE UE:

- Cell Selection and Re-selection Requirements in section 4.7

- Handover requirements in section 5.5 and 5.6

- Random access requirements in section 6.2.3

- RRC re-establishment requirements in section 6.7

- RRC connection release with redirection requirements in section 6.8

- UE transmit timing requirements in section 7.26

- Radio Link monitoring requreiements in section 7.19

- Timing advance requirements in section 7.28

- UE timer accuracy requirement in section 7.27

- E-UTRAN intra frequency measurement requirements in section 8.13.2.1 and 8.13.3.1.1, 8.13.3.1.2, and 8.13.3.1.3

- E-UTRAN inter frequency measurement requirements in section 8.13.2.6 and 8.13.3.5

- UE measurement capability in section 8.13.2.7 and 8.13.3.6

- E-UTRAN E-CID measurements requirements in section 8.13.2.5.1, 8.13.2.5.2, 8.13.2.5.3, 8.13.2.5.4, 8.13.2.5.5, 8.13.2.5.6, 8.16.2.1, 8.16.2.2, 8.16.2.2a and 8.13.3.4

- E-UTRAN OTDOA RSTD measurements requirements in section 8.16.2.3, 8.16.2.4, 8.16.3.1 and 8.16.3.2 except those requiring any of the measurement gap pattern in Table 8.1.2.1-3.

- Measurement accuracy requirements in section 9.1.25

- Measurement accuracy requirements in section 9.1.21 if the UE is of category 1bis.

- Requirements for E-UTRA ProSe Direct Discovery and E-UTRA ProSe Direct Communication are applicable for ProSe operation on either the uplink frequency of PCC, or SCC, or a non-serving carrier, but:

- with ProSe operation limited to one carrier on a given subframe.

- Requirements for interruptions due to ProSe Direct Discovery and/or ProSe Direct Communications specified in clause 7.16.3 apply, but:

- with configured serving carriers of up to two downlink CCs, unless the UE is configured with reception gap for ProSe operation, and

- with configured serving carriers of up to two uplink CCs, unless the UE is configured with transmission gap for ProSe operation.

- The requirements for UE category NB1 are derived assuming UE category NB1and a single antenna receiver. UE category NB1 is defined in TS 36.306 [31].

- The requirements for normal coverage shall apply for UE category NB1 provided that the radio condition of its serving cell are: NSCH Ês/Iot ≥ -6 dB and NRS Ês/Iot ≥ -6 dB.

- The requirements for enhanced coverage shall apply for UE category NB1 provided that the radio condition of its serving cell are: -15 dB ≤ NSCH Ês/Iot < -6 dB and -15 dB ≤ NRS Ês/Iot < -6 dB.

- The measurement accuracy requirements in section 9.1.22 for intra-frequency and inter-frequency absolute NRSRQ accuracy for UE Category NB1 apply only in idle mode.

- The measurement accuracy requirements in section 9.1.22 for intra-frequency absolute NRSRP accuracy for UE Category NB1 apply in idle and connected mode.

- The measurement accuracy requirements in section 9.1.22 for inter-frequency absolute NRSRP accuracy for UE Category NB1 apply only in idle mode.

- The requirements for SRS carrier based switching shall apply when the UE capable of SRS carrier based switching is configured to perform SRS carrier based switching for transmitting SRS and/or RACH in one or more CCs in the same or different time resources.

**-** The requirements for a UE category 1bis are derived assuming UE category 1bis [31] and a single antenna receiver. Following requirements are applicable to UE category 1bis.

- Cell re-selection requirements in section 4.2.2.1 to 4.2.2.10

- Handover requirements in section 5.1, 5.2, 5.3 and 5.4

- RRC re-establishment requirements in section 6.1

- Random access requirements in section 6.2

- RRC connection release with redirection requirements in section 6.3

- UE transmit timing requirements in section 7.1

- UE timer accuracy requirements in section 7.2

- Timing advance requirements in section 7.3

- Radio link monitoring requirements in section 7.11

- UE measurement capability in section 8.1.2.1

- E-UTRAN intra frequency measurement requirements in section 8.5.2.1.1 and 8.5.2.1.3

- E-UTRAN inter frequency measurement requirements in section 8.1.2.3.1, 8.1.2.3.2, 8.1.2.3.3 and 8.1.2.3.4

- Inter RAT measurement requirements in section 8.1.2.4

- OTDOA Intra-Frequency measurement requirements in section 8.1.2.5.3, 8.1.2.5.4

- OTDOA Inter-Frequency measurement requirements in section 8.1.2.6.5, 8.1.2.6.6, 8.1.2.6.7 and 8.1.2.6.8

- E-UTRAN E-CID measurement requirements in section 8.1.2.7

- CGI reading requirements for UE category 0 in section 8.5.2.1.4 and 8.5.2.1.6

- Intra-frequency RSRP Accuracy Requirements in section 9.1.2.7 and 9.1.2.8

- Inter-frequency RSRP Accuracy Requirements in section 9.1.3.3 and 9.1.3.4

- Intra-frequency RSRQ Accuracy Requirements in section 9.1.5.5

- Inter-frequency RSRQ Accuracy Requirements in section 9.1.6.5 and 9.1.6.6

- RSTD Intra-Frequency Accuracy Requirement in section 9.1.10.5

- RSTD Inter-Frequency Accuracy Requirement in section 9.1.10.6

- UE Rx – Tx time difference measurement accuracy requirements in section 9.1.9.1 and 9.1.9.2

- The requirements for UE category NB2 are derived assuming UE category NB2 and a single antenna receiver. UE category NB2 is defined in TS 36.306 [31]. Following requirements are applicable to UE category NB2.

- Cell selection and re-selection requirements in section 4.6.1 and 4.6.2

- UE Positioning measurement in idle state in section 4.8

- RRC Re-establishment requirements in section 6.5

- Random access requirements in section 6.6

- RRC connection redirection to non-anchor carrier requirements in section 6.9

- UE transmit timing requirements in section 7.20

- UE timer accuracy requirements in section 7.21

- Timing advance requirements in section 7.22

- Radio link monitoring requirements in section 7.23

- UE RRC\_CONNECTED state measurement requirement in section 8.14

- UE measurement accuracy requirements in section 9.1.22

- Power headroom requirements in section 9.1.23

- All requirements in this specification for UE receiving PMCH in FeMBMS/Unicast-mixed cells apply only for FeMBMS/Unicast-mixed cells configured based on frame structure 1.

- Requirements for E-UTRA carrier aggregation with one or more FeMBMS/Unicast-mixed SCells shall apply, provided the total number of SCCs, including SCCs with FeMBMS/Unicast-mixed SCells, does not exceed the the maximum number of SCCs the UE is capable of.

- Unless explictly stated, requirements related to NR do not apply when CCA is used on serving or neighbour cells.

#### 3.6.1.1 Applicability of requirements for UE capable of network-based CRS interference mitigation

If network-based CRS interference mitigation is enabled in a cell, then the UE capable of network-based CRS interference mitigation [31] can assume the following rules:

- CRS is transmitted over full bandwidth of the cell during active time periods (T1) and over at least 6 central resource blocks of the cell during the inactive time periods (T2), and

- CRS is transmitted over full bandwidth of the cell during at least N1 number of non-MBSFN DL subframes immediately before the T1 time period, and

- CRS is transmitted over full bandwidth of the cell during at least N2 number of DL subframes after the T1 time period when UE receives the downlink physical channel during the T1 time period, and

- CRS is transmitted over full bandwidth of the cell in a subframe which is comprised in any non-zero length T1, N1, or N2, and

- The active time period T1 at least includes any period of the time where

- UE monitors/receives the downlink physical channels: PDCCH, SPDCCH, EPDCCH, MPDCCH, PDSCH, PMCH, PCFICH, PHICH, or

- UE receives the downlink physical signals: DM-RS, NZP CSI-RS, MBSFN-RS, and PRS, or

- UE transmits the uplink physical channels: PUCCH, SPUCCH, PUSCH, and PRACH, or

- UE transmits the uplink physical signals: DM-RS and SRS.

The values of the parameters T1, T2, N1 and N2 are specified for relevant requirements in their corresponding sections. The inactive time periods T2 shall not contain any subframe where the UE requires CRS over the full cell bandwidth for any purpose to meet the requirements in this specification.

UE can additionally assume the following active time period T1 after the PRACH transmission:

- for UE performing random access, the time from the start of RAR window until MSG2 and MSG4 is received and DRX is configured.

- for UE transmitting PRACH due to handover, the time from the start of RAR window until the handover/RRC connection reconfiguration is complete;

- for UE transmitting a scheduling request over PRACH, the time from the start of RAR window until MSG2 is received.

For a UE capable of supporting dual connectivity and/or carrier aggregation, UE can additionally assume that no inactive time period T2 is present in any of its serving cell(s) in the following period of the time:

- the time from receiving the PSCell addition command until UE starts the PSCell release period,

- the time from receiving of SCell activation command until UE starts the SCell deactivation period,

- the time from receiving of SCell configuration command until UE sends *RRCConnectionReconfigurationComplete*.

For UE in RRC\_IDLE and configured with eDRX\_IDLE, UE shall assume that inactive time periods T2 comprises any subframe that is outside PTW which is not comprised in the N1 and N2 number of DL subframe before and after any active time period T1 within PTW.

For measurements on neighbor cells that is indicated by the high layer to support the network-based CRS interference mitigation,

- if the UE is configured with *widebandRSRQ-Meas* [2] to measure WB-RSRQ then the UE shall assume that CRS are available in the measured cell over the *AllowedMeasBandwidth* [2],

- otherwise the UE shall assume the *AllowedMeasBandwidth* [2] is 6 RBs and inactive time periods T2 may be used in a neighbor cell.

If network-based CRS interference mitigation is enabled in a cell, all the requirements in this specification shall be met for UE capable of network-based CRS interference mitigation, provided that:

- N1 = 8 and N2 = 1 unless other specified below;

- for UE configured with DRX or eDRX\_CONN, the active time periods T1 also includes the periods where no DRX is used (see Section 5 for the definition of the no DRX used state) by the UE, preceeded by N1 and followed by N2;

- for UE operating in HD-FDD mode, provided CRS are available in the concerned cell during UL gaps [16] occurring during the UE’s UL transmission, with N1=N2=0 subframes before and after the UL gaps [16] occurring during the UE’s UL transmission;

- for UE monitoring or receiving paging, the active time periods T1 also includes all configured paging occasions, with N1 = 8 and N2 = 1 subframes before and after each paging occasion respectively;

- for UE in RRC\_IDLE and RRC\_CONNECTED and receiving SIB1 or SIB1-BR, the active time periods T1 also includes all subframes with SIB1, where N1 = 8 and N2 = 1 subframes;

- for UE receiving NRS signals [16], provided CRS are available in the concerned cell in all NRS subframes configured for the UE which are comprised in the active time periods T1 within the UE bandwidth;

- for UE monitoring/receiving PRS, the active time periods T1 also includes all PRS subframes, where N2=0 subframes.

#### 3.6.1.2 Applicability of requirements with CRS muting for category M1 UE capable of CRS muting

If network has indicated that CRS muting is enabled in a cell using the system information broadcast [2], for a UE capable of supporting CRS muting [31], the CRS is transmitted during the active time periods at the following frequency locations within the cell bandwidth:

- over the 6-PRB bandwidth within the cell bandwidth where the UE reception is configured, and

- 2 additional PRBs where each one is adjacent to the UE configured bandwidth for reception, and

- K number of PRBs within the center of the cell bandwidth indicated by the system information broadcast [2]

During the inactive periods (T2), CRS is transmitted over at least K number of PRBs within center of the cell bandwidth. The UE acquires the values of K from system information broadcast [2] and defined as in Table 3.6.1.2-1.

Table 3.6.1.2-1: Number of PRBs (K) containing CRS within the center of cell BW

|  |  |
| --- | --- |
| crs-IntfMitigNumPRBs [2] | K |
| ‘0’ | 6 PRBs |
| ‘1’ | 24 PRBs |

The UE active period (T1) comprises the time period during which UE is engaged in receiving or monitoring any downlink channel/signal. Otherwise, UE is considered to be in inactive period (T2).

The CRS is transmitted over the 6-PRB bandwidth within the cell bandwidth where the UE reception is configured during at least N1 number of subframes immediately before and N2 number of subframes immediately after the T1 time period, which are excluded for the inactive time periods T2. The values of the parameters T1, T2 and N1 are specified for relevant requirements in their corresponding sections.

For a UE that is not pre-provisioned with EARFCN and geographical information [1, 56],

- CRS is transmitted in 1 subframe every 10 ms or 20 ms over full cell bandwidth if K=6 PRBs or 24 PRBs, respectively, and

- CRS is transmitted at least over the central 6 or 24RBs of the cell bandwidth if K=6 PRBs or 24 PRBs, respectively.

For a UE that is pre-provisioned with EARFCN and geographical information [1, 56],

- CRS is transmitted at least over the central 6 or 24RBs of the cell bandwidth if K=6 PRBs or 24 PRBs, respectively.

For measurements on intra-frequency neighbor cells, if *intraFreqNeighCellMeasCenterPRBs* [2] is enabled then the UE shall assume center 6 PRBs for measurements.

If network has indicated that CRS muting is enabled in a cell using the system information broadcast [2], the requirements for UE category M1 in this specification shall be met

- if CRS is transmitted over the 6-PRB bandwidth within the cell bandwidth where the UE reception is configured in a subframe which is comprised in any non-zero length T1, N1, or N2.

- for UE not configured with DRX or eDRX\_CONN, the UE being considered to be always in the active period T1 and the requirements being non-DRX requirements are assumed for the UE.

- for UE configured with DRX or eDRX\_CONN, provided the active time periods T1 comprise the periods where the UE is not using DRX, while N1=1 and N2=0 subframe.

- For UE receiving PDSCH receptions, provided CRS are available in the concerned cell in all subframes which are comprised in the active time periods T1, with N1=1, and N2=1 subframe.

- For UE in RRC\_IDLE and RRC\_CONNECTED and receiving SIB1-BR, provided the active time periods T1 comprise all subframes with SIB1-BR, where N1=1 and N1=8 for UEs which are not capable of supporting CRS muting, and N2=1 subframe.

- For UE receiving random access MSG2 and MSG4, provided the active time period T1 comprises the time from the start of RAR window until MSG2 and MSG4 is received and DRX is configured, where N1=N2=1.

- for UE performing MPDCCH monitoring, provided CRS are available in the concerned cell in all MPDCCH subframes configured for the UE to monitor which are comprised in the active time periods T1, with N1=1 and N2=0 subframes before the MPDCCH subframes.

- for UE operating in HD-FDD mode, provided CRS are available in the concerned cell during UL gaps occurring during UL transmission as defined in TS 36.211 [16], with N1=N2=0 subframes before and after the UL gaps occurring during UL transmission which are comprised in the active time periods T1 within the UE measurement bandwidth;

- provided the UE is configured with measurement gap also for the serving cell measurements according to gap pattern ID # 0 or gap pattern ID # 1 defined in Table 8.1.2.1-1.

#### 3.6.1.3 Applicability of requirements with CRS muting for category M2 UE capable of CRS muting

If network has indicated that CRS muting is enabled in a cell using the system information broadcast [2], for a UE capable of supporting CRS muting [31], the CRS is transmitted during the active time periods at the following frequency locations within the cell bandwidth:

- over the 6-PRB or 24-PRB bandwidth within the cell bandwidth where the UE reception is configured, and

- K number of PRBs within the center of the cell bandwidth indicated by the system information broadcast [2], and

- when the UE is configured with downlink bandwidth of 1.4MHz, 2 additional PRBs where each one is adjacent to the 6-PRB bandwidth within the cell bandwidth where UE is configured bandwidth for reception.

During the inactive periods (T2), CRS is transmitted over at least K number of PRBs within center of the cell bandwidth. The UE acquires the values of K from system information broadcast [2] and defined as in Table 3.6.1.3-1.

Table 3.6.1.3-1: Number of PRBs (K) containing CRS within the center of cell BW

|  |  |
| --- | --- |
| crs-IntfMitigNumPRBs [2] | K |
| ‘0’ | 6 PRBs |
| ‘1’ | 24 PRBs |

The UE active period (T1) comprises the time period during which UE is engaged in receiving or monitoring any downlink channel/signal. Otherwise, UE is considered to be in inactive period (T2).

The CRS is transmitted over the 6-PRB or 24-PRB bandwidth within the cell bandwidth where the UE reception is configured during at least N1 number of subframes immediately before and N2 number of subframes immediately after the T1 time period, which are excluded for the inactive time periods T2. The values of the parameters T1, T2 and N1 are specified for relevant requirements in their corresponding sections.

For a UE that is not pre-provisioned with EARFCN and geographical information [1, 56],

- CRS is transmitted in 1 subframe every 10 ms or 20 ms over full cell bandwidth if K=6 PRBs or 24 PRBs, respectively, and

- CRS is transmitted at least over the central 6 or 24RBs of the cell bandwidth if K=6 PRBs or 24 PRBs, respectively.

For a UE that is pre-provisioned with EARFCN and geographical information [1, 56],

- CRS is transmitted at least over the central 6 or 24RBs of the cell bandwidth if K=6 PRBs or 24 PRBs, respectively.

For measurements on intra-frequency neighbor cells, if *intraFreqNeighCellMeasCenterPRBs* [2] is enabled then the UE shall assume center 6 PRBs for measurements.

If network has indicated that CRS muting is enabled in a cell using the system information broadcast [2], for a UE capable of supporting CRS muting and configured with downlink bandwidth of 1.4MHz and K = 6 in Table 3.6.1.3-1, or for a UE capable of supporting CRS muting and configured with downlink bandwidth of 5MHz and K = 24 in Table 3.6.1.3-1, or for a UE capable of supporting CRS muting and not configured with downlink bandwidth and K = 6 or 24 in Table 3.6.1.3-1, the requirements for UE category M2 in this specification shall be met

- if CRS is transmitted over the 6-PRB or 24-PRB bandwidth within the cell bandwidth where the UE reception is configured in a subframe which is comprised in any non-zero length T1, N1, or N2.

- for UE not configured with DRX or eDRX\_CONN, the UE being considered to be always in the active period T1 and the requirements being non-DRX requirements are assumed for the UE.

- for UE configured with DRX or eDRX\_CONN, provided the active time periods T1 comprise the periods where the UE is not using DRX, while N1=1 and N2=0 subframe.

- For UE receiving PDSCH receptions, provided CRS are available in the concerned cell in all subframes which are comprised in the active time periods T1, with N1= 1, and N2=1 subframe.

- For UE in RRC\_IDLE and RRC\_CONNECTED and receiving SIB1-BR, provided the active time periods T1 comprise all subframes with SIB1-BR, where N1=1 and N1=8 for UEs which are not capable of supporting CRS muting, and N2=1 subframe.

- For UE receiving random access MSG2 and MSG4, provided the active time period T1 comprises the time from the start of RAR window until MSG2 and MSG4 is received and DRX is configured, where N1=N2=1.

- for UE performing MPDCCH monitoring, provided CRS are available in the concerned cell in all MPDCCH subframes configured for the UE to monitor which are comprised in the active time periods T1, with N1=1 and N2=0 subframes before the MPDCCH subframes.

- for UE operating in HD-FDD mode, provided CRS are available in the concerned cell during UL gaps occurring during UL transmission as defined in TS 36.211 [16], with N1=N2=0 subframes before and after the UL gaps occurring during UL transmission which are comprised in the active time periods T1 within the UE measurement bandwidth;

- provided the UE is configured with measurement gap also for the serving cell measurements according to gap pattern ID # 0 or gap pattern ID # 1 defined in Table 8.1.2.1-1.

### 3.6.2 Applicability of requirements for EN-DC operation

Requirements for EN-DC operation are applicable for the UE which has been configured with the following number of E-UTRA CCs and NR CCs:

- up to 5 E-UTRA DL CCs in total with 1 E-UTRA UL CC in MCG. The applicable number of NR CC for EN-DC in the SCG is specified in clause 3.6.2 of TS 38.133 [50].

In addition to the requirements explicitly defined for a UE configured with EN-DC the following requirements shall also apply for the UE configured with EN-DC:

- Handover requirements in sections 5.1, 5.3.1, 5.3.2 and 5.3.3,

- RRC Re-establishment requirements in section 6.1,

- Random access requirements in section 6.2,

- RRC connection release with redirection requirements in section 6.3,

- UE transmit timing requirements defined in section 7.1 for UE configured with only pTAG,

- UE timer accuracy requirements in section 7.2,

- Timing advance requirements defined in section 7.3 for 1ms TTI and 4 subframe HARQ processing,

- Radio link monitoring requirements in section 7.6,

- SCell activation and deactivation delay requirements for E-UTRA carrier aggregation defined in section 7.7 for 1ms TTI and 4 subframe HARQ processing except those for CA with frame structure # 3,

- Requirements on received time difference between the PCell and SCell or between SCells defined in sections 7.9 except those defined for CA with frame structure # 3, .

- E-UTRAN intra frequency measurement requirements in section 8.1.2.2, except requirements specified for UE configured with *highSpeedEnhancedMeasFlag*

- E-UTRAN OTDOA intra-frequency RSTD measurements requirements defined in section 8.1.2.5 except those for UE category 1bis,

- E-UTRAN E-CID measurements requirements in section 8.1.2.7,

- Requirements on measurements for E-UTRA carrier aggregation in section 8.3,

- OTDOA RSTD measurement requirements for E-UTRAN carrier aggregation in section 8.4,

- Requirements in Section 9 for intra-frequency RSRP, RSRQ, RS-SINR, and RSTD measurements accuracy for PCell carrier frequency,

- Requirements in Section 9 for inter-frequency RSRP, RSRQ, RS-SINR, and RSTD measurements accuracy for non-serving E-UTRA carrier frequencies,

- Requirements in Section 9 for carrier aggrgation RSRP, RSRQ, RS-SINR, and RSTD measurements accuracy for PCC, SCC, or both,

- Requirements in Section 9 for inter-RAT E-UTRA−UTRA measurements accuracy and inter-RAT E-UTRA−GSM measurements accuracy for UTRA and GSM carriers,

- Power headroom requirements in Section 9 for PSCell and SCell(s).

### 3.6.3 Applicability of requirements for NE-DC operation

Requirements for NE-DC operation are applicable for the UE which has been configured with the following number of E-UTRA CCs and NR CCs:

- up to 5 E-UTRA DL CCs in total with 1 E-UTRA UL CC in SCG. The applicable number of NR CC for EN-DC in the SCG is specified in clause 3.6.2 of TS 38.133 [50].

In addition to the requirements explicitly defined for a UE configured with NE-DC the following requirements shall also apply for the UE configured with NE-DC:

- Random access requirements in section 6.2 for random access procedures on PSCell and activated SCell(s),

- UE transmit timing requirements in section 7.1 for psTAG using PSCell as a reference cell and sTAG(s),

- UE timer accuracy requirements in section 7.2 for UE operation on PSCell and SCell(s),

- Timing advance requirements in section 7.3 for 1ms TTI and 4 subframe HARQ processing,

- Radio link monitoring requirements in section 7.6 for PSCell,

- SCell activation and deactivation delay requirements for E-UTRA carrier aggregation in section 7.7 for 1ms TTI and 4 subframe HARQ processing except those for CA with frame structure # 3,

- E-UTRAN intra-frequency measurement requirements in section 8.1.2.2 for PSCC and SCC, except requirements specified for UE configured with *highSpeedEnhancedMeasFlag,*

- E-UTRAN inter-frequency measurement requirements in section 8.1.2.3 for non-serving E-UTRA carrier frequencies, except requirements specified for UE configured with *highSpeedEnhancedMeasFlag,*

- E-UTRAN E-CID measurements requirements in section 8.19.5 for PSCell and SCell carrier frequencies, and in section 8.19.3 for non-serving E-UTRA carrier frequencies,

- Requirements in Section 9 for intra-frequency RSRP, RSRQ and RS-SINR measurements accuracy on PSCC and SCC,

- Requirements in Section 9 for inter-frequency RSRP, RSRQ and RS-SINR measurements accuracy on non-serving E-UTRA carrier frequencies,

- Power headroom requirements in Section 9 for PSCell and SCell(s).

### 3.6.4 Applicability of requirements for NGEN-DC operation

All the requirements in this specification applicable for EN-DC are also applicable for NGEN-DC.

3.6.5 Applicability of 2-step RA and 4-step RA in RRM requirements

Unless explicitly stated otherwise the requirements under the following clauses, where the UE transmits random acess (with requirements in clause 6.2.2 [50]) to NR serving cell or NR target cell, are applicable for both 2-step RA and 4-step RA procedures [39]:

- E-UTRAN - NR FR1 handover requirements in clause 5.3.4,

- E-UTRAN - NR FR2 handover requirements in clause 5.3.5,

- RRC connection release with redirection to NR requirements in clause 6.3.2.4 and

- PSCell addition delay requirements in clause 7.31.2.

Unless explicitly stated otherwise the requirements under the following clauses, where the UE transmits random acess (with requirements in clause 6.2.2A [50]) to NR serving cell or NR target cell subject to uplink CCA, are applicable for both 2-step RA and 4-step RA procedures [39]:

- E-UTRAN - NR FR1 handover requirements with CCA in clause 5.3.4A,

- RRC connection release with redirection to NR requirements with CCA in clause 6.3.2.5 and

- PSCell addition delay requirements with CCA in clause 7.31A.2.

# 4 E-UTRAN RRC\_IDLE state mobility

## 4.1 Cell Selection

After a UE has switched on and a PLMN has been selected, the Cell selection process takes place, as described in TS36.304. This process allows the UE to select a suitable cell where to camp on in order to access available services. In this process the UE can use stored information (*Stored information cell selection*) or not (*Initial cell selection*).

## 4.2 Cell Re-selection

### 4.2.1 Introduction

The cell reselection procedure allows the UE to select a more suitable cell and camp on it.

When the UE is in either *Camped* *Normally* state or *Camped on Any Cell* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency, inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency and inter-frequency cells the serving cell may not provide explicit neighbour list but carrier frequency information and bandwidth information only. UE measurement activity is also controlled by measurement rules defined in TS36.304, allowing the UE to limit its measurement activity.

### 4.2.2 Requirements

The UE shall search every layer of higher priority at least every Thigher\_priority\_search = (60 \* Nlayers) seconds when the UE is not configured with eDRX\_IDLE cycle, and at least every Thigher\_priority\_search = MAX(60 \* Nlayers, one eDRX\_IDLE cycle) when UE is configured with eDRX\_IDLE cycle, where Nlayers is the total number of configured higher priority E-UTRA, UTRA FDD, UTRA TDD, CDMA2000 1x, HRPD and NR carrier frequencies and is additionally increased by one if one or more groups of GSM frequencies is configured as a higher priority.

For a UE configured with early measurement reporting, while T331 is running, Nlayers is the combined total number of configured higher priority E-UTRA, UTRA FDD, UTRA TDD, CDMA2000 1x, HRPD and NR carrier frequencies and is additionally increased by one if one or more groups of GSM frequencies is configured as a higher priority, and carriers configured for idle mode DC measurements.

Note: combined total number means that if a carrier is a high priority carrier and additionally a carrier configured for idle mode DC measurements, it only counts as one carrier.

In the requirements of Section 4.2.2 for the UE capable of CA, the applicable exceptions for side conditions are specified in Annex B, Section B.4.2.

For a UE which supports increased carrier monitoring E-UTRA or increased carrier monitoring UTRA, the reselection performance for different carriers may be configured by higher layers to be either normal or reduced. The following definitions are used in the requirements:

Kcarrier : Total number of interfrequency carriers in the neighbour cell list

Kcarrier,normal =Kcarrier- Kcarrier,reduced: Number of interfrequency carriers to be monitored in the normal performance group

Kcarrier,normal,FDD : Number of interfrequency FDD carriers to be monitored in the normal performance group

Kcarrier,normal,TDD : Number of interfrequency TDD carriers to be monitored in the normal performance group

Kcarrier,reduced : Number of interfrequency carriers to be monitored in the reduced performance group

NUTRA\_carrier: Total number of configured UTRA FDD carriers in the neighbour cell list

NUTRA\_carrier,normal= NUTRA\_carrier - NUTRA\_carrier,reduced: Number of UTRA FDD carriers to be monitored in the normal performance group

NUTRA\_carrier,reduced: Number of UTRA FDD carriers to be monitored in the reduced performance group

NUTRA\_carrier\_TDD : Total number of configured UTRA TDD carriers in the neighbour cell list

NUTRA\_carrier\_TDD,normal= NUTRA\_carrier\_TDD - NUTRA\_carrier\_TDD,reduced: Number of UTRA TDD carriers to be monitored in the normal performance grop

NUTRA\_carrier\_TDD,reduced: Number of UTRA TDD carriers to be monitored in the reduced performance group

The minimum performance requirements for a UE which supports Increased UE carrier monitoring E-UTRA [2, 31] are calculated as defined in section 4.2.2.4 provided that Kcarrier,normal ≤3 for a UE capable of either FDD E-UTRA carrier monitoring or TDD E-UTRA carrier monitoring or Kcarrier,normal ≤6 for a UE capable of both FDD and TDD E-UTRA carrier monitoring provided Kcarrier,normal,FDD ≤3 and Kcarrier,normal,TDD ≤3and the minimum performance requirements for a UE which supports Increased UE carrier monitoring UTRA [2, 31] are calculated as defined in section 4.2.2.5 provided that NUTRA\_carrier\_normal≤3 and NUTRA\_carrier\_TDD,normal≤3. In case the limits for the number of normal performance carriers is exceeded considering the broadcast neighbour cell list and the bands supported by the UE, the UE which supports Increased UE carrier monitoring E-UTRA shall measure at least 3 interfrequency carriers with normal performance and the UE which supports Increased UE carrier monitoring UTRA shall measure at least 3 UTRA carriers with normal performance. For a UE capable of monitoring E-UTRAN FDD and TDD carriers, in case the limits for the number of normal performance carriers is exceeded considering the broadcast neighbour cell list and the bands supported by the UE, the UE shall measure at least 3 FDD and 3 TDD E-UTRAN interfrequency carriers with normal performance. Additionally, reduced performance requirements shall be met for carriers for which the *Reduced measurement performance* IE is indicated, up to the UE measurement capability in section 4.2.2.9a.The minimum performance requirements for a UE which does not support Increased UE carrier monitoring E-UTRA [2,31] are calculated assuming all E-UTRA carriers required to be monitored for such UE, are having normal performance and are in normal performance group, i.e. Kcarrier,normal =Kcarrier and Kcarrier,reduced=0. The minimum performance requirements for a UE which does not support Increased UE carrier monitoring UTRA [2,31] are calculated assuming all UTRA carriers required to be monitored for such UE, are having normal performance and are in normal performance group, i.e. NUTRA\_carrier,normal= NUTRA\_carrier, NUTRA\_carrier\_TDD,normal= NUTRA\_carrier\_TDD and NUTRA\_carrier,reduced =0 and NUTRA\_carrier\_TDD,reduced =0. No reduced performance carrier requirement applies to a UE not supporting Increased UE carrier monitoring E-UTRA or UTRA [2, 31]. Capabilities for number of carriers to monitor for a UE which does not support Increased carrier monitoring E-UTRA or Increased carrier monitoring UTRA are specified in section 4.2.2.9

#### 4.2.2.1 Measurement and evaluation of serving cell

The UE shall measure the RSRP and RSRQ level of the serving cell and evaluate the cell selection criterion S defined in [1] for the serving cell at least every DRX cycle.

The UE shall filter the RSRP and RSRQ measurements of the serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least DRX cycle/2.

If the UE is not configured with eDRX\_IDLE cycle and has evaluated according to Table 4.2.2.1-1 in Nserv consecutive DRX cycles that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities. If the UE is configured with eDRX\_IDLE cycle and has evaluated according to Table 4.2.2.1-2 in Nserv consecutive DRX cycles within a single PTW that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

If the UE in RRC\_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information during the time T, the UE shall initiate cell selection procedures for the selected PLMN as defined in [1], where T=10 s if the UE is not configured with eDRX\_IDLE cycle, and T=MAX(10 s, one eDRX\_IDLE cycle) if the UE is configured with eDRX\_IDLE cycle.

Table 4.2.2.1-1: Nserv

|  |  |
| --- | --- |
| DRX cycle length [s] | Nserv [number of DRX cycles] |
| 0.32 | 4 |
| 0.64 | 4 |
| 1.28 | 2 |
| 2.56 | 2 |

Table 4.2.2.1-2: Nservfor UE configured with eDRX\_IDLE cycle

|  |  |  |  |
| --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Nserv [number of DRX or eDRX cycles Note 3] |
| 5.12 | N/A | N/A | 2 |
| 10.24 ≤ eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | ≥1.28 (1) | 2 |
| 0.64 | ≥1.28 (1) | 2 |
| 1.28 | ≥2.56 (2) | 2 |
| 2.56 | ≥5.12 (4) | 2 |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 5.12s, number of DRX cycles otherwise. | | | |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

#### 4.2.2.2 Void

#### 4.2.2.3 Measurements of intra-frequency E-UTRAN cells

The UE shall be able to identify new intra-frequency cells and perform RSRP and RSRQ measurements of identified intra-frequency cells without an explicit intra-frequency neighbour list containing physical layer cell identities.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS36.304 within Tdetect,EUTRAN\_Intrawhen that Treselection= 0. An intra frequency cell is considered to be detectable according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot defined in

- Annex B.1.3 for Cat-M1 UE

- Annex B.1.6 for category 1bis UE

- Annex B.1.1, otherwise

for a corresponding Band.

The UE shall measure RSRP and RSRQ at least every Tmeasure,EUTRAN\_Intra for intra-frequency cells that are identified and measured according to the measurement rules.

The UE shall filter RSRP and RSRQ measurements of each measured intra-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure,EUTRAN\_Intra/2

The UE shall not consider a E-UTRA neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined [1] within Tevaluate,E-UTRAN\_intra when Treselection = 0, provided that the cell is

- at least 4dB better ranked for Cat-M1 UE and category 1bis UE

- at least 3 dB better ranked, otherwise

When evaluating cells for reselection, the side conditions for RSRP and SCH apply to both serving and non-serving intra-frequency cells.

If Treselection timer has a non zero value and the intra-frequency cell is better ranked than the serving cell, the UE shall evaluate this intra-frequency cell for the Treselection time. If this cell remains better ranked within this duration, then the UE shall reselect that cell.

For UE neither configured with eDRX\_IDLE cycle nor configured with *highSpeedEnhancedMeasFlag*, Tdetect,EUTRAN\_Intra, Tmeasure,EUTRAN\_Intra and Tevaluate, E-UTRAN\_intra are specified in Table 4.2.2.3-1. For UE configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_Intra, Tmeasure,EUTRAN\_Intra and Tevaluate, E-UTRAN\_intra are specified in Table 4.2.2.3-2, where the requirements apply provided that the serving cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,EUTRAN\_Intra, Tmeasure,EUTRAN\_Intra and Tevaluate, E-UTRAN\_intra when multiple PTWs are used. For UE configured with *highSpeedEnhancedMeasFlag*, Tdetect,EUTRAN\_Intra, Tmeasure,EUTRAN\_Intra and Tevaluate, E-UTRAN\_intra are specified in Table 4.2.2.3-3. For UE configured with *highSpeedEnhMeasFlag2-r16*, Tdetect,EUTRAN\_Intra, Tmeasure,EUTRAN\_Intra and Tevaluate, E-UTRAN\_intra are specified in Table 4.2.2.3-4.

Table 4.2.2.3-1 : Tdetect,EUTRAN\_Intra, Tmeasure,EUTRAN\_Intra and Tevaluate, E-UTRAN\_intra

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,EUTRAN\_Intra [s] (number of DRX cycles) | Tmeasure,EUTRAN\_Intra [s] (number of DRX cycles) | Tevaluate,E-UTRAN\_intra  [s] (number of DRX cycles) |
| 0.32 | 11.52 (36) | 1.28 (4) | 5.12 (16) |
| 0.64 | 17.92 (28) | 1.28 (2) | 5.12 (8) |
| 1.28 | 32(25) | 1.28 (1) | 6.4 (5) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |

Table 4.2.2.3-2: Tdetect,EUTRAN\_Intra, Tmeasure,EUTRAN\_Intra and Tevaluate,E-UTRAN\_intra for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect,EUTRAN\_Intra [s] (number of DRX or eDRX cycles Note 3) | Tmeasure,EUTRAN\_Intra [s] (number of DRX or eDRX cycles Note 3) | Tevaluate,E-UTRAN\_intra  [s] (number of DRX or eDRX cycles Note 3) |
| 5.12 | N/A | N/A | 117.76 (23) | 5.12 (1) | 10.24 (2) |
| 10.24 ≤ eDRX\_IDLE cycle length ≤ 2621.444 | 0.32 | ≥1.28 (1) | (23) | 0.32 (1) | 0.64 (2) |
| 0.64 | ≥1.28 (1) | 0.64 (1) | 1.28 (2) |
| 1.28 | ≥2.56 (2) | 1.28 (1) | 2.56 (2) |
| 2.56 | ≥5.12 (4) | 2.56 (1) | 5.12 (2) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 5.12s, number of DRX cycles otherwise. | | | | | |

Table 4.2.2.3-3 : Tdetect,EUTRAN\_Intra, Tmeasure,EUTRAN\_Intra and Tevaluate, E-UTRAN\_intra for UE configured with *highSpeedEnhancedMeasFlag*

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,EUTRAN\_Intra [s] (number of DRX cycles) | Tmeasure,EUTRAN\_Intra [s] (number of DRX cycles) | Tevaluate,E-UTRAN\_intra  [s] (number of DRX cycles) |
| 0.32 | 3.2 (10) | 0.32(1) | 0.96(3) |
| 0.64 | 6.4 (10) | 0.64 (1) | 1.92 (3) |
| 1.28 | 12.8(10) | 1.28 (1) | 3.84 (3) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |

Table 4.2.2.3-4 : Tdetect,EUTRAN\_Intra, Tmeasure,EUTRAN\_Intra and Tevaluate, E-UTRAN\_intra for UE configured with *highSpeedEnhMeasFlag2-r16*

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,EUTRAN\_Intra [s] (number of DRX cycles) | Tmeasure,EUTRAN\_Intra [s] (number of DRX cycles) | Tevaluate,E-UTRAN\_intra  [s] (number of DRX cycles) |
| 0.32 | 2.56 (8) | 0.32(1) | 0.96(3) |
| 0.64 | 5.12 (8) | 0.64 (1) | 1.92 (3) |
| 1.28 | 8.96 (7) | 1.28 (1) | 3.84 (3) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

#### 4.2.2.4 Measurements of inter-frequency E-UTRAN cells

The UE shall be able to identify new inter-frequency cells and perform RSRP or RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the serving cell, even if no explicit neighbour list with physical layer cell identities is provided.

If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ then the UE shall search for inter-frequency layers of higher priority at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2.2.

If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ then the UE shall search for and measure inter-frequency layers of higher, equal or lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority layers shall be the same as that defined below.

If the UE is not configured with eDRX\_IDLE cycle or configured with an eDRX\_IDLE cycle not longer than 20.48 s, the UE shall be able to evaluate whether a newly detectable inter-frequency cell in normal performance group meets the reselection criteria defined in TS36.304 within Kcarrier,normal \* Tdetect,EUTRAN\_Inter, and able to evaluate whether a newly detectable inter-frequency cell in reduced performance group meets the reselection criteria defined in TS36.304 within 6 \* Kcarrier,reduced \* Tdetect,EUTRAN\_Inter if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when Treselection = 0 provided that the reselection criteria is met by a margin of at least 5dB for reselections based on ranking or 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities. If the UE is configured with eDRX\_IDLE cycle longer than 20.48 s, the UE shall be able to evaluate whether a newly detectable inter-frequency cell in normal performance group meets the reselection criteria defined in TS36.304 within Kcarrier,normal \* Tdetect,EUTRAN\_Inter, and when Srxlev < 3 dB or Squal < 3 dB and able to evaluate whether a newly detectable inter-frequency cell in reduced performance group meets the reselection criteria defined in TS36.304 within 6 \* Kcarrier,reduced \* Tdetect,EUTRAN\_Inter if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when Treselection = 0 provided that the reselection criteria is met by a margin of at least 5dB for reselections based on ranking or 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities. An inter-frequency cell is considered to be detectable according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot defined in Annex B.1.2 for a corresponding Band.

For UE category 1bis, if the UE is not configured with eDRX\_IDLE cycle or configured with an eDRX\_IDLE cycle not longer than 20.48 s, the UE shall be able to evaluate whether a newly detectable inter-frequency cell in normal performance group meets the reselection criteria defined in TS36.304 within Kcarrier,normal \* Tdetect,EUTRAN\_Inter, and able to evaluate whether a newly detectable inter-frequency cell in reduced performance group meets the reselection criteria defined in TS36.304 within 6 \* Kcarrier,reduced \* Tdetect,EUTRAN\_Inter if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when Treselection = 0 provided that the reselection criteria is met by a margin of at least 5.5dB for reselections based on ranking or 6.5dB for RSRP reselections based on absolute priorities or 5dB for RSRQ reselections based on absolute priorities. If the UE is configured with eDRX\_IDLE cycle longer than 20.48 s, the UE shall be able to evaluate whether a newly detectable inter-frequency cell in normal performance group meets the reselection criteria defined in TS36.304 within Kcarrier,normal \* Tdetect,EUTRAN\_Inter, and when Srxlev < 3 dB or Squal < 3 dB and able to evaluate whether a newly detectable inter-frequency cell in reduced performance group meets the reselection criteria defined in TS36.304 within 6 \* Kcarrier,reduced \* Tdetect,EUTRAN\_Inter if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when Treselection = 0 provided that the reselection criteria is met by a margin of at least 5.5dB for reselections based on ranking or 6.5dB for RSRP reselections based on absolute priorities or 5dB for RSRQ reselections based on absolute priorities. An inter-frequency cell is considered to be detectable according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot defined in Annex B.1.2 for a corresponding Band.

When higher priority cells are found by the higher priority search, they shall be measured at least every Tmeasure,E-UTRAN\_Inter . If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a E-UTRA carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

If the UE is configured with eDRX\_IDLE cycle not longer than 20.48 s, the UE shall measure RSRP or RSRQ at least every Kcarrier,normal \* Tmeasure,EUTRAN\_Inter for identified lower or equal priority inter-frequency cells in normal performance group, and at least every 6 \* Kcarrier,reduced \* Tmeasure,EUTRAN\_Inter for identified lower or equal priority inter-frequency cells in reduced performance group. If the UE is configured with eDRX\_IDLE cycle longer than 20.48 s, the UE shall measure RSRP or RSRQ at least every Kcarrier,normal \* Tmeasure,EUTRAN\_Inter for identified lower or equal priority inter-frequency cells in normal performance group, and when Srxlev < 3 dB or Squal < 3 dB at least every 6 \* Kcarrier,reduced \* Tmeasure,EUTRAN\_Inter for identified lower or equal priority inter-frequency cells in reduced performance group. If the UE detects on a E-UTRA carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall filter RSRP or RSRQ measurements of each measured higher, lower and equal priority inter-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure,EUTRAN\_Inter/2.

The UE shall not consider a E-UTRA neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

If the UE is configured with eDRX\_IDLE cycle not longer than 20.48 s, for an inter-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell in normal performance group has met reselection criterion defined TS 36.304 within Kcarrier,normal \* Tevaluate,E-UTRAN\_Inter, and capable of evaluating that the inter-frequency cell in reduced performance group has met reselection criterion defined TS 36.304 within 6 \* Kcarrier,reduced \* Tevaluate,E-UTRAN\_Inter, when Treselection = 0 provided that the reselection criteria is met by a margin of at least 5dB for reselections based on ranking or 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities. If the UE is configured with eDRX\_IDLE cycle longer than 20.48 s, for an inter-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell in normal performance group has met reselection criterion defined TS 36.304 within Kcarrier,normal \* Tevaluate,E-UTRAN\_Inter, and when Srxlev < 3 dB or Squal < 3 dB capable of evaluating that the inter-frequency cell in reduced performance group has met reselection criterion defined TS 36.304 within 6 \* Kcarrier,reduced \* Tevaluate,E-UTRAN\_Inter, when Treselection = 0 provided that the reselection criteria is met by a margin of at least 5dB for reselections based on ranking or 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities. When evaluating cells for reselection, the side conditions for RSRP and SCH apply to both serving and inter-frequency cells.

If Treselection timer has a non zero value and the inter-frequency cell is better ranked than the serving cell, the UE shall evaluate this inter-frequency cell for the Treselection time. If this cell remains better ranked within this duration, then the UE shall reselect that cell.

For UE not configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_Inter, Tmeasure,EUTRAN\_Inter and Tevaluate, E-UTRAN\_inter are specified in Table 4.2.2.4-1. For UE configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_Inter, Tmeasure,EUTRAN\_Inter and Tevaluate, E-UTRAN\_inter are specified in Table 4.2.2.4-2, where the requirements apply provided that the serving cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,EUTRAN\_Inter, Tmeasure,EUTRAN\_Inter and Tevaluate, E-UTRAN\_inter when multiple PTWs are used.

Table 4.2.2.4-1 : Tdetect,EUTRAN\_Inter, Tmeasure,EUTRAN\_Inter and Tevaluate,E-UTRAN\_Inter

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,EUTRAN\_Inter [s] (number of DRX cycles) | Tmeasure,EUTRAN\_Inter [s] (number of DRX cycles) | Tevaluate,E-UTRAN\_Inter  [s] (number of DRX cycles) |
| 0.32 | 11.52 (36) | 1.28 (4) | 5.12 (16) |
| 0.64 | 17.92 (28) | 1.28 (2) | 5.12 (8) |
| 1.28 | 32(25) | 1.28 (1) | 6.4 (5) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |

Table 4.2.2.4-2: Tdetect,EUTRAN\_Inter, Tmeasure,EUTRAN\_Inter and Tevaluate, E-UTRAN\_inter for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect,EUTRAN\_Inter [s] (number of DRX or eDRX cycles Note 3) | Tmeasure,EUTRAN\_Inter [s] (number of DRX or eDRX cycles Note 3) | Tevaluate,E-UTRAN\_inter  [s] (number of DRX or eDRX cycles Note 3) |
| 5.12 | N/A | N/A | 117.76 (23) | 5.12 (1) | 10.24 (2) |
| 10.24 ≤ eDRX\_IDLE cycle length ≤ 2621.4 | 0.32 | ≥1.28 (1) | (23) | 0.32 (1) | 0.64 (2) |
| 0.64 | ≥1.28 (1) | 0.64 (1) | 1.28 (2) |
| 1.28 | ≥2.56 (2) | 1.28 (1) | 2.56 (2) |
| 2.56 | ≥5.12 (4) | 2.56 (1) | 5.12 (2) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 5.12s, number of DRX cycles otherwise. | | | | | |

For higher priority cells, a UE may optionally use a shorter value for **TmeasureE-UTRA\_Inter** ,which shall not be less than Max(0.64 s, one DRX cycle).

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

#### 4.2.2.5 Measurements of inter-RAT cells

If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ then the UE shall search for inter-RAT layers of higher priority at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2.2

If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ then the UE shall search for and measure inter-RAT layers of higher, lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority inter-RAT layers shall be the same as that defined below for lower priority RATs.

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

##### 4.2.2.5.1 Measurements of UTRAN FDD cells

When the measurement rules indicate that UTRA FDD cells are to be measured, the UE shall measure CPICH Ec/Io and CPICH RSCP of detected UTRA FDD cells in the neighbour frequency list at the minimum measurement rate specified in this section. The UE shall filter CPICH Ec/Io and CPICH RSCP measurements of each measured UTRA FDD cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least half the minimum specified measurement period.

If the UE is not configured with eDRX\_IDLE cycle or configured with eDRX\_IDLE cycle not longer than 20.48 s, the UE shall evaluate whether newly detectable UTRA FDD cells in normal performance group have met the reselection criteria in TS 36.304 within time NUTRA\_carrier,normal \* TdetectUTRA\_FDD ,and evaluate whether newly detectable UTRA FDD cells in reduced performance group have met the reselection criteria in TS 36.304 within time 6 \* NUTRA\_carrier,reduced \* TdetectUTRA\_FDD when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ when TreselectionRAT = 0 provided that the reselection criteria is met by a margin of at least 6dB for reselections based on RSCP, or a margin of at least 3dB for reselections based on Ec/Io. If the UE is configured with eDRX\_IDLE cycle longer than 20.48 s, the UE shall evaluate whether newly detectable UTRA FDD cells in normal performance group have met the reselection criteria in TS 36.304 within time (NUTRA\_carrier,normal) \* TdetectUTRA\_FDD ,and when Srxlev < 3 dB or Squal < 3 dB evaluate whether newly detectable UTRA FDD cells in reduced performance group have met the reselection criteria in TS 36.304 within time 6 \* NUTRA\_carrier,reduced \* TdetectUTRA\_FDD when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ when TreselectionRAT = 0 provided that the reselection criteria is met by a margin of at least 6dB for reselections based on RSCP, or a margin of at least 3dB for reselections based on Ec/Io.

If the UE is not configured with eDRX\_IDLE cycle or configured with eDRX\_IDLE cycle not longer than 20.48 s, cells which have been detected shall be measured at least every NUTRA\_carrier,normal \* TmeasureUTRA\_FDD for the cells in normal performance group, and at least every 6 \* NUTRA\_carrier,reduced \* TmeasureUTRA\_FDD for the cells in reduced performance group when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ. If the UE is configured with eDRX\_IDLE cycle longer than 20.48 s, cells which have been detected shall be measured at least every (NUTRA\_carrier,normal) \* TmeasureUTRA\_FDD for the cells in normal performance group, and when Srxlev < 3 dB or Squal < 3 dB at least every 6 \* NUTRA\_carrier,reduced \* TmeasureUTRA\_FDD for the cells in reduced performance group when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ.

When higher priority UTRA FDD cells are found by the higher priority search, they shall be measured at least every Tmeasure,UTRA\_FDD. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell.

If the UE is not configured with eDRX\_IDLE cycle or configured with eDRX\_IDLE cycle not longer than 20.48 s, for a cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that an already identified UTRA FDD cell has met reselection criterion defined in TS 36.304 [1] within NUTRA\_carrier,normal \* TevaluateUTRA\_FDD if the cell is in normal performance group and within 6 \* NUTRA\_carrier,reduced \* TevaluateUTRA\_FDD if the cell is in reduced performance group when Treselection = 0provided that the reselection criteria is met by a margin of at least 6dB for reselections based on RSCP, or a margin of at least 3dB for reselections based on Ec/Io. If the UE is configured with eDRX\_IDLE cycle longer than 20.48 s, for a cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that an already identified UTRA FDD cell has met reselection criterion defined in TS 36.304 [1] within (NUTRA\_carrier,normal) \* TevaluateUTRA\_FDD if the cell is in normal performance group and when Srxlev < 3 dB or Squal < 3 dB within 6 \* NUTRA\_carrier,reduced \* TevaluateUTRA\_FDD if the cell is in reduced performance group when Treselection = 0provided that the reselection criteria is met by a margin of at least 6dB for reselections based on RSCP, or a margin of at least 3dB for reselections based on Ec/Io.

If Treselection timer has a non zero value and the UTRA FDD cell is satisfied with the reselection criteria which are defined in [1], the UE shall evaluate this UTRA FDD cell for the Treselection time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

For UE not configured with eDRX\_IDLE cycle, TdetectUTRA\_FDD, TmeasureUTRA\_FDD and TevaluateUTRA\_FDD are specified in Table 4.2.2.5.1-1. For UE configured with eDRX\_IDLE cycle, TdetectUTRA\_FDD, TmeasureUTRA\_FDD and TevaluateUTRA\_FDD are specified in Table 4.2.2.5.1-2, where the requirements apply provided that the serving cell is configured with eDRX\_IDLE and is the same in all PTWs during any of TdetectUTRA\_FDD, TmeasureUTRA\_FDD and TevaluateUTRA\_FDD when multiple PTWs are used.

Table 4.2.2.5.1-1: TdetectUTRA\_FDD, TmeasureUTRA\_FDD, and TevaluateUTRA\_FDD

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | TdetectUTRA\_FDD [s] | TmeasureUTRA\_FDD [s] (number of DRX cycles) | TevaluateUTRA\_FDD  [s] (number of DRX cycles) |
| 0.32 | 30 | 5.12 (16) | 15.36 (48) |
| 0.64 | 5.12 (8) | 15.36 (24) |
| 1.28 | 6.4(5) | 19.2 (15) |
| 2.56 | 60 | 7.68 (3) | 23.04 (9) |

Table 4.2.2.5.1-2: TdetectUTRA\_FDD, TmeasureUTRA\_FDD and TevaluateUTRA\_FDD for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | TdetectUTRA\_FDD [s] (number of DRX or eDRX cycles Note 4) | TmeasureUTRA\_FDD [s] (number of DRX or eDRX cycles Note 4) | TevaluateUTRA\_FDD  [s] (number of DRX or eDRX cycles Note 4) |
| 5.12 | N/A | N/A | 117.76 (23) | 15.36 (3) | 46.08 (9) |
| 10.24 ≤ eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | ≥1.28 (1) | Note 3 (23) | 0.96 (3) | Note 3 (9) |
| 0.64 | ≥2.56 (2) | 1.92 (3) | Note 3 (9) |
| 1.28 | ≥3.84 (3) | 3.84 (3) | Note 3 (9) |
| 2.56 | ≥7.68 (6) | 7.68 (3) | Note 3 (9) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: The time is calculated depending on the number N of DRX cycles as follows:  NOTE 4: Number of eDRX cycles when eDRX\_IDLE cycle length equals 5.12s, number of DRX cycles otherwise. | | | | | |

For higher priority cells, a UE may optionally use a shorter value for **TmeasureUTRA\_FDD**, which shall not be less than Max(0.64 s, one DRX cycle).

##### 4.2.2.5.2 Measurements of UTRAN TDD cells

When the measurement rules indicate that UTRA TDD cells are to be measured, the UE shall measure P-CCPCH RSCP of detected UTRA TDD cells in the neighbour frequency list at the minimum measurement rate specified in this section. The UE shall filter P-CCPCH RSCP measurements of each measured UTRA TDD cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least half the minimum specified measurement period. If the UE is not configured with eDRX\_IDLE cycle, P-CCPCH RSCP of UTRAN TDD cells shall not be filtered over a longer period than that specified in table 4.2.2.5.2-1. If the UE is configured with eDRX\_IDLE cycle, P-CCPCH RSCP of UTRAN TDD cells shall not be filtered over a longer period than that specified in table 4.2.2.5.2-2.

If the UE is not configured with eDRX\_IDLE cycle or configured with eDRX\_IDLE cycle not longer than 20.48 s, the UE shall evaluate whether newly detectable UTRA TDD cells in normal performance group have met the reselection criteria in TS 36.304 within time NUTRA\_carrier\_TDD,normal \* TdetectUTRA\_TDD, and evaluate whether newly detectable UTRA TDD cells in reduced performance group have met the reselection criteria in TS 36.304 within time 6 \* NUTRA\_carrier\_TDD,reduced \* TdetectUTRA\_TDD when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ when Treselection = 0 provided that the reselection criteria is met by a margin of at least 6dB. If the UE is configured with eDRX\_IDLE cycle longer than 20.48 s, the UE shall evaluate whether newly detectable UTRA TDD cells in normal performance group have met the reselection criteria in TS 36.304 within time (NUTRA\_carrier\_TDD,normal) \* TdetectUTRA\_TDD, and when Srxlev < 3 dB or Squal < 3 dB evaluate whether newly detectable UTRA TDD cells in reduced performance group have met the reselection criteria in TS 36.304 within time 6 \* NUTRA\_carrier\_TDD,reduced \* TdetectUTRA\_TDD when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ when Treselection = 0 provided that the reselection criteria is met by a margin of at least 6dB.

If the UE is not configured with eDRX\_IDLE cycle or configured with eDRX\_IDLE cycle not longer than 20.48 s, cells which have been detected shall be measured at least every NUTRA\_carrier\_TDD,normal \* TmeasureUTRA\_TDD for the cells in normal performance group, and at least every 6 \* NUTRA\_carrier\_TDD,reduced \* TmeasureUTRA\_TDD for the cells in reduced performance group, when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ. If the UE is configured with eDRX\_IDLE cycle longer than 20.48 s, cells which have been detected shall be measured at least every (NUTRA\_carrier\_TDD,normal) \* TmeasureUTRA\_TDD for the cells in normal performance group, and when Srxlev < 3 dB or Squal < 3 dB at least every 6 \* NUTRA\_carrier\_TDD,reduced \* TmeasureUTRA\_TDD for the cells in reduced performance group, when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ.

When higher priority UTRA TDD cells are found by the higher priority search, they shall be measured at least every Tmeasure,UTRA\_TDD. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell.

If the UE is not configured with eDRX\_IDLE cycle or configured with eDRX\_IDLE cycle not longer than 20.48 s, for a cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that an already identified UTRA TDD cell has met reselection criterion defined in [1] within NUTRA\_carrier\_TDD,normal \*TevaluateUTRA\_TDD if the cell is in normal performance group and within 6 \* NUTRA\_carrier\_TDD,reduced \* TevaluateUTRA\_TDD if the cell is in reduced performance group when Treselection = 0provided that the reselection criteria is met by a margin of at least 6dB. If the UE is configured with eDRX\_IDLE cycle longer than 20.48 s, for a cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that an already identified UTRA TDD cell has met reselection criterion defined in [1] within NUTRA\_carrier\_TDD,normal \*TevaluateUTRA\_TDD if the cell is in normal performance group and when Srxlev < 3 dB or Squal < 3 dB within 6 \* NUTRA\_carrier\_TDD,reduced \* TevaluateUTRA\_TDD if the cell is in reduced performance group when Treselection = 0provided that the reselection criteria is met by a margin of at least 6dB.

If Treselection timer has a non zero value and the UTRA TDD cell is satisfied with the reselection criteria which are defined in [1], the UE shall evaluate this UTRA TDD cell for the Treselection time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

For UE not configured with eDRX\_IDLE cycle, TdetectUTRA\_TDD, TmeasureUTRA\_TDD and TevaluateUTRA\_TDD are specified in Table 4.2.2.5.2-1. For UE configured with eDRX\_IDLE cycle, TdetectUTRA\_TDD, TmeasureUTRA\_TDD and TevaluateUTRA\_TDD are specified in Table 4.2.2.5.2-2, where the requirements apply provided that the serving cell is configured with eDRX\_IDLE and is the same in all PTWs during any of TdetectUTRA\_TDD, TmeasureUTRA\_TDD and TevaluateUTRA\_TDD when multiple PTWs are used.

Table 4.2.2.5.2-1: TdetectUTRA\_TDD, TmeasureUTRA\_TDD and TevaluateUTRA\_TDD

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | TdetectUTRA\_TDD [s] | TmeasureUTRA\_TDD [s] (number of DRX cycles) | TevaluateUTRA\_TDD  [s] (number of DRX cycles) |
| 0.32 | 30 | 5.12 (16) | 15.36 (48) |
| 0.64 | 5.12 (8) | 15.36 (24) |
| 1.28 | 6.4(5) | 19.2 (15) |
| 2.56 | 60 | 7.68 (3) | 23.04 (9) |

Table 4.2.2.5.2-2: TdetectUTRA\_TDD, TmeasureUTRA\_TDD and TevaluateUTRA\_TDD for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | TdetectUTRA\_TDD [s] (number of DRX or eDRX cycles Note 4) | TmeasureUTRA\_TDD [s] (number of DRX or eDRX cycles Note 4) | TevaluateUTRA\_TDD  [s] (number of DRX or eDRX cycles Note 4) |
| 5.12 | N/A | N/A | 117.76 (23) | 15.36 (3) | 46.08 (9) |
| 10.24 ≤ eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | ≥1.28 (1) | Note 3 (23) | 0.96 (3) | Note 3 (9) |
| 0.64 | ≥2.56 (2) | 1.92 (3) | Note 3 (9) |
| 1.28 | ≥3.84 (3) | 3.84 (3) | Note 3 (9) |
| 2.56 | ≥7.68 (6) | 7.68 (3) | Note 3 (9) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: The time is calculated depending on the number N of DRX cycles as follows:  NOTE 4: Number of eDRX cycles when eDRX\_IDLE cycle length equals 5.12s, number of DRX cycles otherwise. | | | | | |

For higher priority cells, a UE may optionally use a shorter value for **TmeasureUTRA\_TDD**, which shall not be less than Max(0.64 s, one DRX cycle).

##### 4.2.2.5.3 Measurements of GSM cells

When the measurement rules defined in [1] indicate that E-UTRAN inter-frequencies or inter-RAT frequency cells are to be measured, the UE shall measure the signal level of the GSM BCCH carriers if the GSM BCCH carriers are indicated in the measurement control system information of the serving cell. GSM BCCH carriers of lower priority than the serving cell shall be measured at least every Tmeasure,GSM.

When higher priority GSM BCCH carriers are found by the higher priority search, they shall be measured at least every Tmeasure,GSM, and the UE shall decode the BSIC of the GSM BCCH carrier. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection, or to continuously verify the BSIC of the GSM BCCH carrier every 30s. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell.

The UE shall maintain a running average of 4 measurements for each GSM BCCH carrier. The measurement samples for each cell shall be as far as possible uniformly distributed over the averaging period.

If continuous GSM measurements are required by the measurement rules in [1], the UE shall attempt to verify the BSIC at least every 30 seconds for each of the 4 strongest GSM BCCH carriers. If a change of BSIC is detected for one GSM cell then that GSM BCCH carrier shall be treated as a new GSM neighbour cell. If the UE detects on a BCCH carrier a BSIC which is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform BSIC re-confirmation for that cell.

The UE shall not consider the GSM BCCH carrier in cell reselection, if the UE cannot demodulate the BSIC of that GSM BCCH carrier. Additionally, the UE shall not consider a GSM neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

If Treselection timer has a non zero value and the GSM cell is satisfied with the reselection criteria which are defined in [1], the UE shall evaluate this GSM cell for the Treselection time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

For UE not configured with eDRX\_IDLE cycle, Tmeasure,GSM is specified in Table 4.2.2.5.3-1. For UE configured with eDRX\_IDLE cycle, Tmeasure,GSM is specified in Table 4.2.2.5.3-2, where the requirements apply provided that the serving cell is configured with eDRX\_IDLE and is the same in all PTWs during Tmeasure,GSM when multiple PTWs are used.

Table 4.2.2.5.3-1: Tmeasure,GSM,

|  |  |
| --- | --- |
| DRX cycle length [s] | Tmeasure,GSM [s] (number of DRX cycles) |
| 0.32 | 5.12 (16) |
| 0.64 | 5.12 (8) |
| 1.28 | 6.4(5) |
| 2.56 | 7.68 (3) |

Table 4.2.2.5.3-2: Tmeasure,GSM for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | | PTW length [s] (number of 1.28s periods) | Tmeasure,GSM [s] (number of DRX or eDRX cycles Note 3) | |
| 5.12 | | N/A | N/A | | 15.36 (3) | |
| 10.24 ≤ eDRX\_IDLE cycle length ≤ 2621.44 | | 0.32 | ≥1.28 (1) | | 0.96 (3) | |
| 0.64 | ≥2.56 (2) | | 1.92 (3) | |
| 1.28 | ≥3.84 (3) | | 3.84 (3) | |
| 2.56 | ≥7.68 (6) | | 7.68 (3) | |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 5.12s, number of DRX cycles otherwise. | | | | | |

##### 4.2.2.5.4 Measurements of HRPD cells

In order to perform measurement and cell reselection to HRPD cell, the UE shall acquire the timing of HRPD cells.

When the measurement rules indicate that HRPD cells are to be measured, the UE shall measure CDMA2000 HRPD Pilot Strength of HRPD cells in the neighbour cell list at the minimum measurement rate specified in this section.

The parameter ‘Number of HRPD Neighbor Frequency’, which is transmitted on E-UTRAN BCCH, is the number of carriers used for all HRPD cells in the neighbour cell list.

When the E-UTRA serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE shall search for CDMA2000 HRPD layers of higher priority at least every Thigher\_priority\_search where Thigher\_priority\_search is defined in clause 4.2.2.

For CDMA2000 HRPD cells which have been detected, the UE shall measure CDMA2000 HRPD Pilot Strength at least every (Number of HRPD Neighbor Frequency)\*TmeasureHRPD, when the E-UTRA serving cell Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ.

The UE shall be capable of evaluating that the CDMA2000 HRPD cell has met cell reselection criterion defined in [1] within TevaluateHRPD.

For UE not configured with eDRX\_IDLE cycle, Table 4.2.2.5.4-1 gives values of TmeasureHRPD and TevaluateHRPD. For UE configured with eDRX\_IDLE cycle, TmeasureHRPD and TevaluateHRPD are specified in Table 4.2.2.5.4-2, where the requirements apply provided that the serving cell is configured with eDRX\_IDLE and is the same in all PTWs during any of TmeasureHRPD and TevaluateHRPD when multiple PTWs are used.

Table 4.2.2.5.4-1: TmeasureHRPD and TevaluateHRPD

|  |  |  |
| --- | --- | --- |
| DRX cycle length [s] | TmeasureHRPD [s] (number of DRX cycles) | TevaluateHRPD [s] (number of DRX cycles) |
| 0.32 | 5.12 (16) | 15.36 (48) |
| 0.64 | 5.12 (8) | 15.36 (24) |
| 1.28 | 6.4 (5) | 19.2 (15) |
| 2.56 | 7.68 (3) | 23.04 (9) |

Table 4.2.2.5.4-2: TmeasureHRPD and TevaluateHRPD for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | TmeasureHRPD [s] (number of DRX or eDRX cycles Note 4) | TevaluateHRPD  [s] (number of DRX or eDRX cycles Note 4) |
| 5.12 | N/A | N/A | 15.36 (3) | 46.08 (9) |
| 10.24 ≤ eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | ≥1.28 (1) | 0.96 (3) | Note 3 (9) |
| 0.64 | ≥2.56 (2) | 1.92 (3) | Note 3 (9) |
| 1.28 | ≥3.84 (3) | 3.84 (3) | Note 3 (9) |
| 2.56 | ≥7.68 (6) | 7.68 (3) | Note 3 (9) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: The time is calculated depending on the number N of DRX cycles as follows:  NOTE 4: Number of eDRX cycles when eDRX\_IDLE cycle length equals 5.12s, number of DRX cycles otherwise. | | | | |

If Treselection timer has a non zero value and the CDMA2000 HRPD cell is satisfied with the reselection criteria which are defined in [1], the UE shall evaluate this CDMA2000 HRPD cell for the Treselection time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

##### 4.2.2.5.5 Measurements of cdma2000 1X

In order to perform measurement and cell reselection to cdma2000 1X cell, the UE shall acquire the timing of cdma2000 1X cells.

When the measurement rules indicate that cdma2000 1X cells are to be measured, the UE shall measure cdma2000 1x RTT Pilot Strength of cdma2000 1X cells in the neighbour cell list at the minimum measurement rate specified in this section.

The parameter ‘Number of CDMA2000 1X Neighbor Frequency’, which is transmitted on E-UTRAN BCCH, is the number of carriers used for all cdma2000 1X cells in the neighbour cell list.

When the E-UTRA serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE shall search for cdma2000 1X layers of higher priority at least every Thigher\_priority\_search where Thigher\_priority\_search is defined in clause 4.2.2.

For CDMA2000 1X cells which have been detected, the UE shall measure CDMA2000 1xRTT Pilot Strength at least every (Number of CDMA2000 1X Neighbor Frequency)\*TmeasureCDMA2000\_1X, when the E-UTRA serving cell Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ. The UE shall be capable of evaluating that the cdma2000 1X cell has met cell reselection criterion defined in [1] within TevaluateCDMA2000\_1X.

For UE not configured with eDRX\_IDLE cycle, Table 4.2.2.5.5-1 gives values of TmeasureCDMA2000\_1X and TevaluateCDMA2000\_1X. For UE configured with eDRX\_IDLE cycle, TmeasureCDMA2000\_1X and TevaluateCDMA2000\_1X are specified in Table 4.2.2.5.5-2 where the requirements apply provided that the serving cell is configured with eDRX\_IDLE and is the same in all PTWs during any of TmeasureCDMA2000\_1X and TevaluateCDMA2000\_1X when multiple PTWs are used.

Table 4.2.2.5.5-1: TmeasureCDMA2000 1X and TevaluateCDMA2000 1X

|  |  |  |
| --- | --- | --- |
| DRX cycle length [s] | TmeasureCDMA2000\_1X [s] (number of DRX cycles) | TevaluateCDMA2000\_1X [s] (number of DRX cycles) |
| 0.32 | 5.12 (16) | 15.36 (48) |
| 0.64 | 5.12 (8) | 15.36 (24) |
| 1.28 | 6.4 (5) | 19.2 (15) |
| 2.56 | 7.68 (3) | 23.04 (9) |

Table 4.2.2.5.5-2: TmeasureCDMA2000\_1X and TevaluateCDMA2000\_1X for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | TmeasureCDMA2000\_1X [s] (number of DRX or eDRX cycles Note 4) | TevaluateCDMA2000\_1X  [s] (number of DRX or eDRX cycles Note 4) |
| 5.12 | N/A | N/A | 15.36 (3) | 46.08 (9) |
| 10.24 ≤ eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | ≥1.28 (1) | 0.96 (3) | Note 3 (9) |
| 0.64 | ≥2.56 (2) | 1.92 (3) | Note 3 (9) |
| 1.28 | ≥3.84 (3) | 3.84 (3) | Note 3 (9) |
| 2.56 | ≥7.68 (6) | 7.68 (3) | Note 3 (9) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: The time is calculated depending on the number N of DRX cycles as follows:  NOTE 4: Number of eDRX cycles when eDRX\_IDLE cycle length equals 5.12s, number of DRX cycles otherwise. | | | | |

If Treselection timer has a non zero value and the CDMA2000 1X cell is satisfied with the reselection criteria which are defined in [1], the UE shall evaluate this CDMA2000 1X cell for the Treselection time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

##### 4.2.2.5.6 Measurements of NR cells

If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ then the UE shall search for inter-RAT NR layers of higher priority at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2.2.

If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ then the UE shall search for and measure inter-RAT NR layers of higher, lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority inter-RAT NR layers shall be the same as that defined below for lower priority RATs.

The requirements in this section apply for inter-RAT NR measurements. When the measurement rules indicate that inter-RAT NR cells are to be measured, the UE shall measure SS-RSRP and SS-RSRQ of detected NR cells in the neighbour frequency list at the minimum measurement rate specified in this section. If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, a carrier is indicated to meet high speed requirement if *highSpeedInterRAT-NR-r16* is configured and the carrier to be measured is configured with *highSpeedCarrierNR-r16*. If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE is required to meet non high speed requirements no matter whether *highSpeedInterRAT-NR-r16* or *highSpeedCarrierNR-r16* is configured or not. The parameter NNR\_carrier is the number of configured NR carriers indicated to meet non high speed requirement in the neighbour frequency list. NNR\_carrier\_HST is the number of configured carriers for reselection indicated to meet high speed requirements.

The parameter NNR\_carrier for a UE configured with idle mode DC measurements (while T331 is running) is the combined number of configured NR carriers indicated to meet non high speed requirement in the neighbour frequency list, and NR carriers configured for idle mode DC measurements, excluding the configured NR carriers for reselection indicated to meet high speed requirements.

Note: combined total number means that if a carrier is indicated in the neighbour frequency list and additionally a carrier configured for idle mode DC measurements, it only counts as one carrier.

The UE shall filter SS-RSRP and SS-RSRQ measurements of each measured NR cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least half the minimum specified measurement period.

The UE shall be able to evaluate whether a newly detectable inter-RAT NR cell meets the reselection criteria defined in TS 36.304 [1] within NNR\_carrier\_HST \* Tdetect, NR\_HST + NNR\_carrier \* Tdetect, NR

when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ when Treselection = 0 provided that the reselection criteria is met by a margin of at least 6 dB in FR1 or 7.5 dB in FR2 for SS-RSRP reselections based on absolute priorities or 4 dB in FR1 and 4 dB in FR2 for SS-RSRQ reselections based on absolute priorities.

When higher priority cells are found by the higher priority search, they shall be measured at least every Tmeasure,NR. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this section shall still be met by the UE before it makes any determination that it may stop measuring the cell.

If the UE detects on an inter-RAT NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall not consider an inter-RAT NR cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

Cells which have been detected shall be measured at least every NNR\_carrier\_HST \* Tmeasure, NR\_HST + NNR\_carrier \* Tmeasure, NR when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ.

For a cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that an already identified inter-RAT NR cell has met reselection criterion defined in TS 36.304 [1] within NNR\_carrier\_HST \* Tevaluate, NR\_HST + NNR\_carrier \* Tevaluate, NR when Treselection = 0as specified in Table 4.2.2.5.6-1 and table 4.2.2.5.6-2 provided that the reselection criteria is met by a margin of at least 6 dB in FR1 or 7.5 dB in FR2 for SS-RSRP reselections based on absolute priorities or 4 dB in FR1 and 4 dB in FR2 for SS-RSRQ reselections based on absolute priorities.

If Treselection timer has a non zero value and the inter-RAT NR cell is satisfied with the reselection criteria which are defined in TS 36.304 [1], the UE shall evaluate this NR cell for the Treselection time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

Table 4.2.2.5.6-1: Tdetect,NR, TmeasureNR, and Tevaluate,NR

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | Tdetect,NR [s] (number of DRX cycles) | Tmeasure,NR [s] (number of DRX cycles) | Tevaluate,NR  [s] (number of DRX cycles) |
| FR1 | FR2Note1 |
| 0.32 | 1 | 8 | 11.52 x 1.5 x N1  (36 x 1.5 x N1) | 1.28 x 1.5 x N1  (4 x 1.5 x N1) | 5.12 x 1.5 x N1  (16 x 1.5 x N1) |
| 0.64 | 5 | 17.92 x N1  (28 x N1) | 1.28 x N1  (2 x N1) | 5.12 x N1  (8 x N1) |
| 1.28 | 4 | 32 x N1  (25 x N1) | 1.28 x N1  (1 x N1) | 6.4 x N1  (5 x N1) |
| 2.56 | 3 | 58.88 x N1  (23 x N1) | 2.56 x N1  (1 x N1) | 7.68 x N1  (3 x N1) |
| NOTE 1: Applies for UE supporting power class 2&3&4. For UE supporting power class 1 or 5, N1 = 8 for all DRX cycle length. | | | | | |

Table 4.2.2.5.6-2: Tdetect,NR\_HST, TmeasureNR\_HST, and Tevaluate,NR\_HST for UE configured with highSpeedInterRAT-NR-r16

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_HST [s] (number of DRX cycles) | Tmeasure,NR\_HST [s] (number of DRX cycles) | Tevaluate,NR\_HST  [s] (number of DRX cycles) |
|
| 0.32 | 4.16 x M2 (13 x M2)Note 2 | 0.64 x M3 (2 x M3)Note 2 | 0.96 x M4 (3 x M4) Note 2 |
| 0.64 | 7.68 (12)) | 1.28 (2) | 1.92 (3) |
| 1.28 | 12.8(10) | 1.28 (1) | 3.84 (3) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |
| Note 1: FR2 high speed requirements are not specified.  Note 2: M2=1.5, M3=2 and M4=2 if SMTC periodicity of measured intra-frequency cell > 40 ms; otherwise M2=M3=M4=1.. | | | |

##### 4.2.2.5.7 Measurements of NR cells subject to CCA

The UE shall be able to identify new inter-RAT cells subject to CCA and perform SS-RSRP or SS-RSRQ measurements of identified inter-RAT cells if carrier frequency information is provided by the serving cell, even if no explicit neighbour list with physical layer cell identities is provided.

If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ then the UE shall search for inter-RAT layers of higher priority at least every Thigher\_priority\_search.

If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ then the UE shall search for and measure inter-RAT layers of higher, lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority layers shall be the same as that defined below in this subclause.

The UE shall be able to evaluate whether a newly detectable inter-RAT cell meets the reselection criteria defined in TS38.304 within Kcarrier \* Tdetect,NR\_Inter + Kcarrier\_CCA \* Tdetect,NR\_Inter\_CCA if at least carrier frequency information is provided for inter-RAT neighbour cells by the serving cells when Treselection = 0 provided that the reselection criteria is met by a margin of at least 6dB in FR1 for SS-RSRP reselections based on absolute priorities or 4dB in FR1 for SS-RSRQ reselections based on absolute priorities.

The parameter Kcarrier is the number of NR inter-RAT carriers on licensed band and Kcarrier\_CCA is the number of NR inter-RAT carriers on unlicensed band indicated by the serving cell. An inter-RAT cell is considered to be detectable according to the conditions defined in Annex B.x.y for a corresponding Band.

When higher priority cells are found by the higher priority search, they shall be measured at least every Tmeasure,NR\_Inter\_CCA. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this section shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall measure SS-RSRP or SS-RSRQ at least every Kcarrier \* Tmeasure,NR\_Inter + Kcarrier\_CCA \* Tmeasure,NR\_Inter\_CCA (see table 4.2.2.5.7-1) for identified lower priority inter-RAT cells. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

For a cell that is already identified, after 2 unsuccessful measurement attempts due to exceeding the maximum number of SMTC occasions not available at the UE, the UE shall detect cells on any of the configured serving- and/or non-serving carriers.

In the requirements of clause 4.2.2.5.7, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but the *N* candidate SSB positions for the same SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding detection, measurement, or evaluation period, where:

- For the cell detection procedure: *N* is at least one candidate SSB position (NOTE: the one candidate SSB position for the cell detection shall not be impacted by the set of candidate SSB positions which are already being measured by the UE within the current measurement period of the on-going measurements), and

- For other procedures in clause 4.2.2.5.7: *N* are the first two successive candidate SSB positions when two or more candidate SSB positions are configured for this SSB index in one discovery burst transmission window, otherwise N is one candidate SSB position;

otherwise the SMTC occasion is considered as available at the UE.

The UE shall filter SS-RSRP or SS-RSRQ measurements of each measured higher and lower priority inter-RAT cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure,NR\_Inter\_CCA/2.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an inter-RAT cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the inter-RAT cell has met reselection criterion defined TS 38.304 within Kcarrier \* Tevaluate,NR\_Inter + Kcarrier\_CCA \* Tevaluate,NR\_Inter\_CCA when Treselection = 0as specified in table 4.2.2.5.7-1 provided that the reselection criteria is met by

- 6dB in FR1 for SS-RSRP reselections based on absolute priorities or

- 4dB in FR1 for SS-RSRQ reselections based on absolute priorities.

If Treselection timer has a non zero value and the inter-RAT cell is satisfied with the reselection criteria, the UE shall evaluate this inter-RAT cell for the Treselection time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

Table 4.2.2.5.7-1: Tdetect,NR\_Inter\_CCA, Tmeasure,NR\_Inter\_CCA and Tevaluate,NR\_Inter\_CCA

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_Inter\_CCA [s] (number of DRX cycles) | Tmeasure,NR\_Inter\_CCA [s] (number of DRX cycles) | Tevaluate,NR\_Inter\_CCA [s] (number of DRX cycles) |
|
| 0.32 | 0.32x([36]+Md)  {([36]+ Md) } | 0.32x([4]+Mm)  {([4]+ Mm) } | 0.32x([16]+Me)  {([16]+ Me) } |
| 0.64 | 0.64x([28]+ Md)  {[28]+ Md } | 0.64x([2]+ Mm)  {[2]+ Mm } | 0.64x([8]+ Me)  {[8]+ Me } |
| 1.28 | 1.28x([25]+ Md)  {[25]+ Md } | 1.28x([1]+ Mm)  {[1]+ Mm } | 1.28x([5]+ Me)  {[5]+ Me } |
| 2.56 | 2.56x([23]+ Md)  {[23]+ Md } | 2.56x([1]+ Mm)  {[1]+ Mm } | 2.56x([3]+ Me)  {[3]+ Me } |
| Note 1: Md, Mm, Me are the number of DRX cycles each with at least one SMTC occasion not available at the UE during the Tdetect,NR\_Inter\_CCA,, **Tmeasure,NR\_Inter\_CCA**and **Tevaluate,NR\_Inter\_CCA**, respectively. Mm,max, Md,max and Me,max are the maximum values of Mm, Md and Me, respectively.  Note 2: Mm ≤ Mm,max, where: Mm,max = [16] for DRX cycle = 0.32 seconds, Mm,max = [8] for DRX cycle = 0.64 seconds, Mm,max = [4] for DRX cycle = 1.28 seconds, Mm,max = [4] for DRX cycle = 2.56 seconds,  Note 3: Md ≤ Md,max, where: Md,max = [4] \* Mm,max,  Note 4: Me ≤ Me,max, where: Me,max = [2] \* Mm,max, | | | |

The UE shall restart the measurements upon exceeding Mm,max, Md.max, or Me,max.

##### 4.2.2.5.8 Measurements of NR cells for RedCap

This clause contains requirements on the NR capable E-UTRAN RedCap UE regarding measurement in RRC\_IDLE state. The requirements are specified for inter-RAT NR frequency measurements for serving E-UTRAN cell.

If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ then the UE shall search for inter-RAT NR layers of higher priority at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2.2.

If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ then the UE shall search for and measure inter-RAT NR layers of higher, lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority inter-RAT NR layers shall be the same as that defined below for lower priority RATs.

The requirements in this section apply for inter-RAT NR measurements. When the measurement rules indicate that inter-RAT NR cells are to be measured, the UE shall measure SS-RSRP and SS-RSRQ of detected NR cells in the neighbour frequency list at the minimum measurement rate specified in this section. The parameter NNR\_carrier\_RedCap is the total number of configured NR carriers in the neighbour frequency list. The UE shall filter SS-RSRP and SS-RSRQ measurements of each measured NR cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least half the minimum specified measurement period.

The UE shall be able to evaluate whether a newly detectable inter-RAT NR cell meets the reselection criteria defined in TS 36.304 [1] within (NNR\_carrier\_RedCap) \* TdetectNR\_RedCap when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ when Treselection = 0 provided that the reselection criteria is met by a margin of at least 5 dB in FR1 or 6.5 dB in FR2 for reselections based on ranking or 6 dB in FR1 or 7.5 dB in FR2 for SS-RSRP reselections based on absolute priorities or 4 dB in FR1 and 4 dB in FR2 for SS-RSRQ reselections based on absolute priorities.

When higher priority cells are found by the higher priority search, they shall be measured at least every Tmeasure,NR\_RedCap. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this section shall still be met by the UE before it makes any determination that it may stop measuring the cell.

If the UE detects on an inter-RAT NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall not consider an inter-RAT NR cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

Cells which have been detected shall be measured at least every (NNR\_carrier\_RedCap) \* TmeasureNR\_RedCap when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ.

For a cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that an already identified inter-RAT NR cell has met reselection criterion defined in TS 36.304 [1] within (NNR\_carrier\_RedCap) \* TevaluateNR\_RedCap when Treselection = 0provided that the reselection criteria is met by a margin of at least 5dB in FR1 or 6.5 dB in FR2 for reselections based on ranking or 6 dB in FR1 or 7.5 dB in FR2 for SS-RSRP reselections based on absolute priorities or 4 dB in FR1 and 4 dB in FR2 for SS-RSRQ reselections based on absolute priorities.

For UE not configured with eDRX\_IDLE cycle, Tdetect,NR\_RedCap, Tmeasure,NR\_RedCap and Tevaluate,NR\_RedCap are specified in Table 4.2.2.5.8-1 and Table 4.2.2.5.6-1 for 1 Rx RedCap and 2 Rx RedCap respectively. For UE configured with eDRX\_IDLE cycle, Tdetect,NR\_RedCap, Tmeasure,NR\_RedCap and Tevaluate,NR\_RedCap are specified in Table 4.2.2.5.8-2 for 1 Rx RedCap and in Table 4.2.2.5.8-3 for 2 Rx RedCap.

If Treselection timer has a non zero value and the inter-RAT NR cell is satisfied with the reselection criteria which are defined in TS 36.304 [1], the UE shall evaluate this NR cell for the Treselection time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

Table 4.2.2.5.8-1: Tdetect,NR\_RedCap, Tmeasure,NR\_RedCap and Tevaluate,NR\_RedCap

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | Tdetect,NR\_RedCap [s] (number of DRX cycles) | Tmeasure,NR\_RedCap [s] (number of DRX cycles) | Tevaluate,NR\_RedCap  [s] (number of DRX cycles) |
| FR1 | FR2Note1 |
| 0.32 | 1 | 8 | 11.52 x N1 x 1.5 (36 x N1 x 1.5) | 1.28 x N1 x 1.5 (4 x N1 x 1.5) | 5.12 x N1 x 1.5 (16 x N1 x 1.5) |
| 0.64 | 5 | 17.92x N1 (28 x N1) | 1.28 x N1 (2 x N1) | 5.12 x N1 (8 x N1) |
| 1.28 | 4 | 32 x N1 (25 x N1) | 1.28 x N1 (1 x N1) | 6.4 x N1 (5 x N1) |
| 2.56 | 3 | 58.88 x N1 (23 x N1) | 2.56 x N1 (1 x N1) | 7.68 x N1 (3 x N1) |
| NOTE 1: Applies for RedCap UE of all power classes. | | | | | |

Table 4.2.2.5.8-2: Tdetect,NR\_RedCap, Tmeasure,NR\_RedCap and Tevaluate,NR\_RedCap for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect,NR\_RedCap [s] (number of DRX cycles) | Tmeasure,NR\_RedCap [s] (number of DRX cycles) | Tevaluate,NR\_RedCap [s] (number of DRX cycles) |
|
| 2.56 | - | - | 58.88 (23) | 2.56 (1) | 5.12 (2) |
| 5.12 | - | - | 117.76 (23) | 5.12 (1) | 10.24 (2) |
| 10.24 | - | - | 235.52 (23) | 10.24 (1) | 20.48 (2) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤10485.76 | 0.32 | ≥1.28 (1) | (23) | 0.32 x M2 (1 x M2) | 0.64 x M2 (2 x M2) |
| 0.64 | ≥1.28 (1) | 0.64 (1) | 1.28 (2) |
| 1.28 | ≥2.56 (2) | 1.28 (1) | 2.56 (2) |
| 2.56 | ≥5.12 (4) | 2.56 (1) | 5.12 (2) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 2.56s, 5.12s and 10.24s. Otherwise, number of DRX cycles. | | | | | |

Table 4.2.2.5.8-3: Tdetect,NR\_RedCap, Tmeasure,NR\_RedCap and Tevaluate,NR\_RedCap for UE configured with eDRX\_IDLE cycle (Frequency range FR2)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Scaling Factor (N1) Note1 | Tdetect,NR\_RedCap [s] (number of DRX cycles) | Tmeasure,NR\_RedCap [s] (number of DRX cycles) | Tevaluate,NR\_RedCap [s] (number of DRX cycles) |
| 2.56 | - | - | 3 | 58.88 x N1 (23 x N1) | 2.56 x N1 (1 x N1) | 7.68 x N1 (3 x N1) |
| 5.12 | - | - | 3 | 117.76 x N1 (23 x N1) | 5.12 x N1 (1 x N1) | 10.24 x N1 (2 x N1) |
| 10.24 | - | - | 3 | 235.52 x N1 (23 x N1) | 10.24 x N1 (1 x N1) | 20.48 x N1 (2 x N1) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤10485.76 | 0.32 | ≥5.12 (4) | 8 | (23 x N1) | 0.32 x N1 (1 x N1) | 0.64 x N1 (2 x N1) |
| 0.64 | ≥6.4 (5) | 5 | 0.64 x N1 (1 x N1) | 1.28 x N1 (2 x N1) |
| 1.28 | ≥10.24 (8) | 4 | 1.28 x N1 (1 x N1) | 2.56 x N1 (2 x N1) |
| 2.56 | ≥15.36 (12) | 3 | 2.56 x N1 (1 x N1) | 5.12 x N1 (2 x N1) |
| NOTE 1: Applies for RedCap UE of all power classes.  NOTE 2: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 3: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 4: Number of eDRX cycles when eDRX\_IDLE cycle length equals 2.56s, 5.12s and 10.24s. Otherwise, number of DRX cycles.  NOTE 5: The lower bound of PTW length is derived based on . | | | | | | |

#### 4.2.2.6 Evaluation of cell re-selection criteria

The UE shall evaluate the intra-frequency, inter-frequency and inter-RAT cell reselection criteria defined in [1] at least every DRX cycle. When a non zero value of Treselection is used, the UE shall only perform reselection on an evaluation which occurs simultaneously to, or later than the expiry of the Treselection timer.

For UE configured with eDRX\_IDLE cycle, the cell reselection criteria shall be evaluated within at least every DRX cycle within the PTW.

#### 4.2.2.7 Maximum interruption in paging reception

UE shall perform the cell re-selection with minimum interruption in monitoring downlink channels for paging reception. When the UE is configured with eDRX\_IDLE cycle, the UE shall not miss any paging in a PTW provided the paging is sent in at least 2 DRX cycles before the end of that PTW.

At intra-frequency and inter-frequency cell re-selection, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels of the target intra-frequency and inter-frequency cell for paging reception. The interruption time shall not exceed TSI-EUTRA + 50 ms.

At inter-RAT cell re-selection, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels for paging reception of the target inter-RAT cell. For E-UTRAN to UTRA cell re-selection the interruption time must not exceed TSI-UTRA + 50 ms. For E-UTRAN to GSM cell re-selection the interruption time must not exceed TBCCH + 50 ms. For E-UTRAN to NR cell re-selection the interruption time must not exceed TSI-NR + 2\*Ttarget\_cell\_SMTC\_period ms.

TSI-EUTRA is the time required for receiving all the relevant system information data according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 36.331 [2] for a E-UTRAN cell.

TSI-UTRA is the time required for receiving all the relevant system information data according to the reception procedure and the RRC procedure delay of system information blocks defined in [7] for a UTRAN cell.

TBCCH is the maximum time allowed to read BCCH data from a GSM cell defined in [8].

TSI-NR is the time required for receiving all the relevant system information data according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 38.331 [38] for an NR cell.

Ttarget\_cell\_SMTC\_period is the periodicity of the SMTC occasions configured for the target NR cell. If the target cell is in the PCI list of *smtc2-LP-r16*, the SMTC periodicityfollows the periodicity configured in *smtc2-LP-r16*; otherwise, the SMTC periodicity follows *measTimingConfig-r15*. Ttarget\_cell\_SMTC\_period = 5ms if both *measTimingConfig-r15* and *smtc2-LP-r16* are not configured.

These requirements assume sufficient radio conditions, so that decoding of system information can be made without errors and does not take into account cell re-selection failure.

At cell re-selection to HRPD, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable of starting to monitor downlink channels for paging reception of the target HRPD cell. For HRPD cell re-selection the interruption time must not exceed TSI-HRPD + 50 ms.

TSI-HRPD is the time required for receiving all the relevant system information data according to the reception procedure and the upper layer (Layer 3) procedure delay of system information blocks defined in [11] in for HRPD cell.

At cell re-selection to cdma2000 1X, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable of starting to monitor downlink channels for paging reception of the target cdma2000 1X cell. For cdma2000 1X cell re-selection the interruption time must not exceed TSI-cdma2000\_1X + 50 ms.

TSI-cdma2000\_1X is the time required for receiving all the relevant system information data according to the reception procedure and the upper layer (Layer 3) procedure delay of system information blocks defined in [15] for cdma2000 1X cell.

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

#### 4.2.2.8 void

#### 4.2.2.9 UE measurement capability

For idle mode cell re-selection purposes, and for UE supporting *ca-IdleModeMeasurements-r15* LTE CA or *endc-IdleInactiveMeasFR1-r16* and/or *endc-IdleInactiveMeasFR2-r16* MR-DC measurements,the UE shall be capable of monitoring at least:

- Intra-frequency carrier, and

- Depending on UE capability, 3 FDD E-UTRA inter-frequency carriers, and

- Depending on UE capability, 3 TDD E-UTRA inter-frequency carriers, and

- Depending on UE capability, 3 FDD UTRA carriers, and

- Depending on UE capability, 3 TDD UTRA carriers, and

- Depending on UE capability, 32 GSM carriers, and

- Depending on UE capability, 3 cdma2000 1x carriers, and

- Depending on UE capability, 3 HRPD carriers.

- Depending on UE capability, 8 NR inter-RAT carriers.

In addition to the requirements defined above, a UE supporting E-UTRA measurements and any of the above inter-RAT measurements excluding NR measurements in RRC\_IDLE state shall be capable of monitoring a total of at least 8 carrier frequency layers, which includes serving layer, comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD, UTRA FDD, UTRA TDD, GSM (one GSM layer corresponds to 32 cells), cdma2000 1x and HRPD layers.

In addition to the requirements defined above, the UE which supports E-UTRA measurements and any of the above inter-RAT measurements including NR measurements in RRC\_IDLE state shall be capable of monitoring a total of at least 10 effective carrier frequency layers, which includes serving layer, comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD, UTRA FDD, UTRA TDD, GSM (one GSM layer corresponds to 32 carriers), cdma2000 1x, HRPD and NR layers.

#### 4.2.2.9a UE measurement capability (Increased UE carrier monitoring)

UE which support Increased UE carrier monitoring E-UTRA according to the capabilities in [2,31] shall be capable of monitoring at least

- Depending on UE capability, 8 FDD E-UTRA inter-frequency carriers, and

- Depending on UE capability, 8 TDD E-UTRA inter-frequency carriers

UE which support increased UE carrier monitoring UTRA according to the capabilities in [2,31] shall additionally be capable of monitoring at least

- Depending on UE capability, 6 FDD UTRA carriers, and

- Depending on UE capability, 7 TDD UTRA carriers, and

In addition to the requirements defined above, a UE supporting E-UTRA measurements in RRC\_IDLE state and supporting Increased UE carrier monitoring E-UTRA or increased UE carrier monitoring UTRA according to the capabilities in [2,31] shall be capable of monitoring a total of at least 13 carrier frequency layers, which includes serving layer, comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD, UTRA FDD, UTRA TDD, GSM (one GSM layer corresponds to 32 cells), cdma2000 1x and HRPD layers.

In addition to the requirements defined above, the UE which indicates support for Increased UE carrier monitoring E-UTRA or increased UE carrier monitoring UTRA according to the capabilities in [2,31], and also supports standalone NR, shall be capable of monitoring a total of at least 15 carrier frequency layers comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD, UTRA FDD, UTRA TDD, GSM (one GSM layer corresponds to 32 carriers), cdma2000 1x, HRPD and NR layers.

The requirements in this section apply for UE regardless of their capability to support eDRX\_IDLE.

#### 4.2.2.10 Reselection to CSG cells

Note: Requirements in this clause are minimum requirements defined to ensure the testability of autonomous CSG search. Further information on autonomous search times in practical deployments is available in [25].

Reselection from non CSG to CSG cells may be performed using UE autonomous search as defined in [1] when at least one CSG ID is included in the UE’s permitted CSG list. The requirements in this clause are valid for reselection to CSG cells previously visited by the UE when the radio configuration parameters, including the carrier frequency and physical cell identity of the CSG cell, non CSG cell and other neighbour cells are unchanged from the most recent previous visit.

NOTE: According to [1], the UE autonomous search function, per UE implementation, determines when and/or where to search for allowed CSG cells.

##### 4.2.2.10.1 Reselection from a non CSG to an inter-frequency CSG cell

The UE shall perform search and reselection to an allowed inter-frequency CSG cell that has met CSG reselection criterion defined in [1] and that is in its allow-list, within 6 minutes in the conditions shown in table 4.2.2.10.1-1. There is no need for statistical testing of this requirement.

Table 4.2.2.10.1-1: Parameters for CSG inter-frequency reselection

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Cell 1 | Cell 2 |
| EARFCN Note1 |  | Channel 1 | Channel 2 |
| CSG indicator |  | False | True |
| Physical cell identityNote1 |  | 1 | 2 |
| CSG identity |  | Not sent | Sent  (Already stored in UE allow-list from previous visit) |
| Propagation conditions |  | Static, non multipath | |
| CSG cell previously visited by UE |  | Yes | |
| PBCH\_RA | dB | 0 | 0 |
| PBCH\_RB | dB |
| *PSS\_RA* | *dB* |
| *SSS\_RA* | *dB* |
| *PCFICH\_RB* | *dB* |
| PHICH\_RA | dB |
| PHICH\_RB | dB |
| PDCCH\_RA | dB |
| PDCCH\_RB | dB |
| PDSCH\_RA | dB |
| PDSCH\_RB | dB |
| OCNG\_RANote 1 | dB |
| OCNG\_RBNote 1 | dB |
| Qrxlevmin | dBm | -140 | -140 |
|  | dBm/15 kHz | Off | |
| RSRP Note2 | dBm/15 KHz | -110 | -110 |
| Note 1: For this requirement to be applicable, the EARFCN and physical cell identity for cell 1 and cell 2 shall be unchanged from when the CSG cell was visited previously  Note 2: Chosen to ensure that CSG autonomous search has a high probability of success on every attempt made by UE | | | |

##### 4.2.2.10.2 Reselection from a non CSG to an inter-RAT UTRAN FDD CSG cell

The UE shall perform search and reselection to an allowed inter-RAT UTRAN FDD CSG cell that has met CSG reselection criterion defined in [1] and that is in its allow-list, within 6 minutes in the conditions shown in table 4.2.2.10.2-1. There is no need for statistical testing of this requirement.

Table 4.2.2.10.2-1: Parameters for CSG inter-RAT UTRAN FDD reselection

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Cell 1 | Cell 2 |
| EARFCN Note1 |  | Channel 1 | N/A |
| UARFCN Note1 |  | N/A | Channel 2 |
| CSG indicator |  | False | True |
| Physical cell identityNote1 |  | 1 | N/A |
| Primary scrambling code Note1 |  | N/A | Scrambling code 2 |
| CSG identity |  | Not sent | Sent  (Already stored in UE allow-list from previous visit) |
| Propagation conditions |  | Static, non multipath | |
| CSG cell previously visited by UE |  | Yes | |
| PBCH\_RA | dB | 0 | N/A |
| PBCH\_RB | dB |
| *PSS\_RA* | *dB* |
| *SSS\_RA* | *dB* |
| *PCFICH\_RB* | *dB* |
| PHICH\_RA | dB |
| PHICH\_RB | dB |
| PDCCH\_RA | dB |
| PDCCH\_RB | dB |
| PDSCH\_RA | dB |
| PDSCH\_RB | dB |
| OCNG\_RANote 1 | dB |
| OCNG\_RBNote 1 | dB |
| Qrxlevmin | dBm | -140 |
|  | dBm/15 kHz | Off |
| RSRP Note2 | dBm/15 KHz | -110 |
| CPICH\_RSCP Note2 | dBm | N/A | -100 |
| CPICH\_Ec/Ior | dB | -10 |
| PCCPCH\_Ec/Ior | dB | -12 |
| SCCPCH\_Ec/Ior | dB | -12 |
| AICH\_Ec/Ior | dB | -15 |
| SCH\_Ec/Ior | dB | -15 |
| PICH\_Ec/Ior | dB | -15 |
|  | dBm/3.84 MHz | Off |
| Note 1: For this requirement to be applicable, the EARFCN and physical cell identity for cell 1 and the UARFCN and scrambling code for cell 2 shall be unchanged from when the CSG cell was visited previously  Note 2: Chosen to ensure that CSG autonomous search has a high probability of success on every attempt made by UE | | | |

#### 4.2.2.11 Void

#### 4.2.2.12 Void

#### 4.2.2.13 Void

#### 4.2.2.14 UE measurement capability for RedCap

Editor notes: There is no agreement on how to capture UE measurement capability for RedCap 2Rx.

This clause contains requirements on UE measurement capability for NR capable E-UTRAN RedCap UE. For idle mode cell re-selection purposes, the RedCap UE shall be capable of monitoring at least:

- Intra-frequency carrier, and

- Depending on UE capability, [6] NR inter-RAT carriers, and

- Depending on UE capability, [6] FDD E-UTRA inter-frequency carriers, and

- Depending on UE capability, [6] TDD E-UTRA inter-frequency carriers.

A total of [11] carrier frequency layers, which includes serving layer, comprising of any above defined combinations of E-UTRA FDD, E-UTRA TDD and NR layers.

## 4.3 Minimization of Drive Tests (MDT)

UE supporting minimisation of drive tests in RRC\_IDLE shall be capable of:

- logging measurements in RRC\_IDLE, reporting the logged measurements and meeting requirements in this clause;

- logging of RRC connection establishment failure, reporting the logged failure and meeting requirements in this clause;

- logging of radio link failure and handover failure, reporting the logged failure and meeting requirements in this clause.

### 4.3.1 Introduction

The logged MDT requirements consist of measurement requirements as specified in clause 4.3.2 and relative time stamp accuracy requirements as specified in clause 4.3.3. Both sets of requirements are applicable for intra-frequency, inter-frequency and inter-RAT cases in RRC\_IDLE state. The MDT procedures are described in [27].

For RRC connection establishment failure logging and reporting, the MDT requirements consist of requirements for measurements performed and logged in RRC\_IDLE state specified in clause 4.3.2 and relative time stamp accuracy requirement for RRC connection establishment failure log reporting as specified in clause 4.3.4.

### 4.3.2 Measurements

The requirements specified in this clause apply for the measurements (GSM carrier RSSI, UTRA CPICH RSCP, UTRA CPICH Ec/Io, P-CCPCH RSCP for UTRA 1.28 TDD, E-UTRA RSRP, E-UTRA RSRQ, MBSFN RSRP, MBSFN RSRQ, and MCH BLER) performed and logged by the UE for MDT in RRC\_IDLE. The requirements apply for the measurements included in logged MDT reports and RRC connection establishment failure reports.

#### 4.3.2.1 Requirements

The measurement values that are used to meet

- serving cell and reselection requirements as specified in sections 4.2.2.1, 4.2.2.3, 4.2.2.4, 4.2.2.5,

- MBSFN measurement requirements as specified in section 4.4,

shall also apply to values logged for MDT measurements in RRC\_IDLE state.

### 4.3.3 Relative Time Stamp Accuracy

The relative time stamp for a logged measurement is defined as the time from the moment the MDT configuration was received at the UE until the measurement was logged, see TS 36.331 [2].

#### 4.3.3.1 Requirements

The accuracy of the relative time stamping is such that the drift of the time stamping shall be not more than ± 2 seconds per hour.

### 4.3.4 Relative Time Stamp Accuracy for RRC Connection Establishment Failure Log Reporting

Relative time stamp for RRC connection establishment failure log reporting is defined as the time elapsed from the last RRC connection establishment failure to the time when the log is included in the report TS 36.331 [2]. The UE shall report the RRC connection establishment failure log, while meeting the accuracy requirement specified in clause 4.3.4.1.

#### 4.3.4.1 Requirements

The accuracy of the relative time stamping for RRC connection establishment failure log reporting is such that the drift of the time stamping shall not be larger than ± 0.72 seconds per hour and ± 10 seconds over 48 hours. The relative time stamp accuracy requirements shall apply provided that:

- no power off or detach occurs after the RRC connection establishment failure had been detected and until the log is time-stamped.

NOTE: This requirement does not need to be tested.

### 4.3.5 Relative Time Stamp Accuracy for Radio Link Failure and Handover Failure Log Reporting

The UE shall report the radio link and handover failure log, while meeting the accuracy requirements specified in this section.

#### 4.3.5.1 Requirements for *timeSinceFailure*

Relative time stamp accuracy requirements for *timeSinceFailure* reported for MDT in a radio link failure or handover failure log are specified in this clause. *timeSinceFailure* determines the time elapsed from the last radio link failure or handover failure in E-UTRA to the time when the log is included in the report TS 36.331 [2].

The accuracy of the relative time stamping for *timeSinceFailure* is such that the drift of the time stamping shall not be larger than ± 0.72 seconds per hour and ± 10 seconds over 48 hours. These relative time stamp accuracy requirements shall apply provided that:

- no power off or detach occurs after the RLF or handover failure had been detected and until the log is time-stamped.

## 4.4 MBSFN Measurements

### 4.4.1 Introduction

The requirements specified in Section 4.4 apply for MBSFN measurements (MBSFN RSRP, MBSFN RSRQ, and MCH BLER defined in [4]), which are performed in RRC\_IDLE state and logged for MDT by UEs which are MBMS-capable and also indicate their MBSFN measurement logging capability [2].

UE shall measure MBSFN RSRP, MBSFN RSRQ and MCH BLER only in subframes and on carriers where UE is decoding PMCH. The requirements are specified for any carrier where PMCH is received by UE. The requirements specified in this section apply for any carrier frequency with configured MBSFN subframes with PMCH, which may be the same as or different from any serving unicast carrier.

The UE receiving PMCH on any non-serving carrier and performing MBSFN measurements shall not cause interruptions on any serving carrier in the subframes with paging and non-MBSFN multicast transmissions such as system information.

### 4.4.2 MBSFN RSRP measurements

For UE in RRC\_IDLE, the physical layer shall be capable of performing the MBSFN RSRP measurement [4] within the MBSFN RSRP measurement period and log the measurement, while meeting the MBSFN RSRP measurement accuracy requirements specified in section 9.8.2. The MBSFN RSRP measurement logging shall be according to the MBSFN RSRP measurement report mapping specified in Section 9.8.2.2.

The MBSFN RSRP measurement period is defined as MAX(640 ms, period during which the UE decodes [5, Section 10] 5 subframes containing PMCH transmissions) except SCS = 370.37 Hz numerology. For SCS = 370.37 Hz numerology, the MBSFN RSRP measurement period is defined as MAX(640 ms, period during which the UE decodes [5, Section 10] 5 symbols containing PMCH transmissions).

The same requirement applies for UE configured with DRX or eDRX\_IDLE.

### 4.4.3 MBSFN RSRQ measurements

For UE in RRC\_IDLE, the physical layer shall be capable of performing the MBSFN RSRQ measurement [4] within the MBSFN RSRP measurement period and report the measurement, while meeting the MBSFN RSRQ measurement accuracy requirements specified in section 9.8.3. The MBSFN RSRQ measurement logging shall be according to the MBSFN RSRQ measurement report mapping specified in Section 9.8.3.2.

The MBSFN RSRQ measurement period is defined as MAX(640 ms, period during which the UE decodes [5, Section 10] 5 subframes containing PMCH transmissions) except SCS = 370.37 Hz numerology. For SCS = 370.37 Hz numerology, the MBSFN RSRQ measurement period is defined as MAX(640 ms, period during which the UE decodes [5, Section 10] 5 symbols containing PMCH transmissions).

The same requirement applies for UE configured with DRX or eDRX\_IDLE.

### 4.4.4 MCH BLER measurements

The UE physical layer shall be capable of performing and logging the MCH BLER measurement [4] within the MCH BLER measurement period.

The MCH BLER measurement period is equal to the MBSFN logging interval configured by higher layers [2].

The MCH BLER logging shall be according to the MCH BLER measurement report mapping specified in Section 9.8.4.

The same requirement applies for UE configured with DRX or eDRX\_IDLE.

## 4.5 Proximity-based Services

### 4.5.1 Introduction

This section contains the requirements for the UE capable of ProSe Direct Communication and/or ProSe Direct Discovery in RRC\_IDLE state.

### 4.5.2 Requirements

When a UE in RRC\_IDLE state is participating in transmissions and/or reception for ProSe Direct Discovery and/or ProSe Direct Communication, the UE shall meet all the requirements of Section 4.

Note: The UE may need to interrupt ProSe operation in order to meet the requirements of Section 4.

#### 4.5.2.1 Interruptions with ProSe Direct Discovery

A UE capable of ProSe direct discovery in RRC\_IDLE state shall not cause any interruption for the reception of paging and system information:

- while switching reception between ProSe Direct Discovery and a serving cell, or

- when receiving ProSe direct discovery signals or

- while switching receiver chain ON/OFF for ProSe Direct Discovery reception if the UE has a dedicated receiver chain for ProSe Direct Discovery

#### 4.5.2.2 Interruptions with ProSe Direct Communication

A UE capable of ProSe direct communication in RRC\_IDLE state shall not cause any interruption for the reception of paging and system information:

- while switching reception between ProSe Direct Communication and a serving cell, or

- when receiving ProSe direct communication signals, or

- while switching receiver chain ON/OFF for ProSe Direct Communications reception.

#### 4.5.2.3 Initiation/Cease of SLSS transmissions with ProSe Direct Discovery

The requirements in this subclause are applicable to a UE capable of ProSe Direct Discovery and SLSS transmission and reception.

The requirements apply when the conditions for SLSS transmissions specified in [2] are met; *networkControlledSyncTx* is not configured; and *syncTxThreshIC* is included in *SystemInformationBlockType19*. The UE shall be capable of measuring the RSRP of the cell used to transmit Prose Direct Discovery announcements and evaluate to initiate/cease SLSS transmissions within Tevaluate,SLSS as specified in Table 4.5.2.3-1.

Table 4.5.2.3-1: Tevaluate,SLSS with ProSe Direct Discovery

|  |  |
| --- | --- |
| DRX cycle length [s] | Tevaluate,SLSS  [s] (number of DRX cycles) |
| 0.32 | 1.92 (6) |
| 0.64 | 3.84 (6) |
| 1.28 | 7.68 (6) |
| 2.56 | 15.36 (6) |

For the cell used to transmit ProSe Direct Discovery announcements:

- RSRP related side conditions given in Sections 9.1.2.1 and 9.1.2.2 and RSRQ related side conditions given in Clause 9.1.5.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band are fulfilled.

#### 4.5.2.4 Initiation/Cease of SLSS transmissions with ProSe Direct Communication

The requirements in this subclause are applicable to a UE capable of ProSe Direct Communication.

The requirements apply when the conditions for SLSS transmissions specified in [2] are met; *networkControlledSyncTx* is not configured; and *syncTxThreshIC* is included in *SystemInformationBlockType18*. The UE shall be capable of measuring the RSRP of the cell used to transmit ProSe Direct Communication and evaluate to initiate/cease SLSS transmissions within Tevaluate,SLSS as specified in Table 4.5.2.4-1.

Table 4.5.2.4-1: Tevaluate,SLSS with ProSe Direct Communication

|  |  |
| --- | --- |
| DRX cycle length [s] | Tevaluate,SLSS  [s] (number of DRX cycles) |
| 0.32 | 1.92 (6) |
| 0.64 | 3.84 (6) |
| 1.28 | 7.68 (6) |
| 2.56 | 15.36 (6) |

For the cell used to transmit ProSe Direct Communication:

- RSRP related side conditions given in Sections 9.1.2.1 and 9.1.2.2 and RSRQ related side conditions given in Clause 9.1.5.1 for a corresponding Band are fulfilled,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band are fulfilled.

## 4.6 Cell Selection and Re-selection Requirements for UE category NB1

The NB-IoT applicability of the requirements in section 4.6 is defined in Section 3.6.1.

### 4.6.1 Cell Selection

After a UE has switched on and a PLMN has been selected, the Cell selection process takes place, as described in TS36.304. This process allows the UE to select a suitable cell where to camp on in order to access available services. In this process the UE can use stored information (*Stored information cell selection*) or not (*Initial cell selection*).

### 4.6.2 Cell Re-selection

The cell reselection procedure allows the UE to select a more suitable cell and camp on it.

When the UE is in either *Camped* *Normally* state or *Camped on Any Cell* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency and inter-frequency cells indicated by the serving NB-IoT cell. For intra-frequency and inter-frequency cells the serving NB-IoT cell may not provide explicit neighbour list but carrier frequency information and bandwidth information only. UE measurement activity is also controlled by measurement rules defined in TS36.304, allowing the UE to limit its measurement activity.

#### 4.6.2.1 Measurement and evaluation of serving NB-IoT cell for UE category NB1 in normal coverage

The UE shall measure the NRSRP and NRSRQ level of the serving NB-IoT cell on the anchor carrier and evaluate the cell selection criterion S defined in clause 5.2.3.2 in [1] for the serving NB-IoT cell on the anchor carrier at least every DRX cycle.

The UE shall filter the NRSRP and NRSRQ measurements of the NB-IoT serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least DRX cycle/2.

If the UE is configured for receiving paging on the non-anchor carrier then the UE shall evaluate the cell selection criterion S defined in clause 5.2.3.2a in [1] for the serving NB-IoT cell on non-anchor carrier at least every DRX cycle.

The UE is allowed to measure NRSRP level of the serving NB-IoT cell, assuming that *nrs-NonAnchor-config* is enabled indicated by higher layer defined in clause 10.2.6 TS 36.211 [16], on non-anchor carrier provided that:

- The relaxed monitoring criteria defined in TS 36.304 clause 5.2.4.12 are met,

- Transmit power difference of the signals/channels between anchor- and non-anchor carriers is signalled to the UE, via the existing parameter *nrs-PowerOffsetNonAnchor*, and

- UE is not configured with any positioning measurements.

When UE measures the NRSRP on non-anchor carrier, UE shall compare the measurements from anchor carrier and non-anchor carrier at least once every one hour by the following inequality:

| NRSRPanchor – (NRSRPnon-anchor - *nrs-PowerOffsetNonAnchor*) | ≤ 10 dB

where NRSRPanchor is the NRSRP measurement on anchor carrier and NRSRPnon-anchor is the NRSRP measurement on non-anchor carrier. The measurement for comparison shall use at least 2 measurements for filtering. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least DRX cycle/2. If the measurement for comparison satisfy the inequality, UE is allowed to perform RRM measurements on the non-anchor carrier until the next comparison takes place or until the relaxed monitoring conditions are no longer met. UE shall perform NRSRP measurement on anchor carrier if the inequality is not satisfied until the next comparison takes place.

When all the conditions for measuring NRSRP on non-anchor carrier are satisfied, the UE shall filter the NRSRP of the serving NB-IoT cell using at least 2 measurements spaced by at least DRX cycle/2, where the measurements used for the filtering may include measurements on anchor carrier and on non-anchor carrier.

If the UE is not configured with eDRX\_IDLE cycle and has evaluated according to Table 4.6.2.1-1 in Nserv\_NB -NC consecutive DRX cycles that the serving NB-IoT cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving NB-IoT cell, regardless of the measurement rules currently limiting UE measurement activities. If the UE is configured with eDRX\_IDLE cycle and has evaluated according to Table 4.6.2.1-2 in Nserv\_NB-NC consecutive DRX cycles within a single PTW that the serving NB-IoT cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving NB-IoT cell, regardless of the measurement rules currently limiting UE measurement activities.

If the UE in RRC\_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency and inter-frequency information indicated in the system information during the time T, the UE shall initiate cell selection procedures for the selected PLMN as defined in [1], where T=40 s if the UE is not configured with eDRX\_IDLE cycle, and T=MAX(40 s, one eDRX\_IDLE cycle) if the UE is configured with eDRX\_IDLE cycle.

Table 4.6.2.1-1: Nserv\_NB-NC

|  |  |
| --- | --- |
| DRX cycle length [s] | Nserv\_NB-IoT-NC [number of DRX cycles] |
| 0.32 | 2 |
| 0.64 | 2 |
| 1.28 | 2 |
| 2.56 | 2 |
| 5.12 | 2 |
| 10.24 | 2 |

Table 4.6.2.1-2: Nserv\_NB-NCfor UE configured with eDRX\_IDLE cycle

|  |  |  |  |
| --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 2.56s periods) | Nserv\_NB-IoT-NC [number of DRX cycles] |
| 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | 0.32 | ≥2.56 (1) | 2 |
| 0.64 | ≥2.56 (1) | 2 |
| 1.28 | ≥5.12 (2) | 2 |
| 2.56 | ≥7.68 (3) | 2 |
| 5.12 | ≥12.8 (5) | 2 |
| 10.24 | ≥23.04 (9) | 2 |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section X of TS 24.008 [34]. | | | |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

#### 4.6.2.1A Measurement and evaluation of serving NB-IoT cell for HD-FDD UE category NB1 in normal coverage when configured with WUS

The UE which supports *wakeUpSignal* [2] shall meet the requirement defined for the DRX cycle length of N\*DRX\_cycle in Section 4.6.2.1, provided the following conditions are met:

- WUS has been configured in the serving NB-IoT cell using *WUS-Config-NB-r15* [2], and

- The serving cell measurement relaxation is signalled as ***n*** by the network using *numDRX-CycleRelaxed-r15*, and

- Serving cell S criteria is met with at least 2 dB margin.

- the relaxed monitoring criteria for neighbour cells in TS 36.304 [1] clause 5.2.4.12.1 is fulfilled, and

, where the relaxation factor N is given by Table 4.6.2.1A-1. Otherwise the requirements defined for the configured DRX cycle length in Section 4.6.2.1 shall apply.

The UE shall further meet the requirements in section 4.6.2.1 during time period T0 after following occasions:

- after the end of reception of latest paging message, or

- from the moment UE has switched from RRC\_CONNECTED state to RRC\_IDLE state.

T0 = N\*DRX cycle if the UE is not configured with eDRX\_IDLE cycle where the value of N specified in Table 4.6.2.1A-1;

T0 = one eDRX IDLE cycle if the UE is configured with eDRX\_IDLE cycle;

Table 4.6.2.1A-1: The relaxation factor N for a UE not configured with eDRX IDLE cycle

|  |  |
| --- | --- |
| DRX cycle length [s] | Value |
| 0.32 | Min(*n* , 8) |
| 0.64 | Min(*n* , 8) |
| 1.28 | Min(***n*** , 8) |
| 2.56 | Min(***n*** , 4) |
| 5.12 | Min(***n*** , 2) |
| 10.24 | 1 |
| NOTE: ***n*** is signalled by the network by using *numDRX-CycleRelaxed-r15* defined in TS 36.331 [2]. | |

Table 4.6.2.1A-2: The relaxation factor N for a UE configured with eDRX IDLE cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| DRX cycle length [s] | Value | | | | |
| 2.56 ≤ PTW length [s] < 5.12 | 5.12 ≤ PTW length [s] < 7.68 | 7.68 ≤ PTW length [s] < 12.8 | 12.8 ≤ PTW length [s] < 23.04 | 23.04 ≤ PTW length [s] |
| 0.32 | Min(*n* , 2) | Min(*n* , 4) | Min(*n* , 8) | Min(*n* , 8) | Min(*n* , 8) |
| 0.64 | 1 | Min(*n* , 2) | Min(*n* , 4) | Min(*n* , 8) | Min(*n* , 8) |
| 1.28 | N/A | 1 | Min(***n*** , 2) | Min(***n*** , 4) | Min(***n*** , 8) |
| 2.56 | N/A | N/A | 1 | Min(***n*** , 2) | Min(***n*** , 4) |
| 5.12 | N/A | N/A | N/A | 1 | Min(***n*** , 2) |
| 10.24 | N/A | N/A | N/A | N/A | 1 |
| NOTE: ***n*** is signalled by the network by using *numDRX-CycleRelaxed-r15* defined in TS 36.331 [2]. | | | | | |

#### 4.6.2.2 Measurements of intra-frequency NB-IoT cells for UE category NB1 in normal coverage

The UE shall be able to identify new intra-frequency cells and perform NRSRP measurements of identified intra-frequency cells without an explicit intra-frequency neighbour list containing physical layer cell identities.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS36.304 within Tdetect,NB\_Intra\_NCwhen Treselection= 0. An intra frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.1.4 for a corresponding Band.

The UE shall measure NRSRP at least every Tmeasure,NB\_Intra\_NC for intra-frequency cells that are identified and measured according to the measurement rules.

The UE shall filter NRSRP measurements of each measured intra-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure,NB\_Intra-NC/2

The UE shall not consider an NB-IoT neighbour cell in cell reselection if it is indicated as not allowed in the measurement control system information of the serving NB-IoT cell.

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined [1] within Tevaluate,NB\_intra-NC when Treselection = 0, provided that the cell is at least XdB better ranked, where ‘X’ is specified in Table 4.6.2.4-3. When evaluating cells for reselection, the side conditions for NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot apply to both serving and non-serving NB-IoT intra-frequency cells.

If Treselection timer has a non zero value and the intra-frequency cell is better ranked than the serving NB-IoT cell, the UE shall evaluate this intra-frequency cell for the Treselection time. If this cell remains better ranked within this duration, then the UE shall reselect that cell.

For UE not configured with eDRX\_IDLE cycle, Tdetect,NB\_Intra\_NC, Tmeasure,NB\_Intra\_NC and Tevaluate, NB\_intra\_NC are specified in Table 4.6.2.2-1. For UE configured with eDRX\_IDLE cycle, Tdetect,NB\_Intra -NC, Tmeasure,NB\_Intra\_NC and Tevaluate, NB\_intra-NC are specified in Table 4.6.2.2-2, where the requirements apply provided that the serving NB-IoT cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,NB\_Intra\_NC, Tmeasure,NB\_Intra\_NC and Tevaluate, NB\_intra\_NC when multiple PTWs are used.

Table 4.6.2.2-1 : Tdetect,NB\_Intra -NC, Tmeasure,NB\_Intra -NC and Tevaluate, NB\_intra -NC

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NB\_Intra\_NC [s] (number of DRX cycles) | Tmeasure,NB\_Intra\_NB\_NC [s] (number of DRX cycles) | Tevaluate,NB\_intra\_NB\_NC  [s] (number of DRX cycles) |
| 0.32 | 26 (80) | 1.28 (4) | 5.12 (16) |
| 0.64 | 26 (40) | 1.28 (2) | 5.12 (8) |
| 1.28 | 51 (40) | 1.28 (1) | 6.5 (5) |
| 2.56 | 51 (20) | 2.56 (1) | 7.68 (3) |
| 5.12 | 102 (20) | 5.12 (1) | 10.24 (2) |
| 10.24 | 102 (10) | 10.24 (1) | 20.48 (2) |

Table 4.6.2.2-2: Tdetect,NB\_Intra\_NC, Tmeasure,NB\_Intra\_NC and Tevaluate,NB\_intra\_NC for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 2.56s periods) | Tdetect,NB\_Intra -NC [s] (number of DRX cycles) | Tmeasure,NB\_Intra\_NC [s] (number of DRX cycles) | Tevaluate,NB\_intra\_NC  [s] (number of DRX cycles) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | 0.32 | ≥ 2.56 (1) | (20) | 1.28 (4) | 2.56 (8) |
| 0.64 | ≥ 2.56 (1) | 1.28 (2) | 2.56 (4) |
| 1.28 | ≥ 5.12 (2) | 1.28 (1) | 2.56 (2) |
| 2.56 | ≥ 7.68 (3) | 2.56 (1) | 5.12 (2) |
| 5.12 | ≥ 12.8 (5) | 5.12 (1) | 10.24 (2) |
| 10.24 | ≥ 23.04 (9) | 10.24 (1) | 20.48 (2) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section X of TS 24.008 [34]. | | | | | |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

If all the relaxed monitoring criteria defined in clause 5.2.4.12 [1] are fulfilled then the UE’s intra-frequency measurement is not required to meet Tdetect,NB\_Intra\_NC, Tmeasure,NB\_Intra\_NC and Tevaluate,NB\_intra\_NC as defined in Table 4.6.2.2-1 and Table 4.6.2.2-2.

#### 4.6.2.3 Measurement and evaluation of serving NB-IoT cell for UE category NB1 in enhanced coverage

The UE shall measure the NRSRP and NRSRQ level of the serving NB-IoT cell on the anchor carrier and evaluate the cell selection criterion S defined in clause 5.2.3.2 in [1] for the serving NB-IoT cell on the anchor carrier at least every DRX cycle.

The UE shall filter the NRSRP and NRSRQ measurements of the serving NB-IoT cell using at least 4 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least DRX cycle/2.

If the UE is configured for receiving paging on the non-anchor carrier then the UE shall evaluate the cell selection criterion S defined in clause 5.2.3.2a in [1] for the serving NB-IoT cell on non-anchor carrier at least every DRX cycle.

The UE is allowed to measure NRSRP level of the serving NB-IoT cell, assuming that *nrs-NonAnchor-config* is enabled indicated by higher layer defined in clause 10.2.6 TS 36.211 [16], on non-anchor carrier provided that:

- The relaxed monitoring criteria defined in TS 36.304 clause 5.2.4.12 are met,

- Transmit power difference of the signals/channels between anchor- and non-anchor carriers is signalled to the UE, via the existing parameter *nrs-PowerOffsetNonAnchor*,

- UE is not configured with any positioning measurements.

*- nB* configured by higher layer is not equal to *4T.*

When all the conditions for measuring NRSRP on non-anchor carrier are satisfied, the UE shall filter the NRSRP of the serving NB-IoT cell using at least 4 measurements, where the measurements used for the filtering may include measurements on anchor carrier and on non-anchor carrier.

If the UE is not configured with eDRX\_IDLE cycle and has evaluated according to Table 4.6.2.3-1 in Nserv\_NB\_EC consecutive DRX cycles that the serving NB-IoT cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving NB-IoT cell, regardless of the measurement rules currently limiting UE measurement activities. If the UE is configured with eDRX\_IDLE cycle and has evaluated according to Table 4.6.2.3-2 in Nserv\_NB -EC consecutive DRX cycles within a single PTW that the serving NB-IoT cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving NB-IoT cell, regardless of the measurement rules currently limiting UE measurement activities.

If the UE in RRC\_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency and inter-frequency information indicated in the system information during the time T, the UE shall initiate cell selection procedures for the selected PLMN as defined in [1], where T= 80 s if the UE is not configured with eDRX\_IDLE cycle, and T=MAX(80 s, one eDRX\_IDLE cycle) if the UE is configured with eDRX\_IDLE cycle.

Table 4.6.2.3-1: Nserv\_NB\_EC

|  |  |
| --- | --- |
| DRX cycle length [s] | Nserv\_NB -EC [number of DRX cycles] |
| 0.32 | 4 |
| 0.64 | 4 |
| 1.28 | 4 |
| 2.56 | 4 |
| 5.12 | 4 |
| 10.24 | 4 |

Table 4.6.2.3-2: Nserv\_NB\_ECfor UE configured with eDRX\_IDLE cycle

|  |  |  |  |
| --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 2.56s periods) | Nserv\_NB\_EC [number of DRX cycles] |
| 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | 0.32 | ≥ 2.56 (1) | 4 |
| 0.64 | ≥ 5.12 (2) | 4 |
| 1.28 | ≥ 7.68 (3) | 4 |
| 2.56 | ≥ 12.8 (5) | 4 |
| 5.12 | ≥ 23.04 (9) | 4 |
| 10.24 | ≥ 43.52 (17) | 4 |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section X of TS 24.008 [34]. | | | |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

#### 4.6.2.3A Measurement and evaluation of serving NB-IoT cell for HD-FDD UE category NB1 in enhanced coverage when configured with WUS

The UE which supports *wakeUpSignal* [2] shall meet the requirement defined for the DRX cycle length of N\*DRX\_cycle in Section 4.6.2.3, provided the following conditions are met:

- WUS has been configured in the serving NB-IoT cell using *WUS-Config-NB-r15* [2], and

- The serving cell measurement relaxation is signalled as ***n*** by the network using *numDRX-CycleRelaxed-r15*, and

- Serving cell S criteria is met with at least 2 dB margin.

- the relaxed monitoring criteria for neighbour cells in TS 36.304 [1] clause 5.2.4.12.1 is fulfilled, and

, where the relaxation factor N is given by Table 4.6.2.3A-1. Otherwise the requirements defined for the configured DRX cycle length in Section 4.6.2.3 shall apply.

The UE shall further meet the requirements in section 4.6.2.3 during time period T0 after following occasions:

- after the end of reception of latest paging message, or

- from the moment UE has switched from RRC\_CONNECTED state to RRC\_IDLE state.

T0 = N\*DRX cycle if the UE is not configured with eDRX\_IDLE cycle where the value of N specified in Table 4.6.2.3A-1;

T0 = one eDRX IDLE cycle if the UE is configured with eDRX\_IDLE cycle;

Table 4.6.2.3A-1: The relaxation factor N for a UE not configured with eDRX IDLE cycle

|  |  |
| --- | --- |
| DRX cycle length [s] | Value |
| 0.32 | Min(***n*** , 8) |
| 0.64 | Min(***n*** , 8) |
| 1.28 | Min(***n*** , 8) |
| 2.56 | Min(***n*** , 4) |
| 5.12 | Min(***n*** , 2) |
| 10.24 | 1 |
| NOTE: ***n*** is signalled by the network by using *numDRX-CycleRelaxed-r15* defined in TS 36.331 [2]. | |

Table 4.6.2.3A-2: The relaxation factor N for a UE configured with eDRX IDLE cycle

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| DRX cycle length [s] | Value | | | | | |
| 2.56 ≤ PTW length [s] < 5.12 | 5.12≤ PTW length [s] < 7.68 | 7.68 ≤ PTW length [s] < 12.8 | 12.8 ≤ PTW length [s] < 23.04 | 23.04 ≤ PTW length [s] < 43.52 | 43.52 ≤ PTW length [s] |
| 0.32 | 1 | Min(*n* , 2) | Min(*n* , 4) | Min(*n* , 8) | Min(*n* , 8) | Min(*n* , 8) |
| 0.64 | N/A | 1 | Min(*n* , 2) | Min(*n* , 4) | Min(*n* , 8) | Min(*n* , 8) |
| 1.28 | N/A | N/A | 1 | Min(***n*** , 2) | Min(***n*** , 4) | Min(***n*** , 8) |
| 2.56 | N/A | N/A | N/A | 1 | Min(***n*** , 2) | Min(***n*** , 4) |
| 5.12 | N/A | N/A | N/A | N/A | 1 | Min(***n*** , 2) |
| 10.24 | N/A | N/A | N/A | N/A | N/A | 1 |
| NOTE: ***n*** is signalled by the network by using *numDRX-CycleRelaxed-r15* defined in TS 36.331 [2]. | | | | | | |

#### 4.6.2.4 Measurements of intra-frequency NB-IoT cells for UE category NB1 in enhanced coverage

The UE shall be able to identify new intra-frequency cells and perform NRSRP measurements of identified intra-frequency cells without an explicit intra-frequency neighbour list containing physical layer cell identities.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS36.304 within Tdetect,NB\_Intra\_ECwhen that Treselection= 0. An intra frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.1.4 for a corresponding Band.

The UE shall measure NRSRP at least every Tmeasure,NB\_Intra\_EC for intra-frequency cells that are identified and measured according to the measurement rules.

The UE shall filter NRSRP measurements of each measured intra-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure,NB\_Intra\_ EC/2

The UE shall not consider a NB-IoT neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving NB-IoT cell.

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined [1] within Tevaluate,NB\_intra\_EC when Treselection = 0, provided that the cell is at least XdB better ranked, where ‘X’ is specified in Table 4.6.2.4-3. When evaluating cells for reselection, the side conditions for NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot apply to both serving and non-serving NB-IoT intra-frequency cells.

If Treselection timer has a non zero value and the intra-frequency cell is better ranked than the serving NB-IoT cell, the UE shall evaluate this intra-frequency cell for the Treselection time. If this cell remains better ranked within this duration, then the UE shall reselect that cell.

For UE not configured with eDRX\_IDLE cycle, Tdetect,NB\_Intra\_EC, Tmeasure,NB\_Intra\_EC and Tevaluate, NB\_intra\_EC are specified in Table 4.6.2.4-1. For UE configured with eDRX\_IDLE cycle, Tdetect,NB\_Intra\_EC, Tmeasure,NB\_Intra\_EC and Tevaluate, NB\_intra\_EC are specified in Table 4.6.2.4-2, where the requirements apply provided that the serving NB-IoT cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,NB\_Intra\_EC, Tmeasure,NB\_Intra\_EC and Tevaluate, NB\_intra\_EC when multiple PTWs are used.

Table 4.6.2.4-1 : Tdetect,NB\_Intra\_EC, Tmeasure,NB\_Intra\_EC and Tevaluate, NB\_intra\_EC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SCH Ês/Iot of neighboring cell: Q2 | DRX cycle length [s] | Tdetect,NB\_Intra\_ EC [s] (number of DRX cycles) | Tmeasure,NB\_Intra\_ EC [s] (number of DRX cycles) | Tevaluate,NB\_intra\_ EC  [s] (number of DRX cycles) |
| **-15≤ Q2 < -6** | 0.32 | 256 (800) | 1.28 (4) | 10.24 (32) |
| 0.64 | 266 (415) | 1.28 (2) | 10.24 (16) |
| 1.28 | 532 (415) | 1.28 (1) | 12.8 (10) |
| 2.56 | 532 (208) | 2.56 (1) | 15.36 (6) |
| 5.12 | 1063 (208) | 5.12 (1) | 20.48 (4) |
| 10.24 | 1063 (104) | 10.24 (1) | 30.72 (3) |
| **Q2≥-6** | 0.32 | 26 (80) | 1.28 (4) | 10.24 (32) |
| 0.64 | 29 (45) | 1.28 (2) | 10.24 (16) |
| 1.28 | 58 (45) | 1.28 (1) | 12.8 (10) |
| 2.56 | 59 (23) | 2.56 (1) | 15.36 (6) |
| 5.12 | 113 (22) | 5.12 (1) | 20.48 (4) |
| 10.24 | 113 (11) | 10.24 (1) | 30.72 (3) |

Table 4.6.2.4-2: Tdetect,NB\_Intra\_EC, Tmeasure,NB\_Intra\_EC and Tevaluate,NB\_intra\_EC for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 2.56s periods) | Tdetect,NB\_Intra\_EC [s] (number of DRX cycles) | Tmeasure,NB\_Intra\_EC [s] (number of DRX cycles) | Tevaluate,NB\_intraEC  [s] (number of DRX cycles) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | 0.32 | ≥12.8 (5) | (406) | 1.28 (4) | 10.24 (32) |
| 0.64 | ≥12.8 (5) | 1.28 (2) | 10.24 (16) |
| 1.28 | ≥15.36 (6) | 1.28 (1) | 12.8 (10) |
| 2.56 | ≥17.92 (7) | 2.56 (1) | 15.36 (6) |
| 5.12 | ≥23.04 (9) | 5.12 (1) | 20.48 (4) |
| 10.24 | ≥33.28 (13) | 10.24 (1) | 30.72 (3) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section X of TS 24.008 [34]. | | | | | |

Table 4.6.2.4-3: Conditions on NSCH Ês/Iot of identified and of the neighbour cell

|  |  |  |
| --- | --- | --- |
| NSCH Ês/Iot of already identified cell including serving cell: Q1 | Neighbouring cell NSCH Ês/Iot: Q2 | Cell Reselection Margin  ‘X’ |
| -15≤Q1<-6 | -15≤ Q2 < -6 | 8.3 |
| -15≤Q1<-6 | Q2 -6 | 8.3 |
| Q1 -6 | Q2 -6 | 4 |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

If all the relaxed monitoring criteria defined in clause 5.2.4.12 [1] are fulfilled then the UE’s intra-frequency measurement is not required to meet Tdetect,NB\_Intra\_EC, Tmeasure,NB\_Intra\_EC and Tevaluate,NB\_intra\_EC as defined in Table 4.6.2.4-1 and Table 4.6.2.4-2.

#### 4.6.2.5 Measurements of inter-frequency NB cells for UE category NB1 in normal coverage

The UE shall be able to identify new inter-frequency cells and perform NRSRP measurements of identified inter-frequency cells if carrier frequency information is provided by the serving NB-IoT cell, even if no explicit neighbour list with physical layer cell identities is provided.

If Srxlev ≤ SnonIntraSearchP then the UE shall search for and measure inter-frequency layers in preparation for possible reselection.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS36.304 within Pcarrier \* Tdetect,NB\_Inter\_NC, if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving NB-IoT cells when Treselection = 0 provided that the reselection criteria is met by a margin of at least Y dB, where Pcarrier is the number of inter-frequency carriers for which carrier frequency information was provided by the serving NB-IoT cell and ‘Y’ is specified by Table 4.6.2.6-3 (when Q1 -6 dB). An inter-frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.1.5 for a corresponding Band.

The UE shall filter NRSRP measurements of each measured inter-frequency cell using at least [2] measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure, Inter\_NB-IoT\_NC/2.

If an inter-frequency cell has been already detected but that has not been reselected to the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 36.304 within Pcarrier \* Tevaluate,NB\_Inter\_NC. When evaluating cells for reselection, the side conditions for NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot apply to both serving and inter-frequency cells.

If Treselection timer has a non zero value and the inter-frequency cell is better ranked than the serving NB-IoT cell, the UE shall evaluate this inter-frequency cell for the Treselection time. If this cell remains better ranked within this duration, then the UE shall reselect that cell.

For UE not configured with eDRX\_IDLE cycle, Tdetect,NB\_Inter\_NC, Tmeasure,NB\_Inter\_NC and Tevaluate, NB\_inter\_NC are specified in Table 4.6.2.5-1. For UE configured with eDRX\_IDLE cycle, Tdetect,NB\_Inter\_NC, Tmeasure,NB\_Inter\_NC and Tevaluate, NB\_inter\_NC are specified in Table 4.6.2.5-2, where the requirements apply provided that the serving NB-IoT cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,NB\_Inter\_NC, Tmeasure,NB\_Inter\_NC and Tevaluate, NB\_inter\_NC when multiple PTWs are used.

Table 4.6.2.5-1 : Tdetect,NB\_Inter\_NC, Tmeasure,NB\_Inter\_NC and Tevaluate,NB\_Inter\_NC

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NB\_Inter\_ NC [s] (number of DRX cycles) | Tmeasure,NB\_Inter\_ NC [s] (number of DRX cycles) | Tevaluate,NB\_Inter\_ NC  [s] (number of DRX cycles) |
| 0.32 | 26 (80) | 1.28 (4) | 5.12 (16) |
| 0.64 | 26 (40) | 1.28 (2) | 5.12 (8) |
| 1.28 | 51 (40) | 1.28 (1) | 6.5 (5) |
| 2.56 | 51 (20) | 2.56 (1) | 7.68 (3) |
| 5.12 | 102 (20) | 5.12 (1) | 10.24 (2) |
| 10.24 | 102 (10) | 10.24 (1) | 20.48 (2) |

Table 4.6.2.5-2: Tdetect,NB\_Inter\_ NC, Tmeasure,NB\_Inter\_NC and Tevaluate, NB\_inter\_ NC for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | | DRX cycle length [s] | | PTW length [s] (number of 2.56s periods) | | Tdetect,NB\_Inter\_NC [s] (number of DRX cycles) | Tmeasure,NB\_Inter\_NC [s] (number of DRX cycles) | Tevaluate,NB\_inter\_ NC  [s] (number of DRX cycles) | |
| 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | | 0.32 | | ≥ 2.56 (1) | | (20) | | 1.28 (4) | 2.56 (8) |
| 0.64 | | ≥ 2.56 (1) | | 1.28 (2) | 2.56 (4) |
| 1.28 | | ≥5.12 (2) | | 1.28 (1) | 2.56 (2) |
| 2.56 | | ≥7.68 (3) | | 2.56 (1) | 5.12 (2) |
| 5.12 | | ≥12.8 (5) | | 5.12 (1) | 10.24 (2) |
| 10.24 | | ≥23.04 (9) | | 10.24 (1) | 20.48 (2) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section X of TS 24.008 [34]. | | | | | | | | | |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

If all the relaxed monitoring criteria defined in clause 5.2.4.12 [1] are fulfilled then the UE’s inter-frequency measurement is not required to meet Tdetect,NB\_Intra\_EC, Tmeasure,NB\_Intra\_EC and Tevaluate,NB\_intra\_EC as defined in Table 4.6.2.5-1 and Table 4.6.2.5-2.

#### 4.6.2.6 Measurements of inter-frequency NB-IoT cells for UE category NB1 in enhanced coverage

The UE shall be able to identify new inter-frequency cells and perform NRSRP measurements of identified inter-frequency cells if carrier frequency information is provided by the serving NB-IoT cell, even if no explicit neighbour list with physical layer cell identities is provided.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS36.304 within Pcarrier \* Tdetect,NB\_Inter\_EC. An inter-frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.1.5 for a corresponding Band.

The UE shall not cause any interruption to the paging reception and acquisition of SI while performing measurement on serving or any neighbor cells.

The UE shall filter NRSRP measurements of each measured inter-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure,NB\_Inter \_EC/2.

If an inter-frequency cell has been already detected but that has not been reselected to the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 36.304 within Pcarrier \* Tevaluate,NB\_Inter\_EC. When evaluating cells for reselection, the side conditions for NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot apply to both serving and inter-frequency NB-IoT cells.

If Treselection timer has a non zero value and the inter-frequency cell is better ranked than the serving NB-IoT cell, the UE shall evaluate this inter-frequency cell for the Treselection time. If this cell remains better ranked within this duration, then the UE shall reselect that cell.

For a UE not configured with eDRX\_IDLE cycle, Tdetect,NB\_Inter\_EC, Tmeasure,NB\_Inter\_EC and Tevaluate, NB\_inter\_EC are specified in Table 4.6.2.6-1. For UE configured with eDRX\_IDLE cycle, Tdetect,NB\_Inter\_EC, Tmeasure,NB\_Inter\_EC and Tevaluate, NB\_inter\_EC are specified in Table 4.6.2.6-2 for the UE in enhanced coverage, where the requirements apply provided that the serving NB-IoT cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,NB\_Inter\_EC, Tmeasure,NB\_Inter\_EC and Tevaluate, NB\_inter\_EC when multiple PTWs are used.

Table 4.6.2.6-1 : Tdetect,NB\_Inter\_EC, Tmeasure,NB\_Inter\_EC and Tevaluate,NB\_Inter\_EC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SCH Ês/Iot of neighboring cell: Q2 | DRX cycle length [s] | Tdetect,NB\_Inter\_ EC [s] (number of DRX cycles) | Tmeasure,NB\_Inter\_ EC [s] (number of DRX cycles) | Tevaluate,NB\_Inter\_ EC  [s] (number of DRX cycles) |
| **-15≤ Q2 < -6** | 0.32 | 256 (800) | 1.28 (4) | 10.24 (32) |
| 0.64 | 266 (415) | 1.28 (2) | 10.24 (16) |
| 1.28 | 532 (415) | 1.28 (1) | 12.8 (10) |
| 2.56 | 532 (208) | 2.56 (1) | 15.36 (6) |
| 5.12 | 1063 (208) | 5.12 (1) | 20.48 (4) |
| 10.24 | 1063 (104) | 10.24 (1) | 30.72 (3) |
| **Q2≥-6** | 0.32 | 26 (80) | 1.28 (4) | 10.24 (32) |
| 0.64 | 29 (45) | 1.28 (2) | 10.24 (16) |
| 1.28 | 58 (45) | 1.28 (1) | 12.8 (10) |
| 2.56 | 59 (23) | 2.56 (1) | 15.36 (6) |
| 5.12 | 113 (22) | 5.12 (1) | 20.48 (4) |
| 10.24 | 113 (11) | 10.24 (1) | 30.72 (3) |

Table 4.6.2.6-2: Tdetect,NB\_Inter\_EC, Tmeasure,NB\_Inter\_EC and Tevaluate, NB\_inter\_EC for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **eDRX\_IDLE cycle length [s]** | **DRX cycle length [s]** | | **PTW length [s]** **(number of 2.56s periods)** | **Tdetect,NB\_Inter\_EC [s] (number of DRX cycles)** | **Tmeasure,NB\_Inter\_EC [s] (number of DRX cycles)** | **Tevaluate,NB\_interEC**  **[s] (number of DRX cycles)** |
| 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | 0.32 | ≥12.8 (5) | | ([406]) | 1.28 (4) | 10.24 (32) |
| 0.64 | ≥12.8 (5) | | 1.28 (2) | 10.24 (16) |
| 1.28 | ≥15.36 (6) | | 1.28 (1) | 12.8 (10) |
| 2.56 | ≥17.92 (7) | | 2.56 (1) | 15.36 (6) |
| 5.12 | ≥23.04 (9) | | 5.12 (1) | 20.48 (4) |
| 10.24 | ≥33.28 (13) | | 10.24 (1) | 30.72 (3) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section X of TS 24.008 [34]. | | | | | | |

Table 4.6.2.6-3: Conditions on NSCH Ês/Iot of identified and of the neighbour cell

|  |  |  |
| --- | --- | --- |
| NSCH Ês/Iot of already identified cell including serving cell: Q1 | Neighbouring cell NSCH Ês/Iot: Q2 | Cell Reselection Margin  ‘Y’ |
| -15≤Q1<-6 | -15≤ Q2 < -6 | 9.3 |
| -15≤Q1<-6 | Q2-6 | 9.3 |
| Q1 -6 | Q2-6 | 5 |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

If all the relaxed monitoring criteria defined in clause 5.2.4.12 [1] are fulfilled then the UE’s inter-frequency measurement is not required to meet Tdetect,NB\_Intra\_EC, Tmeasure,NB\_Intra\_EC and Tevaluate,NB\_intra\_EC as defined in Table 4.6.2.6-1 and Table 4.6.2.6-2.

#### 4.6.2.7 Maximum interruption in paging reception in normal coverage

UE shall perform the cell re-selection with minimum interruption in monitoring downlink channels for paging reception. When the UE is configured with eDRX\_IDLE cycle, the UE shall not miss any paging in a PTW provided the paging is sent in at least 2 DRX cycles before the end of that PTW.

At intra-frequency and inter-frequency cell re-selection, the UE shall monitor the downlink of serving NB-IoT cell for paging reception until the UE is capable to start monitoring downlink channels of the target intra-frequency and inter-frequency cell for paging reception. The interruption time shall not exceed TSI-NB1-NC + 100 ms.

#### 4.6.2.7A Maximum interruption in paging reception in enhanced coverage

UE shall perform the cell re-selection with minimum interruption in monitoring downlink channels for paging reception. When the UE is configured with eDRX\_IDLE cycle, the UE shall not miss any paging in a PTW provided the paging is sent in at least 2 DRX cycles before the end of that PTW.

At intra-frequency and inter-frequency cell re-selection, the UE shall monitor the downlink of serving NB-IoT cell for paging reception until the UE is capable to start monitoring downlink channels of the target intra-frequency and inter-frequency cell for paging reception. The interruption time shall not exceed TSI-NB1-EC + 100 ms.

#### 4.6.2.8 UE measurement capability

For idle mode cell re-selection purposes, the UE shall be capable of monitoring at least:

- Depending on UE capability, an intra-frequency carrier.

- Depending on UE capability, at least 2 inter-frequency carriers.

#### 4.6.2.9 WUS receptions for NB1

This clause contains requirements on the UE regarding WUS reception provided that the WUS has been configured in the serving NB-IoT cell*.*

The UE shall be capable of receiving the WUS signals of the serving NB-IoT cell provided that the minimum number of repetitions configured in the NB-IoT serving cell is according to Table 4.6.2.9-1 for normal coverage and Table 4.6.2.9-2 for enhanced coverage.

The requirements in this clause also apply when UE is configured to monitor 2 sequences within the same resource.

Table 4.6.2.9-1: Conditions for WUS reception for UE normal coverage level

|  |  |  |
| --- | --- | --- |
| DRX cycle length [s] | Required number of repetition of WUS signal with 1 transmit antenna | Required number of repetition of WUS signal with 2 transmit antennas |
| ≤ 5.12 | 64 | 32 |
| >5.12 | 128 | 64 |

Table 4.6.2.9-2: Conditions for WUS reception for UE enhanced coverage level

|  |  |  |
| --- | --- | --- |
| DRX cycle length [s] | Required number of repetition of WUS signal with 1 transmit antenna | Required number of repetition of WUS signal with 2 transmit antennas |
| ≤ 5.12 | 128 | 64 |
| > 5.12 | 256 | 128 |

### 4.6.3 Requirements for transmission using preconfigured uplink resources for UE category NB1

#### 4.6.3.1 Introduction

The requirements in this clause are applicable when the UE is configured with timing alignment (TA) validation using *pur-NRSRP-ChangeThreshold-r16* for transmitting in uplink using preconfigured uplink resources (PUR) as specified in [TS 36.331].

#### 4.6.3.2 Requirements on UE synchronization for transmission using PUR

The requirements in this clause are applicable for the UE in normal coverage or in enhanced coverage.

The UE is allowed to transmit using the preconfigured uplink resources provided that the UE is synchronized towards the serving cell prior to transmission. If the UE is not able to obtain the synchronization towards the serving cell then the UE shall drop the PUR transmission. The UE determines the PUR transmission occasion according to the received PUR configuration [TS 36.331].

#### 4.6.3.3 Requirements on TA validation for transmission using PUR

When only *NRSRP-ChangeThresh-NB-r16* [TS 36.331] is configured for TA validation based on NRSRP change criterion according to clause 5.3.3.19 in [TS 36.331], with or without other TA validation criteria, the UE is allowed to transmit using PUR using the timing derived using the latest available value as specified in subclause 7.20 provided that

- the first NRSRP (NRSRP1) measurement and the second NRSRP (NRSRP2) measurements used in the TA validation are valid measurements and,

- timing alignment validation for transmission using PUR is valid according to the validation criteria in section 5.3.3.19 in [TS 36.331] for all configured TA validation criteria.

NRSRP1 is considered valid provided that the following condition is met when in normal coverage:

*(T1 – min(800 ms, N× DRX cycle)) ≤ T1’ ≤ (T1 + min(800 ms, N×DRX cycle))*

NRSRP1 is considered valid provided that the following condition is met when in enhanced coverage:

*(T1 – min(1600 ms, N× DRX cycle)) ≤ T1’ ≤ (T1 + min(1600 ms, N×DRX cycle))*

NRSRP2 is considered valid provided that the following condition is met when in normal coverage:

*T2 – min(800 ms, N×DRX cycle) ≤ T2’ ≤ T2*

NRSRP2 is considered valid provided that the following condition is met when in enhanced coverage:

*T2 – min(1600 ms, N×DRX cycle) ≤ T2’ ≤ T2*

If at least one of NRSRP1 and NRSRP2 is considered to be invalid based on the above conditions then the UE shall not validate the PUR using NRSRP1 and NRSRP2 and shall not transmit using PUR.

Where

- T1 is the time when the latest was obtained by the UE via Timing Advance Command MAC control element or NPDCCH for transmission on PUR,

- T1’ is the time when the UE has completed NRSRP1,

- T2 is the time when the UE performs TA validation defined in clause 5.3.3.19 of TS 36.331 [2] for transmission using PUR,

- T2’ is the time when the UE has completed NRSRP2.

* N is applicable only if relaxed serving cell monitoring as defined in clause 4.6.2.1A for normal coverage or 4.6.2.3A for enhanced coverage is in use. Otherwise, N=1.

- For normal coverage, N is the relaxation factor and is given by Table 4.6.2.1A-1 if the UE is not configured with eDRX\_IDLE cycle and by Table 4.6.2.1A-2 if the UE is configured with eDRX\_IDLE if relaxed serving cell monitoring as defined in clause 4.6.2.1A is in use.

- For enhanced coverage, N is the relaxation factor and is given by Table 4.6.2.3A-1 if the UE is not configured with eDRX\_IDLE cycle and by Table 4.6.2.3A-2 if the UE is configured with eDRX\_IDLE cycle if relaxed serving cell monitoring as defined in clause 4.6.2.3A is in use.

## 4.7 Cell Selection and Re-selection Requirements for UE category M1

The UE category M1 applicability of the requirements in section 4.7 is defined in Section 3.6.1. The requirements in this subclause apply if category M1 UE is in normal and enhanced coverage area of the serving cell. The category M1 normal and enhanced coverge applicability of the requirements is defined in section 3.6.1.

### 4.7.1 Cell Selection

The requirements defined in section 4.1 apply for this section.

### 4.7.2 Cell Re-selection

The cell reselection procedure allows the UE to select a more suitable cell and camp on it.

When the UE is in either *Camped* *Normally* state or *Camped on Any Cell* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency and inter-frequency cells indicated by the serving cell. For intra-frequency and inter-frequency cells the serving cell may not provide explicit neighbour list but carrier frequency information and bandwidth information only. UE measurement activity is also controlled by measurement rules defined in TS36.304, allowing the UE to limit its measurement activity.

If the UE is in normal coverage as defined in section 3.6.1, the requirements in section 4.7.2.1 apply. If the UE is in enhanced coverage as defined in section 3.6.1, the requirements in section 4.7.2.2 apply.

#### 4.7.2.1 Cell Re-selection requirements for UE category M1 in normal coverage

##### 4.7.2.1.1 Measurement and evaluation of serving cell for UE category M1 in normal coverage

The requirements in this subclause apply if UE is in the normal coverage area of the serving cell. The UE is considered to be in normal coverage area of serving cell according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot of the serving cell defined in Annex B.1.3 for a corresponding Band.

The requirements defined in section 4.2.2.1 apply for this section.

The UE is allowed to perform RSRP measurements based on RSS signals provided UE is configured with *rss-ConfigCarrierInfo* [2] and following conditions are met:

- Serving cell RSS are available within the paging MPDCCH narrowband for Nserv successive DRX cycles and the last subframe of the RSS occasion is in the window [n-5, n-1] where n is the first subframe of paging MPDCCH narrowband, and

- RSS power offset (PRSS) with respect to CRS as defined in *RSS-Config* [2], where PRSS ≥ 0 dB, and

- UE is not configured with eDRX\_IDLE cycle, and DRX cycle length is 0.32s or 0.64s.

- Nserv defined in Table 4.7.2.1.1-1 applies if serving cell is measured based on RSS.

Table 4.7.2.1.1-1: Nserv

|  |  |
| --- | --- |
| DRX cycle length [s] | Nserv [number of DRX cycles] |
| 0.32 | 3 |
| 0.64 | 3 |
| 1.28 | N/A |
| 2.56 | N/A |

If UE performs RSRP measurement based on RSS for serving cell, it is not expected to perform RSRP measurement based on CRS on that serving cell.

##### 4.7.2.1.1A Relaxed measurement and evaluation of serving cell for UE category M1 in normal coverage

The UE which supports *wakeUpSignal-r15* or *wakeUpSignal-TDD-r15* shall meet the requirement defined for the DRX cycle length of N\*DRX\_cycle in Section 4.7.2.1.1, provided the following conditions are met:

- WUS has been configured in the serving cell using *WUS-Config-r15*, and

- The serving cell measurement relaxation is signalled by the network using *num-DRX-CyclesRelaxed*, and

- Serving cell S criteria is met with at least 2 dB margin.

- The relaxed monitoring criteria for neighbour cells in TS 36.304 [1] clause 5.2.4.12.1 is fulfilled,

Otherwise the requirements defined for the configured DRX cycle length in Section 4.7.2.1.1 shall apply.

The UE shall further meet the requirements in section 4.7.2.1.1 during time period T0 after following occasions:

- after the end of reception of latest paging message, or

- from the moment UE has switched from RRC\_CONNECTED state to RRC\_IDLE state.

T0 = N\*DRX cycle if the UE is not configured with eDRX\_IDLE cycle and T0 = one eDRX IDLE cycle if the UE is configured with eDRX\_IDLE cycle.

The relaxation factor N is given by Table 4.7.2.1.1A-1 if the UE is not configured with eDRX\_IDLE cycle and by Table 4.7.2.1.1A-2 if the UE is configured with eDRX\_IDLE cycle.

Table 4.7.2.1.1A-1: The relaxation factor N for a UE not configured with eDRX IDLE cycle

|  |  |
| --- | --- |
| **DRX cycle length [s]** | **Value** |
| 0.32 | Min(***n*** , 32) |
| 0.64 | Min(***n*** , 16) |
| 1.28 | Min(***n*** , 8) |
| 2.56 | Min(***n*** , 4) |
| NOTE: ***n*** is signalled by the network by using *num-DRX-CyclesRelaxed* defined in TS 36.331 [2]. | |

Table 4.7.2.1.1A-2: The relaxation factor N for a UE configured with eDRX IDLE cycle

|  |  |  |  |
| --- | --- | --- | --- |
| **DRX cycle length [s]** | **Value** | | |
| **1.28 ≤ PTW length [s] < 2.56** | **2.56 ≤ PTW length [s] < 5.12** | **5.12 ≤ PTW length [s]** |
| 0.32 | Min(***n*** , 2) | Min(***n*** , 4) | Min(***n*** , 8) |
| 0.64 | 1 | Min(***n*** , 2) | Min(***n*** , 4) |
| 1.28 | N/A | 1 | Min(***n*** , 2) |
| 2.56 | N/A | N/A | 1 |
| NOTE: ***n*** is signalled by the network by using *num-DRX-CyclesRelaxed* defined in TS 36.331 [2]. | | | |

##### 4.7.2.1.2 Measurements of intra-frequency cells for UE category M1 in normal coverage

The requirements in this subclause apply if UE is in the normal coverage area of the serving cell. The UE is considered to be in normal coverage area of serving cell according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot of the serving cell defined in Annex B.1.3 for a corresponding Band.

The UE shall be able to identify new intra-frequency cells and perform RSRP and RSRQ measurements of identified intra-frequency cells without an explicit intra-frequency neighbour list containing physical layer cell identities.

The UE is allowed to perform RSRP measurements based on RSS signals provided UE is configured with *rss-ConfigCarrierInfo* [2] and following conditions are met:

- the UE supports measuring neighbour cell RSS on the same paging MPDCCH narrowband, and RSS of the measured cell are available within the paging MPDCCH narrowband for Tevaluate, E-UTRAN\_Intra\_NC\_RSS successive DRX cycles, and the last subframe of the RSS occasion of the measured cell is in the window [n-5, n-1] where n is the first subframe of paging MPDCCH, or

- the UE does not support measuring neighbour cell RSS on the same paging MPDCCH narrowband, and RSS of the measured cell are available within the same RB location as the RSS RB location of the serving cell for Tevaluate, E-UTRAN\_Intra\_NC\_RSS successive DRX cycles,  and the last subframe of the RSS occasion of the measured cell is in the window [n-5, n-1] where n is the first subframe of paging MPDCCH, and

- UE is not configured with eDRX\_IDLE cycle, and

- RSS power offset (PRSS) with respect to CRS as defined in *rss-MeasPowerBias* [2], where PRSS ≥ 0 dB.

If UE performs RSRP measurement based on RSS on detected intra-frequency cell, it is not expected to perform RSRP measurement based on CRS on that measured cell. UE shall compensate the RSS power offset (PRSS) with respect to CRS when derving the RSRP measurement based on RSS.

For performing RSRP measurement based on RSS on detected intra-frequency cells, UE assumes BL/CE DL subframe configuration of each neighbor cell is same as serving cell. The requirements for RSRP measurement based on RSS for a neighbour cell apply provided that BL/CE DL subframe configuration of the neighbor cell is same as serving cell.

Additionally, for performing RSS-based RSRP measurements on detected intra-frequency cells, the UE assumes that the RSS transmission of each neighbor cell starts in the radio frame that is closest in time, i.e. within a window of +/- 5ms, around the corresponding radio frame offset calculated from RRC signalling in the serving cell, as described in TS 36.331 subclause 6.3. The requirements for RSS-based RSRP measurements for neighbor cells apply provided that the RSS transmission of each neighbor cell starts in the radio frame within a window of +/- 5ms around the calculated radio frame offset of the serving cell.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS36.304 within Tdetect,EUTRAN\_Intra\_NCwhen that Treselection= 0. An intra frequency cell is considered to be detectable according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot defined in Annex B.1.3 for a corresponding Band.

The UE shall measure RSRP and RSRQ at least every Tmeasure,EUTRAN\_Intra\_NC for intra-frequency cells that are identified and measured according to the measurement rules.

The UE shall filter RSRP and RSRQ measurements of each measured intra-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure,EUTRAN\_Intra\_NC/2.

The UE shall not consider a E-UTRA neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined [1] within Tevaluate,E-UTRAN\_Intra\_NC when Treselection = 0, provided that the cell is at least 4dB better ranked for Cat-M1 UE. For neigbor cell measured with RSS, the Tevaluate,E-UTRAN\_Intra\_NC\_RSS as defined in Table 4.7.2.1.2-1 applies.

If Treselection timer has a non zero value and the intra-frequency cell is better ranked than the serving cell, the UE shall evaluate this intra-frequency cell for the Treselection time. If this cell remains better ranked within this duration, then the UE shall reselect that cell.

For UE not configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_Intra\_NC, Tmeasure,EUTRAN\_Intra\_NC and Tevaluate, E-UTRAN\_Intra\_NC are specified in Table 4.7.2.1.2-1. For UE configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_Intra\_NC, Tmeasure,EUTRAN\_Intra\_NC and Tevaluate, E-UTRAN\_Intra\_NC are specified in Table 4.7.2.1.2-2, where the requirements apply provided that the serving cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,EUTRAN\_Intra\_NC, Tmeasure,EUTRAN\_Intra\_NC and Tevaluate, E-UTRAN\_Intra\_NC when multiple PTWs are used.

Table 4.7.2.1.2-1 : Tdetect,EUTRAN\_Intra\_NC, Tmeasure,EUTRAN\_Intra\_NC and Tevaluate, E-UTRAN\_Intra\_NC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,EUTRAN\_Intra\_NC [s] (number of DRX cycles) | Tmeasure,EUTRAN\_Intra\_NC [s] (number of DRX cycles) | Tevaluate,E-UTRAN\_intra\_NC  [s] (number of DRX cycles) | Tevaluate,E-UTRAN\_intra\_NC\_RSS  [s] (number of DRX cycles) |
| 0.32 | 11.52 (36) | 1.28 (4) | 5.12 (16) | 3.84 (12) |
| 0.64 | 17.92 (28) | 1.28 (2) | 5.12 (8) | 3.84 (6) |
| 1.28 | 32(25) | 1.28 (1) | 6.4 (5) | 3.84 (3) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) | 7.68 (3) |
| NOTE 1: Void | | | | |

Table 4.7.2.1.2-2: Tdetect,EUTRAN\_Intra\_NC, Tmeasure,EUTRAN\_Intra\_NC and Tevaluate,E-UTRAN\_Intra\_NC for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect,EUTRAN\_Intra\_NC [s] (number of DRX or eDRX cycles Note 4) | Tmeasure,EUTRAN\_Intra\_NC [s] (number of DRX or eDRX cycles Note 4) | Tevaluate,E-UTRAN\_intra\_NC  [s] (number of DRX or eDRX cycles Note 4) |
| 5.12 | N/A | N/A | 117.76 (23) | 5.12 (1) | 10.24 (2) |
| 10.24 ≤ eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | ≥1.28 (1) | (23) | 0.32 (1) | 0.64 (2) |
| 0.64 | ≥1.28 (1) | 0.64 (1) | 1.28 (2) |
| 1.28 | ≥2.56 (2) | 1.28 (1) | 2.56 (2) |
| 2.56 | ≥5.12 (4) | 2.56 (1) | 5.12 (2 ) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: Void  NOTE 4: Number of eDRX cycles when eDRX\_IDLE cycle length equals 5.12s, number of DRX cycles otherwis | | | | | |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

If all the relaxed monitoring criteria defined in clause 5.2.4.12 of TS 36.304 [1] are fulfilled then the UE's intra-frequency measurement is not required to meet Tdetect,EUTRAN\_Intra\_NC, Tmeasure,EUTRAN\_Intra\_NC and Tevaluate,E-UTRAN\_intra\_NC as defined in Table 4.7.2.1.2-1 and Table 4.7.2.1.2-2.

##### 4.7.2.1.3 Measurements of inter-frequency cells for UE category M1 in normal coverage

The requirements in this subclause apply if UE is in the normal coverage area of the serving cell. The UE is considered to be in normal coverage area of serving cell according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot of the serving cell defined in Annex B.1.3 for a corresponding Band.

The UE shall be able to identify new inter-frequency cells and perform RSRP or RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the serving cell, even if no explicit neighbour list with physical layer cell identities is provided. The UE shall not cause any interruption to the paging reception and acquisition of SI while performing measurement on serving or any neighbor cells.

If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ then the UE shall search for inter-frequency layers of higher priority at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2.2.

If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ then the UE shall search for and measure inter-frequency layers of higher, equal or lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority layers shall be the same as that defined below.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS36.304 within Kcarrier\*Tdetect,EUTRAN\_Inter\_NC, if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when Treselection = 0 provided that the reselection criteria is met by a margin of at least 8 dB for reselections based on ranking or 8 dB for RSRP reselections based on absolute priorities or 5.5 dB for RSRQ reselections based on absolute priorities. Kcarrier is the number of inter-frequency carriers in the neighbour cell list. An inter frequency cell is considered to be detectable according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot defined in Annex B.1.8 for a corresponding Band.

When higher priority cells are found by the higher priority search, they shall be measured at least every Tmeasure,E-UTRAN\_Inter\_NC . If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a E-UTRA carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall measure RSRP or RSRQ at least every Kcarrier\*Tmeasure,EUTRAN\_Inter\_NC for identified lower or equal priority inter-frequency cells. If the UE detects on a E-UTRA carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall filter RSRP or RSRQ measurements of each measured higher, lower and equal priority inter-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure,EUTRAN\_Inter\_NC/2.

The UE shall not consider a E-UTRA neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an inter-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 36.304 within Kcarrier\*Tevaluate,E-UTRAN\_Inter\_NC, when Treselection = 0 provided that the reselection criteria is met by a margin of at least 7 dB for reselections based on ranking or 7dB for RSRP reselections based on absolute priorities or 5dB for RSRQ reselections based on absolute priorities.

If Treselection timer has a non zero value and the inter-frequency cell is better ranked than the serving cell, the UE shall evaluate this inter-frequency cell for the Treselection time. If this cell remains better ranked within this duration, then the UE shall reselect that cell.

For UE not configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate, E-UTRAN\_Inter\_NC are specified in Table 4.7.2.1.3-1. For UE configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate, E-UTRAN\_Inter\_NC are specified in Table 4.7.2.1.3-2. Additionally, the requirements in Table 4.7.2.1.3-2 apply provided that the serving cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate, E-UTRAN\_Inter\_NC when multiple PTWs are used.

Table 4.7.2.1.3-1 : Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate,E-UTRAN\_Inter\_NC

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,EUTRAN\_Inter\_NC [s] (number of DRX cycles) | Tmeasure,EUTRAN\_Inter\_NC [s] (number of DRX cycles) | Tevaluate,E-UTRAN\_Inter\_NC  [s] (number of DRX cycles) |
| 0.32 | 11.52 (36) | 1.28 (4) | 5.12 (16) |
| 0.64 | 17.92 (28) | 1.28 (2) | 5.12 (8) |
| 1.28 | 32(25) | 1.28 (1) | 6.4 (5) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |

Table 4.7.2.1.3-2: Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate, E-UTRAN\_inter\_NC for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect,EUTRAN\_Inter\_NC [s] (number of DRX or eDRX cycles Note 3) | Tmeasure,EUTRAN\_Inter\_NC [s] (number of DRX or eDRX cycles Note 3) | Tevaluate,E-UTRAN\_inter\_NC  [s] (number of DRX or eDRX cycles Note 3) |
| 5.12 | N/A | N/A | 117.76 (23) | 5.12 (1) | 10.24 (2) |
| 10.24 ≤ eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | ≥1.28 (1) | (23) | 0.32 (1) | (2) |
| 0.64 | ≥1.28 (1) | 0.64 (1) | (2) |
| 1.28 | ≥1.28 (1) | 1.28 (1) | (2) |
| 2.56 | ≥2.56 (2) | 2.56 (1) | (2) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 5.12s, number of DRX cycles otherwise | | | | | |

For higher priority cells, a UE may optionally use a shorter value forTmeasure,EUTRAN\_Inter\_NC,which shall not be less than Max(0.64 s, one DRX cycle).

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

If all the relaxed monitoring criteria defined in clause 5.2.4.12 of TS 36.304 [1] are fulfilled then the UE's inter-frequency measurement is not required to meet Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate,E-UTRAN\_inter\_NC as defined in Table 4.7.2.1.3-1 and Table 4.7.2.1.3-2.

##### 4.7.2.1.4 Maximum allowed layers for multiple monitoring for UE category M1 in normal coverage

The UE category M1 in normal coverage shall be capable of monitoring at least:

- Depending on UE capability, 2 FDD E-UTRA inter-frequency carriers, and

- Depending on UE capability, 2 TDD E-UTRA inter-frequency carriers.

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 5 carrier frequency layers, which include one serving carrier frequency and any of the above defined combination of E-UTRA FDD inter-frequency and E-UTRA TDD inter-frequency layers.

##### 4.7.2.1.5 Maximum interruption in paging reception for Category M1 UEs in normal coverage

UE shall perform the cell re-selection with minimum interruption in monitoring downlink channels for paging reception. When the UE is configured with eDRX\_IDLE cycle, the UE shall not miss any paging in a PTW provided the paging is sent in at least 2 DRX cycles before the end of that PTW.

At intra-frequency cell re-selection, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels of the target intra-frequency cell for paging reception. The interruption time shall not exceed TSI-EUTRA-M1-NC + 50 ms.

TSI-EUTRA-M1-NC is the time required for receiving all the relevant system information data, which include MIB and relavant SIB, according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 36.331 [2] for an E-UTRAN cell.

These requirements assume normal coverage radio conditions and do not take into account cell re-selection failure.

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

#### 4.7.2.2 Cell Re-selection requirements for UE category M1 in enhanced coverage

##### 4.7.2.2.1 Measurement and evaluation of serving cell for UE category M1 in enhanced coverage

The requirements in this subclause apply if UE is in the enhanced coverage area of the serving cell. The UE is considered to be in enhanced coverage area of serving cell according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot of the serving cell defined in Annex B.1.3 for a corresponding Band.

The UE shall measure the RSRP and RSRQ level of the serving cell and evaluate the cell selection criterion S defined in [1] for the serving cell at least every DRX cycle.

The UE is allowed to perform RSRP measurements based on RSS signals provided UE is configured with *rss-ConfigCarrierInfo* [2] and following conditions are met:

- Serving cell RSS are available within the paging MPDCCH narrowband for Nserv successive DRX cycles and the last subframe of the RSS occasion is in the window [n-5, n-1] where n is the first subframe of paging MPDCCH narrowband, and

- RSS power offset (PRSS)with respect to CRS as defined in *RSS-Config* [2], where PRSS ≥ 0 dB, and

- UE is not configured with eDRX\_IDLE cycle, and DRX cycle length is 0.32s or 0.64s.

If UE performs RSRP measurement based on RSS for serving cell, it is not expected to perform RSRP measurement based on CRS on that serving cell.

The UE shall filter the RSRP and RSRQ measurements of the serving cell using at least 4 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least DRX cycle/2.

If the UE is not configured with eDRX\_IDLE cycle and has evaluated according to Table 4.7.2.2.1-1 in Nserv\_EC consecutive DRX cycles that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

If the UE is configured with eDRX\_IDLE cycle and has evaluated according to Table 4.7.2.2.1-2 in Nserv\_EC consecutive DRX cycles within a single PTW that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

If the UE in RRC\_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information during the time T, the UE shall initiate cell selection procedures for the selected PLMN as defined in [1], where T=20 s if the UE is not configured with eDRX\_IDLE cycle, and T=MAX(20 s, one eDRX\_IDLE cycle) if the UE is configured with eDRX\_IDLE cycle.

Table 4.7.2.2.1-1: Nserv\_EC

|  |  |
| --- | --- |
| DRX cycle length [s] | Nserv\_EC [number of DRX cycles] |
| 0.32 | 8 |
| 0.64 | 8 |
| 1.28 | 4 |
| 2.56 | 4 |

Table 4.7.2.2.1-2: Nserv\_ECfor UE configured with eDRX\_IDLE cycle

|  |  |  |  |
| --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Nserv [number of DRX or eDRX cycles Note 3] |
| 5.12 | N/A | N/A | 4 |
| 10.24 ≤ eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | ≥1.28 (1) | 4 |
| 0.64 | ≥2.56 (2) | 4 |
| 1.28 | ≥5.12 (4) | 4 |
| 2.56 | ≥10.24(8) | 4 |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 5.12s, number of DRX cycles otherwise. | | | |

Nserv\_EC defined in Table 4.7.2.2.1-3 applies if serving cell is measured based on RSS.

Table 4.7.2.2.1-3: Nserv\_EC

|  |  |
| --- | --- |
| DRX cycle length [s] | Nserv [number of DRX cycles] |
| 0.32 | 5 |
| 0.64 | 5 |
| 1.28 | N/A |
| 2.56 | N/A |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

##### 4.7.2.2.1A Relaxed measurement and evaluation of serving cell for UE category M1 in enhaned coverage

The UE which supports *wakeUpSignal-r15* or *wakeUpSignal-TDD-r15* shall meet the requirement defined for the DRX cycle length of N\*DRX\_cycle in Section 4.7.2.2.1, provided the following conditions are met:

- WUS has been configured in the serving cell using *WUS-Config-r15*, and

- The serving cell measurement relaxation is signalled by the network using *num-DRX-CyclesRelaxed*, and

- Serving cell S criteria is met with at least 2 dB margin.

- The relaxed monitoring criteria for neighbour cells in TS 36.304 [1] clause 5.2.4.12.1 is fulfilled,

Otherwise the requirements defined for the configured DRX cycle length in Section 4.7.2.2.1 shall apply.

The UE shall further meet the requirements in section 4.7.2.2.1 during time period T0 after following occasions:

- after the end of reception of latest paging message, or

- from the moment UE has switched from RRC\_CONNECTED state to RRC\_IDLE state.

T0 = N\*DRX cycle if the UE is not configured with eDRX\_IDLE cycle and T0 = one eDRX IDLE cycle if the UE is configured with eDRX\_IDLE cycle.

The relaxation factor N is given by Table 4.7.2.2.1A-1 if the UE is not configured with eDRX\_IDLE cycle and by Table 4.7.2.2.1A-2 if the UE is configured with eDRX\_IDLE cycle.

Table 4.7.2.2.1A-1: The relaxation factor N for a UE not configured with eDRX IDLE cycle

|  |  |
| --- | --- |
| **DRX cycle length [s]** | **Value** |
| 0.32 | Min(***n*** , 32) |
| 0.64 | Min(***n*** , 16) |
| 1.28 | Min(***n*** , 8) |
| 2.56 | Min(***n*** , 4) |
| NOTE: ***n*** is signalled by the network by using *num-DRX-CyclesRelaxed* defined in TS 36.331 [2]. | |

**Table 4.7.2.2.1A-2: The relaxation factor N for a UE configured with eDRX IDLE cycle**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX cycle length [s]** | **Value** | | | |
| **1.28 ≤ PTW length [s] < 2.56** | **2.56 ≤ PTW length [s] < 5.12** | **5.12 ≤ PTW length [s] < 10.24** | **10.24 ≤ PTW length [s]** |
| 0.32 | 1 | Min(***n*** , 2) | Min(***n*** , 4) | Min(***n*** , 8) |
| 0.64 | N/A | 1 | Min(***n*** , 2) | Min(***n*** , 4) |
| 1.28 | N/A | N/A | 1 | Min(***n*** , 2) |
| 2.56 | N/A | N/A | N/A | 1 |
| NOTE: ***n*** is signalled by the network by using *num-DRX-CyclesRelaxed* defined in TS 36.331 [2]. | | | | |

##### 4.7.2.2.2 Measurements of intra-frequency cells for UE category M1 in enhanced coverage

The requirements in this subclause apply if UE is in the enhanced coverage area of the serving cell. The UE is considered to be in enhanced coverage area of serving cell according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot of the serving cell defined in Annex B.1.3 for a corresponding Band.

The UE shall be able to identify new intra-frequency cells and perform RSRP and RSRQ measurements of identified intra-frequency cells without an explicit intra-frequency neighbour list containing physical layer cell identities. The UE shall not cause any interruption to the paging reception and acquisition of SI while performing measurement on serving or any neighbor cells.

The UE is allowed to perform RSRP measurements based on RSS signals provided UE is configured with *rss-ConfigCarrierInfo* [2] and following conditions are met:

- the UE supports measuring neighbour cell RSS on the same paging MPDCCH narrowband, and RSS of the measured cell are available within the paging MPDCCH narrowband for Tevaluate, E-UTRAN\_Intra\_EC\_RSS successive DRX cycles, and the last subframe of the RSS occasion of the measured cell is in the window [n-5, n-1] where n is the first subframe of paging MPDCCH, or

- the UE does not support measuring neighbour cell RSS on the same paging MPDCCH narrowband, and RSS of the measured cell are available within the same RB location as the RSS RB location of the serving cell for Tevaluate, E-UTRAN\_Intra\_EC\_RSS successive DRX cycles, and the last subframe of the RSS occasion of the measured cell is in the window [n-5, n-1] where n is the first subframe of paging MPDCCH, and

- UE is not configured with eDRX\_IDLE cycle, and

- RSS power offset (PRSS) with respect to CRS as defined in *rss-MeasPowerBias* [2], where PRSS ≥ 0 dB.

If UE performs RSRP measurement based on RSS on detected intra-frequency cell, it is not expected to perform RSRP measurement based on CRS on that measured cell. UE shall compensate the RSS power offset (PRSS) with respect to CRS when derving the RSRP measurement based on RSS.

For performing RSRP measurement based on RSS on detected intra-frequency cells, UE assumes BL/CE DL subframe configuration of each neighbor cell is same as serving cell. The requirements for RSRP measurement based on RSS for a neighbour cell apply provided that BL/CE DL subframe configuration of the neighbor cell is same as serving cell.

Additionally, for performing RSS-based RSRP measurements on detected intra-frequency cells, the UE assumes that the RSS transmission of each neighbor cell starts in the radio frame that is closest in time, i.e. within a window of +/- 5ms, around the corresponding radio frame offset calculated from RRC signalling in the serving cell, as described in TS 36.331 subclause 6.3. The requirements for RSS-based RSRP measurements for neighbor cells apply provided that the RSS transmission of each neighbor cell starts in the radio frame within a window of +/- 5ms around the calculated radio frame offset of the serving cell.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS36.304 within Tdetect,EUTRAN\_Intra\_ECwhen that Treselection= 0. An intra-frequency cell is considered to be detectable according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot defined in Annex B.1.3 for a corresponding Band.

The UE shall measure RSRP and RSRQ at least every Tmeasure,EUTRAN\_Intra\_EC for intra-frequency cells that are identified and measured according to the measurement rules.

The UE shall filter RSRP and RSRQ measurements of each measured intra-frequency cell using at least 4 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure,EUTRAN\_Intra\_EC/2.

The UE shall not consider an E-UTRA neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined [1] within Tevaluate,E-UTRAN\_intra\_EC when Treselection = 0, provided that the cell is at least 5dB better ranked. For neigbor cell measured with RSS, the Tevaluate,E-UTRAN\_Intra\_EC\_RSS as defined in Table 4.7.2.2.2-1 and Table 4.7.2.2.2-2 applies.

If Treselection timer has a non zero value and the intra-frequency cell is better ranked than the serving cell, the UE shall evaluate this intra-frequency cell for the Treselection time. If this cell remains better ranked within this duration, then the UE shall reselect that cell.

For UE not configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_Intra\_EC, Tmeasure,EUTRAN\_Intra\_EC and Tevaluate, E-UTRAN\_intra\_EC are specified in Table 4.7.2.2.2-1. For UE configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_Intra\_EC, Tmeasure,EUTRAN\_Intra\_EC and Tevaluate, E-UTRAN\_intra\_EC are specified in Table 4.7.2.2.2-2. Additionally, the requirements in Table 4.7.2.2.2-2 apply provided that the serving cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,EUTRAN\_Intra\_EC, Tmeasure,EUTRAN\_Intra\_EC and Tevaluate, E-UTRAN\_intra\_EC when multiple PTWs are used.

Table 4.7.2.2.2-1 : Tdetect,EUTRAN\_Intra\_EC, Tmeasure,EUTRAN\_Intra\_EC and Tevaluate, E-UTRAN\_intra\_EC

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| SCH Ês/Iot of neighboring cell: Q2 [dB] | DRX cycle length [s] | Tdetect,EUTRAN\_Intra\_EC [s] (number of DRX cycles) | Tmeasure,EUTRAN\_Intra\_EC [s] (number of DRX cycles) | Tevaluate,E-UTRAN\_intra\_EC  [s] (number of DRX cycles) | Tevaluate,E-UTRAN\_intra\_EC\_RSS  [s] (number of DRX cycles) |
| -15≤ Q2 < -6 | 0.32 | 330.24 (1032) | 1.28 (4) | 10.24 (32) | 6.4 (20) |
| 0.64 | 330.24 (516) | 1.28 (2) | 10.24 (16) | 6.4 (10) |
| 1.28 | 524.8 (410) | 1.28 (1) | 12.8 (10) | 6.4 (5) |
| 2.56 | 1039.36 (406) | 2.56 (1) | 15.36 (6) | 12.8 (5) |
| Q2≥-6 | 0.32 | 16.64 (52) | 1.28 (4) | 10.24 (32) | 6.4 (20) |
| 0.64 | 23.04 (36) | 1.28 (2) | 10.24 (16) | 6.4 (10) |
| 1.28 | 38.4 (30) | 1.28 (1) | 12.8 (10) | 6.4 (5) |
| 2.56 | 66.56 (26) | 2.56 (1) | 15.36 (6) | 12.8 (5) |
| NOTE 1: Void | | | | | |

Table 4.7.2.2.2-2: Tdetect,EUTRAN\_Intra\_EC, Tmeasure,EUTRAN\_Intra\_EC and Tevaluate, E-UTRAN\_intra\_EC for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect,EUTRAN\_Intra\_EC [s] (number *N* of DRX or eDRX cycles Note 5) for neighboring cell with SCH Es/IoT:  -15≤ Q2 < -6 [dB] | Tdetect,EUTRAN\_Intra\_EC [s] (number *N* of DRX or eDRX cycles Note 5) for neighboring cell with SCH Es/IoT:  Q2≥-6 [dB] | Tmeasure,EUTRAN\_Intra\_EC [s] (number *N* of DRX or eDRX cycles Note 5) | Tevaluate,E-UTRAN\_intra\_EC  [s] (number *N* of DRX or eDRX cycles Note 5) | Tevaluate,E-UTRAN\_intra\_EC\_RSS  [s] (number *N* of DRX or eDRX cycles Note 5) |
| 5.12 | N/A | N/A | 2078.72 (406) | 133.12 (26) | 5.12 (1) | 30.72 (6) | 25.6 (5) |
| 10.24 ≤ eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | ≥1.28 (1) | Note 3 (406) | Note 3 (26) | 0.32 (1) | Note 3 (6) | Note 3 (5) |
| 0.64 | ≥1.28 (1) | 0.64 (1) | Note 3 (6) | Note 3 (5) |
| 1.28 | ≥2.28 (1) | 1.28 (1) | Note 3 (6) | Note 3 (5) |
| 2.56 | ≥2.56 (2) | 2.56 (1) | Note 3 (6) | Note 3 (5) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: The detection period and the evaluation period depend on the number *N* of DRX cycles and are calculated according to the formula below:  .  NOTE 4: Void  NOTE 5: Number of eDRX cycles when eDRX\_IDLE cycle length equals 5.12s, number of DRX cycles otherwise | | | | | | | |

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

If all the relaxed monitoring criteria defined in clause 5.2.4.12 of TS 36.304 [1] are fulfilled then the UE’s intra-frequency measurement is not required to meet Tdetect,EUTRAN\_Intra\_EC, Tmeasure,EUTRAN\_Intra\_EC and Tevaluate,E-UTRAN\_intra\_EC as defined in Table 4.7.2.2.2-1 and Table 4.7.2.2.2-2.

##### 4.7.2.2.3 Measurements of inter-frequency cells for UE category M1 in enhanced coverage

The requirements in this subclause apply if UE is in the enhanced coverage area of the serving cell. The UE is considered to be in enhanced coverage area of serving cell according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot of the serving cell defined in Annex B.1.3 for a corresponding Band.

The UE shall be able to identify new inter-frequency cells and perform RSRP or RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the serving cell, even if no explicit neighbour list with physical layer cell identities is provided. The UE shall not cause any interruption to the paging reception and acquisition of SI while performing measurement on serving or any neighbor cells.

If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ then the UE shall search for inter-frequency layers of higher priority at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2.2.

If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ then the UE shall search for and measure inter-frequency layers of higher, equal or lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority layers shall be the same as that defined below.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS36.304 within Kcarrier\*Tdetect,EUTRAN\_Inter\_EC, if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when Treselection = 0 provided that the reselection criteria is met by a margin of at least 8 dB for reselections based on ranking. Kcarrier is the number of inter-frequency carriers in the neighbour cell list. An inter frequency cell is considered to be detectable according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot defined in Annex B.1.8 for a corresponding Band.

When higher priority cells are found by the higher priority search, they shall be measured at least every Tmeasure,E-UTRAN\_Inter\_EC . If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a E-UTRA carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall measure RSRP or RSRQ at least every Kcarrier\*Tmeasure,EUTRAN\_Inter\_EC for identified lower or equal priority inter-frequency cells. If the UE detects on a E-UTRA carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall filter RSRP or RSRQ measurements of each measured higher, lower and equal priority inter-frequency cell using at least 4 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure,EUTRAN\_Inter\_EC/2.

The UE shall not consider a E-UTRA neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an inter-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 36.304 within Kcarrier\*Tevaluate,E-UTRAN\_Inter\_EC, when Treselection = 0 provided that the reselection criteria is met by a margin of at least 8 dB for reselections based on ranking.

If Treselection timer has a non zero value and the inter-frequency cell is better ranked than the serving cell, the UE shall evaluate this inter-frequency cell for the Treselection time. If this cell remains better ranked within this duration, then the UE shall reselect that cell.

For UE not configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_Inter\_EC, Tmeasure,EUTRAN\_Inter\_EC and Tevaluate, E-UTRAN\_inter\_EC are specified in Table 4.7.2.2.3-1. For UE configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_Inter\_EC, Tmeasure,EUTRAN\_Inter\_EC and Tevaluate, E-UTRAN\_inter\_EC are specified in Table 4.7.2.2.3-3. Additionally, the requirements in Table 4.7.2.2.3-3 apply provided that the serving cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,EUTRAN\_Inter\_EC, Tmeasure,EUTRAN\_Inter\_EC and Tevaluate, E-UTRAN\_inter\_EC when multiple PTWs are used.

Table 4.7.2.2.3-1: Tdetect,EUTRAN\_Inter\_EC, Tmeasure,EUTRAN\_Inter\_EC and Tevaluate,E-UTRAN\_Inter\_EC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SCH Ês/Iot of neighboring cell: Q2 [dB] | DRX cycle length [s] | Tdetect,EUTRAN\_Inter\_EC [s] (number of DRX cycles) | Tmeasure,EUTRAN\_Inter\_EC [s] (number of DRX cycles) | Tevaluate,E-UTRAN\_inter\_EC  [s] (number of DRX cycles) |
| **-15≤ Q2 < -6** | 0.32 | 330.24 (1032) | 1.28 (4) | 10.24 (32) |
| 0.64 | 330.24 (516) | 1.28 (2) | 10.24 (16) |
| 1.28 | 524.8 (410) | 1.28 (1) | 12.8 (10) |
| 2.56 | 1039.36 (406) | 2.56 (1) | 15.36 (6) |
| **Q2≥-6** | 0.32 | 16.64 (52) | 1.28 (4) | 10.24 (32) |
| 0.64 | 23.04 (36) | 1.28 (2) | 10.24 (16) |
| 1.28 | 38.4 (30) | 1.28 (1) | 12.8 (10) |
| 2.56 | 66.56 (26) | 2.56 (1) | 15.36 (6) |

Table 4.7.2.2.3-2: Void

Table 4.7.2.2.3-3: Tdetect,EUTRAN\_Inter\_EC, Tmeasure,EUTRAN\_Inter\_EC and Tevaluate, E-UTRAN\_inter\_EC for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect,EUTRAN\_Inter\_EC [s] (number of DRX or eDRX cycles Note 4) for neighboring cell with SCH Es/IoT:  -15≤ Q2 < -6 [dB] | Tdetect,EUTRAN\_Inter\_EC [s] (number of DRX or eDRX cycles Note 4) for neighboring cell with SCH Es/IoT:  Q2≥-6 [dB] | Tmeasure,EUTRAN\_Inter\_EC [s] (number of DRX or eDRX cycles Note 4) | Tevaluate,E-UTRAN\_inter\_EC  [s] (number of DRX or eDRX cycles Note 4) |
| 5.12 | N/A | N/A | 2078.72 (406) | 133.12 (26) | 5.12 (1) | 30.72 (6) |
| 10.24 ≤ eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | ≥1.28 (1) | Note 3 (406) | Note 3 (26) | 0.32 (1) | Note 3 (6) |
| 0.64 | ≥1.28 (1) | 0.64 (1) | Note 3 (6) |
| 1.28 | ≥1.28 (1) | 1.28 (1) | Note 3 (6) |
| 2.56 | ≥2.56 (2) | 2.56 (1) | Note 3 (6) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: The detection period and the evaluation period depend on the number *N* of DRX cycles and are calculated according to the formula below:  .  NOTE 4: Number of eDRX cycles when eDRX\_IDLE cycle length equals 5.12s, number of DRX cycles otherwise. | | | | | | |

For higher priority cells, a UE may optionally use a shorter value forTmeasure,EUTRAN\_Inter\_EC,which shall not be less than Max(0.64 s, one DRX cycle).

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

If all the relaxed monitoring criteria defined in clause 5.2.4.12 of TS 36.304 [1] are fulfilled then the UE’s inter-frequency measurement is not required to meet Tdetect,EUTRAN\_Inter\_EC, Tmeasure,EUTRAN\_Inter\_EC and Tevaluate, E-UTRAN\_inter\_EC as defined in Table 4.7.2.2.3-1 and Table 4.7.2.2.3-3.

##### 4.7.2.2.4 Maximum allowed layers for multiple monitoring for UE category M1 in enhanced coverage

The UE category M1 in enhanced coverage shall be capable of monitoring at least:

- Depending on UE capability, 2 FDD E-UTRA inter-frequency carriers, and

- Depending on UE capability, 2 TDD E-UTRA inter-frequency carriers.

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 5 carrier frequency layers, which include one serving carrier frequency and any of the above defined combination of E-UTRA FDD inter-frequency and E-UTRA TDD inter-frequency layers.

##### 4.7.2.2.5 Maximum interruption in paging reception for Category M1 UEs in enhanced coverage

UE shall perform the cell re-selection with minimum interruption in monitoring downlink channels for paging reception. When the UE is configured with eDRX\_IDLE cycle, the UE shall not miss any paging in a PTW provided the paging is sent in at least 2 DRX cycles before the end of that PTW.

At intra-frequency cell re-selection, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels of the target intra-frequency cell for paging reception. The interruption time shall not exceed TSI-EUTRA-M1-EC + 50 ms.

TSI-EUTRA-M1-EC is the time required for receiving all the relevant system information data, which include MIB and relavant SIB, according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 36.331 [2] for an E-UTRAN cell.

These requirements assume extended coverage radio conditions and do not take into account cell re-selection failure.

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

#### 4.7.2.3 WUS receptions for UE category M1

This clause contains requirements on the UE regarding WUS reception provided that WUS has been configured in the serving cell and the UE is configured to receive up to 2 WUS sequences within the same resource*.*

The UE shall be capable of receiving the WUS signals of the serving cell provided that the minimum number of repetitions configured in the serving cell is according to Table 4.7.2.3-1 for normal coverage and Table 4.7.2.3-2 for enhanced coverage and the higher layer parameter *wus-PowerBoost* as indicated in SIB is configured to be 0 dB.

Table 4.7.2.3-1: Conditions for WUS reception for UE normal coverage level

|  |  |  |
| --- | --- | --- |
| DRX cycle length [s] | Required number of repetition of WUS signal with 1 transmit antenna | Required number of repetition of WUS signal with 2 transmit antennas |
| ≤ 1.28 | 32 | 4 |
| > 1.28 | 64 | 4 |

Table 4.7.2.3-2: Conditions for WUS reception for UE enhanced coverage level

|  |  |  |
| --- | --- | --- |
| DRX cycle length [s] | Required number of repetition of WUS signal with 1 transmit antenna | Required number of repetition of WUS signal with 2 transmit antennas |
| ≤ 1.28 | 128 | 32 |
| > 1.28 | 256 | 64 |

### 4.7.3 Channel quality report for UE Category M1 in idle mode

The requirements in this clause shall apply for UE supporting DL channel quality reporting for UE Category M1 as defined in TS 36.321 [17] section 5.25.

The DL channel quality provides the serving eNB with information about

- the minimum MPDCCH repetition level to satisfy the hypothetical MPDCCH block error rate of 1% with the parameters specified in Table 4.7.3-1 if the repetition level in DL quality report is larger than 1, or

- the minimum MPDCCH aggregation level to satisfy the hypothetical MPDCCH block error rate of 1% with the parameters specified in Table 4.7.3-2 if the repetition level in DL quality report is 1 and UE is in normal coverage.

Table 4.7.3-1: MPDCCH transmission parameters for downlink quality reporting, repetition number being reported

|  |  |  |
| --- | --- | --- |
| Attribute | Normal coverage | Enhanced coverage |
| DCI format | 6-1A | 6-1B |
| Starting OFDM symbols | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz | |
| MPDCCH Aggregation level (ECCE) Note2 | 24 | |
| M-PDCCH Transmission type | Distributed | |

Table 4.7.3-2: MPDCCH transmission parameters for downlink quality reporting, aggregation level being reported

|  |  |
| --- | --- |
| Attribute | Normal coverage |
| DCI format | 6-1A |
| Starting OFDM symbols | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz |
| MPDCCH repetition level Note1 | 1 |
| M-PDCCH Transmission type | Distributed |

When UE is in idle mode, the reported MPDCCH repetition level or aggregation level shall be derived from the channel quality measured in the period T in the narrowband where the random access response is transmitted, where

- T is the period from the beginning of the random access response to the beginning of PUSCH for DL channel quality reporting.

The MPDCCH repetition level or aggregation level is chosen from the supported MPDCCH repetition levels and aggregation levels [3]. The report mapping is defined in section 9.1.21.22.

The UE shall satisfy the downlink channel quality measurement accuracy requirements as specified in section 9.1.21.23 if UE is in normal coverage or in section 9.1.21.24 if UE is in enhanced coverage.

### 4.7.4 Requirements for transmission using preconfigured uplink resources for UE category M1

#### 4.7.4.1 Introduction

The requirements in this clause are applicable when the UE is configured with timing alignment (TA) validation using *pur-RSRP-ChangeThreshold* for transmitting in uplink using preconfigured uplink resources (PUR) as specified in [TS 36.331].

#### 4.7.4.2 Requirements on UE synchronization for transmission using PUR

The requirements in this clause are applicable for the UE in normal coverage or in enhanced coverage.

The UE is allowed to transmit using the preconfigured uplink resources provided that the UE is synchronized towards the serving cell prior to transmission. If the UE is not able to obtain the synchronization towards the serving cell then the UE shall drop the PUR transmission. The UE determines the PUR transmission occasion according to the received PUR configuration [TS 36.331].

#### 4.7.4.3 Requirements on TA validation for transmission using PUR

When *rsrp-ChangeThresh* [TS 36.331] is configured for TA validation based on the RSRP change criterion according to clause 5.3.3.19 in [TS 36.331], with or without other TA validation criteria, the UE is allowed to transmit using PUR using the timing derived using the latest available value as specified in subclause 7.24.1 provided that

- the first RSRP (RSRP1) measurement and the second RSRP (RSRP2) measurements used in the TA validation are valid measurements and,

- timing alignment validation for transmission using PUR is valid according to the validation criteria in section 5.3.3. 19 in [TS 36.331] for all configured TA validation criteria.

RSRP1 is considered valid provided that the following condition is met when in normal coverage:

*(T1 – min(480 ms, N× DRX cycle)) ≤ T1’ ≤ (T1 + min(480 ms, N×DRX cycle))*

RSRP1 is considered valid provided that the following condition is met when in enhanced coverage:

*(T1 – min(800 ms, N× DRX cycle)) ≤ T1’ ≤ (T1 + min(800 ms, N×DRX cycle))*

RSRP2 is considered valid provided that the following condition is met when in normal coverage:

*T2 – min(480 ms, N×DRX cycle) ≤ T2’ ≤ T2*

RSRP2 is considered valid provided that the following condition is met when in enhanced coverage:

*T2 – min(800 ms, N×DRX cycle) ≤ T2’ ≤ T2*

If at least one of RSRP1 and RSRP2 is considered to be invalid based on the above conditions then the UE shall not validate the PUR using RSRP1 and RSRP2 and shall not transmit using PUR.

Where

- T1 is the time when the latest was obtained by the UE via Timing Advance Command MAC control element or PDCCH for transmission on PUR,

- T1’ is the time when the UE has completed RSRP1,

- T2 is the time when the UE performs TA validation defined in clause 5.3.3.19 in [TS 36.331] for transmission using PUR,

- T2’ is the time when the UE has completed RSRP2.

- N is applicable only if relaxed serving cell monitoring as defined in clause 4.7.2.1.1A for normal coverage or 4.7.2.2.1A for enhanced coverage is in use. Otherwise, N=1.

- For normal coverage, N is the relaxation factor and is given by Table 4.7.2.1.1A-1 if the UE is not configured with eDRX\_IDLE cycle and by Table 4.7.2.1.1A-2 if the UE is configured with eDRX\_IDLE cycle if relaxed serving cell monitoring as defined in clause 4.7.2.1.1A is in use.

- For enhanced coverage, N is the relaxation factor and is given by Table 4.7.2.2.1A-1 if the UE is not configured with eDRX\_IDLE cycle and by Table 4.7.2.2.1A-2 if the UE is configured with eDRX\_IDLE cycle if relaxed serving cell monitoring as defined in clause 4.7.2.2.1A is in use.

## 4.8 Idle State Positioning Measurement Requirements for UE category NB1

### 4.8.1 OTDOA Intra-Frequency RSTD Measurements for UE category NB1 for normal coverage

The UE shall follow the procedure for RRC\_IDLE state positioning measurements as defined in TS 36.305 [36] clause 7.1.3.

When the physical layer cell identities of the neighbour cells together with the OTDOA assistance data have been provided and the UE has entered the RRC\_IDLE state, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n* = 16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

,

where

is the total time for detecting and measuring at least *n* cells;

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] if Part B subframe configuration is provided; otherwise if only Part A subframe configuration is provided, the  equals to the length of the subframe pattern,

 is the number of NPRS positioning occasions as defined in Table 4.8.1-1,

 =  ms is the measurement time for a single NPRS positioning occasion which includes the sampling time and the processing time;

is the cell-specific number of NPRS subframes within a NPRS occasion as defined in TS36.355[24] if Part B subframe configuration is provided; if only Part A subframe configuration is provided, the NPRS occasion length is 10 ms,

 is the minimum number of NPRS subframes per cell measurement as specified in Section 9.1.22.10.

, , and ,  are the parameters of the same cell, for which  is the largest among all the measured cells.

Table 4.8.1-1: Number of NPRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of NPRS positioning occasions | |
| f1 Note1 | f1 and f2 Note2 |
| 160 ms | 16\* | 32\* |
| >160 ms | 8\* | 16\* |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

and  conditions apply for all subframes of at least  NPRS positioning occasions,

NPRP 1,2|dBm according to Annex B.2.16 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry NPRS.

The time  starts from the point when the UE has received both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the message and data have been delivered to the physical layer of the UE and the UE has entered the RRC\_IDLE state.

The RSTD measurement accuracy for all measured neighbor cells *i* shall fulfill the requirements specified in sub-clause 9.1.22.10.

#### 4.8.1.1 RSTD Measurement Reporting Delay

The reported measurements contained in the event triggered measurement reports shall meet the requirements in clause 9.1.22.10.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

After receiving both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], the UE shall be sent to RRC IDLE state. The measurement reporting delay is defined as the time between the point when the UE has entered the RRC\_IDLE state, and the point when the UE is ready to transmit the measurement report over the air interface and starts to establish a signalling connection with the MME. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of NPUSCH repetitions configured for the UE, otherwise the uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes the delay caused by not having UL resources for the UE to send the measurement report. This measurement reporting delay excludes any delay caused by RRC connection release before the RRC\_IDLE mode measurement. This measurement reporting delay excludes any delay caused by establishing a signalling connection with the MME (including random access procedure) as defined in TS 36.305 [36] for LPP measurement reporting.

The measurement reporting delay shall be less than  defined in Clause 4.8.1.

### 4.8.2 OTDOA Intra-Frequency RSTD Measurements for UE category NB1 for enhanced coverage

The UE shall follow the procedure for RRC\_IDLE state positioning measurements as defined in TS 36.305 [36] clause 7.1.3.

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data have been provided and the UE has entered the RRC\_IDLE state, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n* = 16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

,

where

is the total time for detecting and measuring at least *n* cells;

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] if Part B subframe configuration is provided; otherwise if only Part A subframe configuration is provided, the  equals to the length of the subframe pattern,

 is the number of NPRS positioning occasions as defined in Table 4.8.2-1,

 =  ms is the measurement time for a single NPRS positioning occasion which includes the sampling time and the processing time;

is the cell-specific number of NPRS subframes within a NPRS occasion as defined in TS 36.355[24] if Part B subframe configuration is provided; if only Part A subframe configuration is provided, the NPRS occasion length is 10 ms,

 is the minimum number of NPRS subframes per cell measurement as specified in Section 9.1.22.12.

, , and ,  are the parameters of the same cell, for which  is the largest among all the measured cells.

Table 4.8.2-1: Number of NPRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of NPRS positioning occasions | |
| f1 Note1 | f1 and f2 Note2 |
| 160 ms | 16\* | 32\* |
| >160 ms | 8\* | 16\* |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-15 dB for all Frequency Bands for the reference cell,

≥-15 dB for all Frequency Bands for neighbour cell *i*,

and  conditions apply for all subframes of at least  NPRS positioning occasions,

NPRP 1,2|dBm according to Annex B.2.16 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry NPRS.

The time  starts from the point when the UE has received both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the message and the data have been delivered to the physical layer of the UE, and the UE has entered the RRC\_IDLE state.

The RSTD measurement accuracy for all measured neighbor cells *i* shall fulfill the requirements specified in sub-clause 9.1.22.12.

#### 4.8.2.1 RSTD Measurement Reporting Delay

The reported measurements contained in the event triggered measurement reports shall meet the requirements in clause 9.1.22.12.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

After receiving both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], the UE shall be sent to RRC IDLE state. The measurement reporting delay is defined as the time between the point when the UE has entered the RRC\_IDLE state, and the point when the UE is ready to transmit the measurement report over the air interface and starts to establish a signalling connection with the MME. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of NPUSCH repetitions configured for the UE, otherwise the uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes the delay caused by not having UL resources for the UE to send the measurement report. This measurement reporting delay excludes any delay caused by RRC connection release before the RRC\_IDLE mode measurement. This measurement reporting delay excludes any delay caused by establishing a signalling connection with the MME (including random access procedure) as defined in TS 36.305 [36] for LPP measurement reporting.

The measurement reporting delay shall be less than  defined in Clause 4.8.2.

### 4.8.3 OTDOA Inter-Frequency RSTD Measurements for UE category NB1 for normal coverage

The UE shall support NPRS configuration in more than one resource block [24]. The UE shall follow the procedure for RRC\_IDLE state positioning measurement as defined in TS 36.305 [36] clause 7.1.3.

All positioning subframes indicated in the OTDOA assistance data and specified in sub-clause 9.1.22.11 are available for RSTD measurements in the measured and reference cell.

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data have been provided and the UE has entered the RRC\_IDLE state, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n* = 16 cells, including the reference cell within  ms as given below:

,

where

is the total time for detecting and measuring at least *n* cells;

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] if Part B subframe configuration is provided; otherwise if only Part A subframe configuration is provided, the  equals to the length of the subframe pattern,

 is the number of NPRS positioning occasions as defined in Table 4.8.1-1,

 =  ms is the measurement time for a single NPRS positioning occasion which includes the sampling time and the processing time;

is the cell-specific number of NPRS subframes within a NPRS occasion as defined in TS36.355 [24] if Part B subframe configuration is provided; if only Part A subframe configuration is provided, the NPRS occasion length is 10 ms,

 is the minimum number of NPRS subframes per cell measurement as specified in Section 9.1.22.11.

, , and ,  are the parameters of the same cell, for which  is the largest among all the measured cells.

Table 4.8.1-1: Number of NPRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of NPRS positioning occasions | |
| f1 Note1 | f1 and f2 Note2 |
| 160 ms | 16\* | 32\* |
| >160 ms | 8\* | 16\* |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

and  conditions apply for all subframes of at least  NPRS positioning occasions,

NPRP 1,2|dBm according to Annex B.2.17 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry NPRS.

The time  starts from the point when the UE has received both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the message and data have been delivered to the physical layer of the UE and the UE has entered the RRC\_IDLE state.

The RSTD measurement accuracy for all measured neighbor cells *i* shall fulfill the requirements specified in sub-clause 9.1.22.11.

#### 4.8.3.1 RSTD Measurement Reporting Delay

The reported measurement contained in the event triggered measurement reports shall meet the requirements in clause 9.1.22.11.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

After receiving both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], the UE shall be sent to RRC IDLE state. The measurement reporting delay is defined as the time between the point when the UE has entered the RRC\_IDLE state, and the point when the UE is ready to transmit the measurement report over the air interface and starts to establish a signalling connection with the MME. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of NPUSCH repetitions configured for the UE, otherwise the uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes the delay caused by not having UL resources for the UE to send the measurement report. This measurement reporting delay excludes any delay caused by RRC connection release before the RRC\_IDLE mode measurement. This measurement reporting delay excludes any delay caused by establishing a signalling connection with the MME (including random access procedure) as defined in TS 36.305 [36] for LPP measurement reporting.

The measurement reporting delay shall be less than  defined in Clause 4.8.3.

### 4.8.4 OTDOA Inter-Frequency RSTD Measurements for UE category NB1 for enhanced coverage

The UE shall support NPRS configuration in more than one resource block [24]. The UE shall follow the procedure for RRC\_IDLE state positioning measurement as defined in TS 36.305 [36] clause 7.1.3.

All positioning subframes indicated in the OTDOA assistance data and specified in sub-clause 9.1.22.13 are available for RSTD measurements in the measured and reference cell.

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data have been provided and the UE has entered the RRC\_IDLE state, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n* = 16 cells, including the reference cell within  ms as given below:

,

where

is the total time for detecting and measuring at least *n* cells;

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] if Part B subframe configuration is provided; otherwise if only Part A subframe configuration is provided, the  equals to the length of the subframe pattern,

 is the number of NPRS positioning occasions as defined in Table 4.8.1-1,

 =  ms is the measurement time for a single NPRS positioning occasion which includes the sampling time and the processing time;

is the cell-specific number of NPRS subframes within a NPRS occasion as defined in TS36.355[24] if Part B subframe configuration is provided; if only Part A subframe configuration is provided, the NPRS occasion length is 10 ms,

 is the minimum number of NPRS subframes per cell measurement as specified in Section 9.1.22.13.

, , and ,  are the parameters of the same cell, for which  is the largest among all the measured cells.

Table 4.8.1-1: Number of NPRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of NPRS positioning occasions | |
| f1 Note1 | f1 and f2 Note2 |
| 160 ms | 16\* | 32\* |
| >160 ms | 8\* | 16\* |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-15 dB for all Frequency Bands for the reference cell,

≥-15 dB for all Frequency Bands for neighbour cell *i*,

and  conditions apply for all subframes of at least  NPRS positioning occasions,

NPRP 1,2|dBm according to Annex B.2.17 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry NPRS.

The time  starts from the point when the UE has received both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the message and data have been delivered to the physical layer of the UE and the UE has entered the RRC\_IDLE state.

The RSTD measurement accuracy for all measured neighbor cells *i* shall fulfill the requirements specified in sub-clause 9.1.22.13.

#### 4.8.4.1 RSTD Measurement Reporting Delay

The reported measurements contained in the event triggered measurement reports shall meet the requirements in clause 9.1.22.13.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

After receiving both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], the UE shall be sent to RRC IDLE state. The measurement reporting delay is defined as the time between the point when the UE has entered the RRC\_IDLE state, and the point when the UE is ready to transmit the measurement report over the air interface and starts to establish a signalling connection with the MME. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of NPUSCH repetitions configured for the UE, otherwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes the delay caused by not having UL resources for the UE to send the measurement report. This measurement reporting delay excludes any delay caused by RRC connection release before the RRC\_IDLE mode measurement. This measurement reporting delay excludes any delay caused by establishing a signalling connection with the MME (including random access procedure) as defined in TS 36.305 [36] for LPP measurement reporting.

The measurement reporting delay shall be less than  defined in Clause 4.8.4.

### 4.8.5 Intra-Frequency E-CID NRSRP and NRSRQ Measurements for UE category NB2 for normal coverage

UE shall follow the procedure for idle state positioning measurement as defined in [36] section 7.1.3.

The UE shall be able to identify a new detectable intra frequency cell within Tidentify\_intra\_NC\_ECID provided that the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID intra-frequency NRSRP and NRSRQ measurements [24] and UE has entered the idle state.

For UE not configured with eDRX\_IDLE cycle, Tidentify\_intra\_NC\_ECID is as shown in Table 4.8.5-1. For UE configured with eDRX\_IDLE cycle, Tidentify\_intra\_NC\_ECID is as shown in Table 4.8.5-2.

Table 4.8.5-1: Requirement to identify a newly detectable intra-frequency cell for E-CID NRSRP/NRSRQ measurement

|  |  |  |
| --- | --- | --- |
| DRX cycle length [s] | Tdetect,NB\_Intra\_NC\_ECID [s] (number of DRX cycles) | Tmeasure\_Intra\_NC\_ECID [s] (number of DRX cycles) |
| 0.32 | 26 (80) | 1.28 (4) |
| 0.64 | 29 (45) | 1.28 (2) |
| 1.28 | 58 (45) | 1.28 (1) |
| 2.56 | 59 (23) | 2.56 (1) |
| 5.12 | 113 (22) | 5.12 (1) |
| 10.24 | 113 (11) | 10.24 (1) |

Table 4.8.5-2: Requirement to identify a newly detectable intra-frequency cell for E-CID NRSRP/NRSRQ measurement for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 2.56s periods) | Tdetect,NB\_Intra\_NC\_ECID [s] (number of DRX cycles) | Tmeasure\_Intra\_NC\_ECID [s] (number of DRX cycles) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | 0.32 | ≥12.8 (5) | (20) | 1.28 (4) |
| 0.64 | ≥12.8 (5) | 1.28 (2) |
| 1.28 | ≥15.36 (6) | 1.28 (1) |
| 2.56 | ≥17.92 (7) | 2.56 (1) |
| 5.12 | ≥23.04 (9) | 5.12 (1) |
| 10.24 | ≥33.28 (13) | 10.24 (1) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section X of TS 24.008 [34]. | | | | |

An intra frequency cell is considered to be detectable when the conditions for NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.1.4 are met for a corresponding Band.

For UE not configured with eDRX\_IDLE cycle, the measurement period for intra frequency measurements is Tmeasure\_intra\_NC\_ECID as shown in Table 4.8.5-1. For UE configured with eDRX\_IDLE cycle, the measurement period for intra frequency measurements is Tmeasure\_intra\_NC\_ECID as shown in Table 4.8.5-2.

The UE shall be capable of performing NRSRP and NRSRQ measurement for [1] identified intra-frequency cell, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_NC\_ECID .

The NRSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.22.1. The NRSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.22.3.

#### 4.8.5.1 Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.22.1 and 9.1.22.3.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled. The measurement reporting delay is defined as the time between the point when UE receive ECID-RequestLocationInformation message and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of NPUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report. This measurement reporting delay excludes any delay caused by RRC connection release before the idle mode measurement. This measurement reporting delay excludes any delay caused by establishing a signalling connection with the MME (including random access procedure) as defined in [36] for LPP measurement reporting.

### 4.8.6 Intra-Frequency E-CID NRSRP and NRSRQ Measurements for UE category NB2 for enhanced coverage

UE shall follow the procedure for idle state positioning measurement as defined in [36] section 7.1.3.

The UE shall be able to identify a new detectable intra frequency cell within Tidentify\_intra\_EC\_ECID provided that the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID intra-frequency NRSRP and NRSRQ measurements [24] and UE has entered the idle state.

For UE not configured with eDRX\_IDLE cycle, Tidentify\_intra\_EC\_ECID is as shown in Table 4.8.6-1. For UE configured with eDRX\_IDLE cycle, Tidentify\_intra\_EC\_ECID is as shown in Table 4.8.6-2.

Table 4.8.6-1: Requirement to identify a newly detectable intra-frequency cell for E-CID NRSRP/NRSRQ measurement

|  |  |  |  |
| --- | --- | --- | --- |
| SCH Ês/Iot of neighboring cell: Q2 | DRX cycle length [s] | Tdetect,NB\_Intra\_ EC\_ECID [s] (number of DRX cycles) | Tmeasure,NB\_Intra\_ EC\_ECID [s] (number of DRX cycles) |
| -15≤ Q2 < -6 | 0.32 | 256 (800) | 1.28 (4) |
| 0.64 | 266 (415) | 1.28 (2) |
| 1.28 | 532 (415) | 1.28 (1) |
| 2.56 | 532 (208) | 2.56 (1) |
| 5.12 | 1063 (208) | 5.12 (1) |
| 10.24 | 1063 (104) | 10.24 (1) |
| Q2≥-6 | 0.32 | 26 (80) | 1.28 (4) |
| 0.64 | 29 (45) | 1.28 (2) |
| 1.28 | 58 (45) | 1.28 (1) |
| 2.56 | 59 (23) | 2.56 (1) |
| 5.12 | 113 (22) | 5.12 (1) |
| 10.24 | 113 (11) | 10.24 (1) |

Table 4.8.6-2: Requirement to identify a newly detectable intra-frequency cell for E-CID NRSRP/NRSRQ measurement for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| SCH Ês/Iot of neighboring cell: Q2 | eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 2.56s periods) | Tdetect,NB\_Intra\_ EC\_ECID [s] (number of DRX cycles) | Tmeasure,NB\_Intra\_ EC\_ECID [s] (number of DRX cycles) |
| -15≤ Q2 < -6 | 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | 0.32 | ≥12.8 (5) | (406) | 1.28 (4) |
| 0.64 | ≥12.8 (5) | 1.28 (2) |
| 1.28 | ≥15.36 (6) | 1.28 (1) |
| 2.56 | ≥17.92 (7) | 2.56 (1) |
| 5.12 | ≥23.04 (9) | 5.12 (1) |
| 10.24 | ≥33.28 (13) | 10.24 (1) |
| Q2≥-6 | 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | 0.32 | ≥12.8 (5) | (20) | 1.28 (4) |
| 0.64 | ≥12.8 (5) | 1.28 (2) |
| 1.28 | ≥15.36 (6) | 1.28 (1) |
| 2.56 | ≥17.92 (7) | 2.56 (1) |
| 5.12 | ≥23.04 (9) | 5.12 (1) |
| 10.24 | ≥33.28 (13) | 10.24 (1) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section X of TS 24.008 [34]. | | | | | |

An intra frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.1.4 for a corresponding Band.

For UE not configured with eDRX\_IDLE cycle, the measurement period for intra frequency measurements is Tmeasure\_intra\_EC\_ECID as shown in Table 4.8.6-1. For UE configured with eDRX\_IDLE cycle, the measurement period for intra frequency measurements is Tmeasure\_intra\_EC\_ECID as shown in Table 4.8.6-2.

The UE shall be capable of performing NRSRP and NRSRQ measurement for at least 1 identified intra-frequency cell, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_EC\_ECID.

The NRSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.22.1. The NRSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.22.3.

#### 4.8.6.1 Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.22.1 and 9.1.22.3.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive ECID-RequestLocationInformation message and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of NPUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report. This measurement reporting delay excludes any delay caused by RRC connection release before the idle mode measurement. This measurement reporting delay excludes any delay caused by establishing a signalling connection with the MME (including random access procedure) as defined in [36] for LPP measurement reporting.

### 4.8.7 Inter-Frequency E-CID NRSRP and NRSRQ Measurements for UE category NB2 for normal coverage

UE shall follow the procedure for idle state positioning measurement as defined in [36] section 7.1.3.

The UE shall be able to identify a new detectable inter frequency cell according to the following expression provided that the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID inter-frequency NRSRP and NRSRQ measurements [24] and UE has entered the idle state:

Tidentify\_inter\_NC\_ECID= Nfreq\_NB\_ECID•Tidentify\_inter\_NC\_perCC\_ECID

Where Nfreq\_NB\_ECID is the total number of inter frequency carriers UE measures provided that the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID inter-frequency NRSRP and NRSRQ measurements [24] and UE has entered the idle state.

For UE not configured with eDRX\_IDLE cycle, Tidentify\_inter\_NC\_perCC\_ECID is as shown in Table 4.8.7-1. For UE configured with eDRX\_IDLE cycle, Tidentify\_inter\_NC\_perCC\_ECID is as shown in Table 4.8.7-2.

Table 4.8.7-1: Requirement to identify a newly detectable inter-frequency cell for E-CID NRSRP/NRSRQ measurement

|  |  |  |
| --- | --- | --- |
| DRX cycle length [s] | Tdetect,NB\_Inter\_NC\_perCC\_ECID [s] (number of DRX cycles) | Tmeasure\_Inter\_NC\_ECID [s] (number of DRX cycles) |
| 0.32 | 26 (80) | 1.28 (4) |
| 0.64 | 29 (45) | 1.28 (2) |
| 1.28 | 58 (45) | 1.28 (1) |
| 2.56 | 59 (23) | 2.56 (1) |
| 5.12 | 113 (22) | 5.12 (1) |
| 10.24 | 113 (11) | 10.24 (1) |

Table 4.8.7-2: Requirement to identify a newly detectable inter-frequency cell for E-CID NRSRP/NRSRQ measurement for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 2.56s periods) | Tdetect,NB\_Inter\_NC\_ECID [s] (number of DRX cycles) | Tmeasure\_Inter\_NC\_ECID [s] (number of DRX cycles) |
| 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | 0.32 | ≥12.8 (5) | (20) | 1.28 (4) |
| 0.64 | ≥12.8 (5) | 1.28 (2) |
| 1.28 | ≥15.36 (6) | 1.28 (1) |
| 2.56 | ≥17.92 (7) | 2.56 (1) |
| 5.12 | ≥23.04 (9) | 5.12 (1) |
| 10.24 | ≥33.28 (13) | 10.24 (1) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section X of TS 24.008 [34]. | | | | |

An inter frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.1.5 for a corresponding Band.

For UE not configured with eDRX\_IDLE cycle,the measurement period for inter frequency measurements is Tmeasure\_inter\_NC\_ECID as shown in Table 4.8.7-1. For UE configured with eDRX\_IDLE cycle,the measurement period for inter frequency measurements is Tmeasure\_inter\_NC\_ECID as shown in Table 4.8.7-2.

The UE shall be capable of performing NRSRP and NRSRQ measurement for at least 1 identified inter-frequency cell per inter-frequency for at least 1 inter-frequency carrier, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_inter\_NC\_ECID.

The NRSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.22.5. The NRSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.22.7.

#### 4.8.7.1 Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.22.5 and 9.1.22.7.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive ECID-RequestLocationInformation message and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of NPUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report. This measurement reporting delay excludes any delay caused by RRC connection release before the idle mode measurement. This measurement reporting delay excludes any delay caused by establishing a signalling connection with the MME (including random access procedure) as defined in [36] for LPP measurement reporting.

### 4.8.8 Inter-Frequency E-CID NRSRP and NRSRQ Measurements for UE category NB2 for enhanced coverage

UE shall follow the procedure for idle state positioning measurement as defined in [36] section 7.1.3.

The UE shall be able to identify a new detectable inter frequency cell according to the following expression provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID inter-frequency NRSRP and NRSRQ measurements [24] and UE has entered the idle state:

Tidentify\_inter\_EC= Nfreq\_NB\_ECID•Tidentify\_inter\_EC\_perCC\_ECID

Where Nfreq\_NB\_ECID is the total number of inter frequency carriers UE measuresprovided that the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID inter-frequency NRSRP and NRSRQ measurements [24] and UE has entered the idle state.Tidentify\_inter\_EC\_perCC\_ECID is shown in Table 4.8.8-1

For UE not configured with eDRX\_IDLE cycle, Tidentify\_inter\_EC\_perCC\_ECID is as shown in Table 4.8.8-1. For UE configured with eDRX\_IDLE cycle, Tidentify\_inter\_EC\_perCC\_ECID is as shown in Table 4.8.8-1.

Table 4.8.8-1: Requirement to identify a newly detectable inter-frequency cell for E-CID NRSRP/NRSRQ measurement

|  |  |  |  |
| --- | --- | --- | --- |
| SCH Ês/Iot of neighboring cell: Q2 | DRX cycle length [s] | Tdetect,NB\_Inter\_ EC\_perCC\_ECID [s] (number of DRX cycles) | Tmeasure,NB\_Inter\_ EC\_ECID [s] (number of DRX cycles) |
| -15≤ Q2 < -6 | 0.32 | 256 (800) | 1.28 (4) |
| 0.64 | 266 (415) | 1.28 (2) |
| 1.28 | 532 (415) | 1.28 (1) |
| 2.56 | 532 (208) | 2.56 (1) |
| 5.12 | 1063 (208) | 5.12 (1) |
| 10.24 | 1063 (104) | 10.24 (1) |
| Q2≥-6 | 0.32 | 26 (80) | 1.28 (4) |
| 0.64 | 29 (45) | 1.28 (2) |
| 1.28 | 58 (45) | 1.28 (1) |
| 2.56 | 59 (23) | 2.56 (1) |
| 5.12 | 113 (22) | 5.12 (1) |
| 10.24 | 113 (11) | 10.24 (1) |

Table 4.8.8-2: Requirement to identify a newly detectable inter-frequency cell for E-CID NRSRP/NRSRQ measurement for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| SCH Ês/Iot of neighboring cell: Q2 | eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 2.56s periods) | Tdetect,NB\_Inter\_ EC\_perCC\_ECID [s] (number of DRX cycles) | Tmeasure,NB\_Inter\_ EC\_ECID [s] (number of DRX cycles) |
| **-15≤ Q2 < -6** | 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | 0.32 | ≥12.8 (5) | (406) | 1.28 (4) |
| 0.64 | ≥12.8 (5) | 1.28 (2) |
| 1.28 | ≥15.36 (6) | 1.28 (1) |
| 2.56 | ≥17.92 (7) | 2.56 (1) |
| 5.12 | ≥23.04 (9) | 5.12 (1) |
| 10.24 | ≥33.28 (13) | 10.24 (1) |
| **Q2≥-6** | 20.48 ≤ eDRX\_IDLE cycle length ≤ 10485.76 | 0.32 | ≥12.8 (5) | (20) | 1.28 (4) |
| 0.64 | ≥12.8 (5) | 1.28 (2) |
| 1.28 | ≥15.36 (6) | 1.28 (1) |
| 2.56 | ≥17.92 (7) | 2.56 (1) |
| 5.12 | ≥23.04 (9) | 5.12 (1) |
| 10.24 | ≥33.28 (13) | 10.24 (1) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section X of TS 24.008 [34]. | | | | | |

An inter frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.1.5 for a corresponding Band.

For UE not configured with eDRX\_IDLE cycle, the measurement period for inter frequency measurements is Tmeasure\_inter\_EC\_ECID as shown in Table 4.8.8-1. For UE configured with eDRX\_IDLE cycle, the measurement period for inter frequency measurements is Tmeasure\_inter\_EC\_ECID as shown in Table 4.8.8-2.

The UE shall be capable of performing NRSRP and NRSRQ measurement for at least 1 identified inter-frequency cell per inter-frequency for at least 1 inter-frequency carrier, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_inter\_EC\_ECID.

The NRSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.22.5. The NRSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.22.7.

#### 4.8.8.1 Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.22.5 and 9.1.22.7.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive ECID-RequestLocationInformation message and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of NPUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report. This measurement reporting delay excludes any delay caused by RRC connection release before the idle mode measurement. This measurement reporting delay excludes any delay caused by establishing a signalling connection with the MME (including random access procedure) as defined in [36] for LPP measurement reporting.

## 4.9 Idle Mode CA Measurement

### 4.9.1 Introduction

A UE supporting *ca-IdleModeMeasurements* shall perform the idle mode measurement on the inter-frequency CA candidate frequencies/cells indicated by higher layers and meet the requirement specified in this section. A UE supporting *nr-IdleInactiveMeasFR1-r16* and/or *nr-IdleInactiveMeasFR2-r16* shall perform the idle mode measurement on the NR inter-RAT EN-DC candidate frequencies/cells indicated by higher layers and meet the requirement specified in this section.

Additionally, a UE supporting *ca-IdleModeMeasurements* or *nr-IdleInactiveMeasFR1-r16*/*nr-IdleInactiveMeasFR2-r16* shall perform the idle mode measurement on serving cell and meet the requirement specified in this section.

A UE only supporting *ca-IdleModeMeasurements* shall fulfil the requirements defined for a UE supporting *ca-IdleModeMeasurements* as defined in this section.

A UE only supporting *nr-IdleInactiveMeasFR1-r16*/*nr-IdleInactiveMeasFR2-r16* shall fulfil the requirements defined for a UE supporting *nr-IdleInactiveMeasFR1-r16*/*nr-IdleInactiveMeasFR2-r16* as defined in this section.

A UE supporting both *ca-IdleModeMeasurements* and *nr-IdleInactiveMeasFR1-r16*/*nr-IdleInactiveMeasFR2-r16* shall fulfil the requirements for a UE supporting *ca-IdleModeMeasurements* and *nr-IdleInactiveMeasFR1-r16*/*nr-IdleInactiveMeasFR2-r16* as defined in this section.

The requirements in clause 4.9 apply provided that the UE is provided with a valid timer T331 by dedicated RRC signaling and T331 is running.

### 4.9.2 Requirement

For a UE which supports *ca-IdleModeMeasurements* the UE shall support the idle mode CA measurements on the serving cell, overlapping and non-overlapping carriers.

For inter-frequency idle mode measurements, an overlapping carrier is defined as a carrier configured by higher layer for early measurement reporting and inter-frequency mobility measurements. A non-overlapping carrier is defined as a carrier configured by higher layer for early measurement reporting while not configured for inter-frequency mobility measurements.

#### 4.9.2.1 Detected cell requirement during state transition and Idle mode

This subclause defines the requirements for the detected cell status for the idle mode CA measurement when UE transitions from RRC Connected mode to Idle mode and after UE has entered Idle mode. The requirements are applicable to an E-UTRAN carrier aggregation or EN-DC capable UE which has been configured with one or more downlink SCells or NR PSCell and one or more downlink NR SCells during the Connected mode and which supports *ca-IdleModeMeasurements* or *nr-IdleInactiveMeasFR1-r16*/*nr-IdleInactiveMeasFR2-r16.* The requirements are applicable for E-UTRAN FDD and TDD SCell(s), and NR PSCell and SCells.

Upon releasing the connection and if the UE has been configured with idle mode CA measurement reporting, following requirements apply concerning the detected cells in Connected mode upon state transitioning to Idle mode and during Idle mode:

- A cell which is detected cell in Connected mode prior to connection release, shall remain detected after UE has entered Idle mode and during Idle mode, provided that the following conditions are met:

- The UE has been provided with a list of cells and/or carrier frequencies for early measurement reporting by dedicated RRC signaling and

- The detected cell is among the list of cells or on a carrier frequency provided for early measurement reporting, and

- The UE is provided with a valid timer T331 by dedicated RRC signaling, and

- For inter-frequency carrier, the detected cell remains detectable until UE reconnects to the network and transmits the early measurement report, or for NR inter-RAT carrier, the detected cell and SSBs of the detected cell remains detectable until UE reconnects to the network and transmits the early measurement report.

- The carrier frequency of the detected cell and the carrier frequency of the serving cell are among the supported band combination of the UE.

An inter-frequency cell is considered detectable according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot defined in Annex B.1.1 and Annex B.1.2 for a corresponding Band. An inter-RAT NR cell is considered detectable according to the conditions in B.1.3 of [50] for a corresponding band. An SSB of an inter-RAT NR cell is considered detectable according to SSB\_RP and SSB Ês/Iot defined in Annex B.1.3 of [50] for a corresponding Band.

In the absence or expiration of T331, it is up to UE implementation to apply the requirements on the detected cell status in this subclause.

#### 4.9.2.2 Measurements of inter-frequency CA candidate cells

While T331 is running, the UE shall perform measurement on the configured overlapping and non-overlapping inter-frequency carriers for idle mode measurement reporting.

A UE which supports *ca-IdleModeMeasurements* shall support the idle mode CA measurements of at least 1 non-overlapping inter-frequency carrier and 1 overlapping inter-frequency carrier.

For overlapping carriers, the inter-frequency measurement requirements in section 4.2.2.4 apply.

For non-overlapping carriers, at least prior to transmission of the idle mode measurement report, the UE shall perform at least a single measurement on detected cells on the non-overlapping inter-frequency carrier(s) configured to be measured for early measurement reporting.

In the absence or expiration of T331, it is up to UE implementation to perform the idle mode CA measurement.

For overlapping carriers, the UE shall be capable of performing RSRP and RSRQ measurements of the overlapping carriers, and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements of the overlapping carriers to higher layers, with measurement accuracy as specified in sub-clauses 9.1.3B.2 and 9.1.6B.2, respectively. The UE shall be able to report idle mode CA measurements when idle mode CA measurement reporting is requested by the network.

#### 4.9.2.3 Measurements on serving cell

The UE shall measure the RSRP and RSRQ level of the serving cell and evaluate the cell selection criterion S defined in section 4.2.2.1 and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements of the serving cell to higher layers, with measurement accuracy as specified in sub-clauses 9.1.2B.2 and 9.1.5B.2, respectively.

4.9.2.4 Measurements of inter-RAT NR DC candidate cells

While T331 is running, the UE shall perform measurement on the configured NR inter-RAT carriers for idle mode measurement reporting.

In addition to the requirements defined in section 4.2.2.9 and 4.2.2.9a, a UE which supports *nr-IdleInactiveMeasFR1-r16 or nr-IdleInactiveMeasFR2-r16* shall be able to support idle mode DC measurements of.

- at least 8 inter-RAT NR carriers which are also configured for inter-RAT mobility measurements, and

- at least 2 inter-RAT NR carrier which are not configured for inter-RAT mobility measurements.

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 8 inter-RAT NR carriers for idle mode DC measurements comprising of carriers configured for inter-RAT mobility measurements and carriers not configured for inter-RAT mobility measurements.

For idle mode DC measurements on NR inter-RAT carriers, if Srxlev ≤ SnonIntraSearchP and Squal ≤ SnonIntraSearchQ, the NR inter-RAT measurement requirements defined in clause 4.2.2.5.6 shall apply, where UE shall search for and measure inter-RAT layers configured for idle mode DC measurements in preparation for possible reporting.If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, the UE shall search for NR inter-RAT layers configured for idle mode DC measurements at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2.2, where UE shall search for and measure NR inter-RAT layers configured for idle mode DC measurements in preparation for possible reporting.

For UE supporting *nr-IdleInactiveBeamMeasFR1-r16* and/or *nr-IdleInactiveBeamMeasFR2-r16*, if the UE is configured with *beamMeasConfigIdle-r16* on one or more carriers for idle mode DC measurement, the UE, on each carrier, shall be able to

- detect a newly detectable inter-RAT NR cell and perform RSRP/RSRQ measurement in preparation for reporting, and

- detect and acquire the SSB index for a newly detectable inter-RAT NR cell if *beamMeasConfigIdle-r16* is configured on this carrier and perform RSRP/RSRQ measurement in preparation for reporting

within the requirements defined in clause 4.2.2.5.6 plus k\*TSSB\_index,NR, where k is the number of carriers configured for idle mode DC measurement with *beamMeasConfigIdle-r16*, and TSSB\_index,NR is the additional time period used to acquire the index of the SSB being measured as defined in Table 4.9.2.4-1.

**Table 4.9.2.4-1: TSSB\_index,NR**

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | | TSSB\_index,NR [s] (number of DRX cycles) |
| FR1 | FR2Note1 |
| 0.32 | 1 | 8 | N2 x 1.28 x 1.5 x N1  (N2 x 4 x 1.5 x N1) |
| 0.64 | 5 | N2 x 1.28 x N1  (N2 x 2 x N1) |
| 1.28 | 4 | N2 x 1.28 x N1  (N2 x 1 x N1) |
| 2.56 | 3 | N2 x 2.56 x N1  (N2 x 1 x N1) |
| NOTE 1: Applies for UE supporting power class 2&3&4. For UE supporting power class 1, N1 = 8 for all DRX cycle length.  NOTE 2: N2 = 3 if the NR inter-RAT carrier for idle mode DC measurement reporting is in FR1, and N2= 5 if the NR inter-RAT carrier for idle mode DC measurement reporting is in FR2. | | | |

For UE supporting *nr-IdleInactiveBeamMeasFR1-r16* and/or *nr-IdleInactiveBeamMeasFR2-r16*, if the UE is configured with *beamMeasConfigIdle-r16* for idle mode DC measurement, the UE shall be capable of performing SS-RSRP, SS-RSRQ for at least

- 7 SSBs with different SSB index and/or PCI on an NR inter- RAT layer in FR1,

- 10 SSBs with different SSB index and/or PCI on an NR inter- RAT layer in FR2.

In the absence or expiration of T331, it is up to UE implementation to perform the idle mode DC measurement.

The UE shall be capable of performing SS-RSRP and SS-RSRQ measurements of the carriers for idle mode DC measurements, and the UE physical layer shall be capable of reporting SS-RSRP and SS-RSRQ measurements of the carriers for idle mode DC measurements to higher layers, with measurement accuracy as specified in sub-clauses 9.11.1A and 9.11.2A, respectively. The UE shall be able to report idle mode DC measurements when idle mode DC measurement reporting is requested by the network.

# 4A E-UTRAN RRC\_INACTIVE state mobility

## 4A.1 Cell Re-selection

*Editor’s note: the E-UTRAN RRC\_INACTIVE state mobility defined in section 4A.1 applies under the scope of LTE connectivity to NGCN.*

### 4A.1.1 Introduction

The E-UTRAN RRC\_INACTIVE state requirements defined in this section applies for the UE when connected to NGCN with the conditions that,

- the UE is not configured with eDRX

- the UE is not configured with *highSpeedEnhancedMeasFlag*

### 4A.1.2 Requirements

#### 4A.1.2.1 UE measurement capability

The capability defined in section 4.2.2.9should apply for this section.

#### 4A.1.2.2 Measurement and evaluation of serving cell

The requirements defined in section 4.2.2.1 should apply.

#### 4A.1.2.3 Measurements of intra-frequency E-UTRAN cells

The requirements defined in section 4.2.2.3 should apply.

#### 4A.1.2.4 Measurements of inter-frequency E-UTRAN cells

The requirements defined in section 4.2.2.4should apply.

#### 4A.1.2.5 Evaluation of cell re-selection criteria

The requirements defined in section 4.2.2.6should apply.

#### 4A.1.2.6 Maximum interruption in paging reception

The requirements defined in section 4.2.2.7should apply.

#### 4A.1.2.7 Measurements of inter-RAT NR cells

The requirements defined in section 4.2.2.5.6 should apply.

#### 4A.1.2.8 UE measurement capability for RedCap

The capability defined in section 4.2.2.14should apply for this section.

#### 4A.1.2.9 Measurements of inter-RAT NR cells for RedCap

The requirements in clause 4.2.2.5.8 shall apply when UE is not configured with eDRX\_IDLE. When UE is configured with eDRX\_IDLE, the requirements defined in section 4.2.2.5.8 shall apply with Tdetect,NR\_RedCap, Tmeasure,NR\_RedCap and Tevaluate,NR\_RedCap defined in Table 4A.1.2.9-1 and Table 4A.1.2.9-2.

Table 4A.1.2.9-1: Tdetect,NR\_RedCap, Tmeasure,NR\_RedCap and Tevaluate,NR\_RedCap for UE configured with eDRX\_IDLE cycle (Frequency range FR1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX or eDRX INACTIVE cycle length [s] | Tdetect,NR\_RedCap [s] (number of DRX or eDRX INACTIVE cycles) | Tmeasure,NR\_RedCap [s] (number of DRX or eDRX INACTIVE cycles) | Tevaluate,NR\_RedCap [s] (number of DRX or eDRX INACTIVE cycles) |
|
| 2.56 ≤eDRX\_IDLE cycle length ≤ 10485.76 | 0.32 | 11.52 x 1.5 (36 x 1.5) | 1.28 x 1.5 (4 x 1.5) | 5.12 x 1.5 (16 x 1.5) |
| 0.64 | 17.92 (28) | 1.28 (2) | 5.12 (8) |
| 1.28 | 32 (25) | 1.28 (1) | 6.4 (5) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |
| 5.12 | 117.76 (23) | 5.12 (1) | 15.36 (3) |
| 10.24 | 235.52(23) | 10.24 (1) | 30.72 (3) |

Table 4A.1.2.9-2: Tdetect,NR\_RedCap, Tmeasure,NR\_RedCap and Tevaluate,NR\_RedCap for UE configured with eDRX\_IDLE cycle (Frequency range FR2)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX or eDRX INACTIVE cycle length [s] | Scaling Factor (N1) | Tdetect,NR\_RedCap [s] (number of DRX or eDRX INACTIVE cycles) | Tmeasure,NR\_RedCap [s] (number of DRX or eDRX INACTIVE cycles) | Tevaluate,NR\_RedCap [s] (number of DRX or eDRX INACTIVE cycles) |
|
| 2.56 ≤eDRX\_IDLE cycle length ≤ 10485.76 | 0.32 | 8 | 11.52 x N1 x 1.5 (36 x N1 x 1.5) | 1.28 x N1 x 1.5 (4 x N1 x 1.5) | 5.12 x N1 x 1.5 (16 x N1 x 1.5) |
| 0.64 | 5 | 17.92x N1 (28 x N1) | 1.28 x N1 (2 x N1) | 5.12 x N1 (8 x N1) |
| 1.28 | 4 | 32 x N1 (25 x N1) | 1.28 x N1 (1 x N1) | 6.4 x N1 (5 x N1) |
| 2.56 | 3 | 58.88 x N1 (23 x N1) | 2.56 x N1 (1 x N1) | 7.68 x N1 (3 x N1) |
| 5.12 | 3 | 117.76 x N1 (23 x N1) | 5.12 x N1 (1 x N1) | 15.36 x N1 (3 x N1) |
| 10.24 | 3 | 235.52 x N1 (23 x N1) | 10.24 x N1 (1 x N1) | 30.72 x N1 (3 x N1) |

## 4A.2 Requirements for UE Category M1

### 4A.2.1 Introduction

The E-UTRAN RRC\_INACTIVE state requirements defined in this section applies for the Category M1 UE when connected to NGCN.

### 4A.2.2 Cell Selection

The requirements defined in section 4.7.1 shall apply.

### 4A.2.3 Cell Reselection

#### 4A.2.3.1 Cell Re-selection requirements for UE category M1 in normal coverage

##### 4A.2.3.1.1 Measurement and evaluation of serving cell for UE category M1 in normal coverage

The requirements defined in section 4.7.2.1.1 shall apply when UE is not configured with eDRX\_IDLE. When UE is configured with eDRX\_IDLE, the requirements defined in section 4.7.2.1.1 shall apply with Nserv\_NC defined in Table 4A.2.3.1.1-1.

Table 4A.2.3.1.1-1: Nserv\_NCfor UE configured with eDRX\_IDLE cycle

|  |  |  |
| --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX\_INACTIVE cycle length [s] | Nserv [number of DRX cycles] |
| 5.12 ≤eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | 4 |
| 0.64 | 4 |
| 1.28 | 2 |
| 2.56 | 2 |
| 5.12 | 2 |
| 10.24 Note 1 | 2 |
| Note 1: DRX\_INACTIVE cycle length of 10.24s applies when eDRX\_IDLE cycle length is >= 10.24s. | | |

##### 4A.2.3.1.2 Measurements of intra-frequency cells for UE category M1 in normal coverage

The requirements defined in section 4.7.2.1.2 shall apply when UE is not configured with eDRX\_IDLE. When UE is configured with eDRX\_IDLE, the requirements defined in section 4.7.2.1.2 shall apply with Tdetect,EUTRAN\_Intra\_NC, Tmeasure,EUTRAN\_Intra\_NC and Tevaluate,E-UTRAN\_Intra\_NC defined in Table 4A.2.3.1.2-1.

Table 4A.2.3.1.2-1: Tdetect,EUTRAN\_Intra\_NC, Tmeasure,EUTRAN\_Intra\_NC and Tevaluate,E-UTRAN\_Intra\_NC for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX\_INACTIVE cycle length [s] | Tdetect,EUTRAN\_Intra\_NC [s] (number of DRX cycles) | Tmeasure,EUTRAN\_Intra\_NC [s] (number of DRX cycles) | Tevaluate,E-UTRAN\_intra\_NC  [s] (number of DRX cycles) | Tevaluate,E-UTRAN\_intra\_NC\_RSS  [s] (number of DRX cycles) |
| 5.12 ≤eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | 11.52 (36) | 1.28 (4) | 5.12 (16) | 3.84 (12) |
| 0.64 | 17.92 (28) | 1.28 (2) | 5.12 (8) | 3.84 (6) |
| 1.28 | 32(25) | 1.28 (1) | 6.4 (5) | 3.84 (3) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) | 3.84 (3) |
| 5.12 | 117.76 (23) | 5.12 (1) | 15.36 (3) | 15.36 (3) |
| 10.24 Note 1 | 235.52 (23) | 10.24 (1) | 30.72 (3) | 30.72 (3) |
| Note 1: DRX\_INACTIVE cycle length of 10.24s applies when eDRX\_IDLE cycle length is >= 10.24s. | | | | | |

##### 4A.2.3.1.3 Measurements of inter-frequency cells for UE category M1 in normal coverage

The requirements defined in section 4.7.2.1.3 shall apply when UE is not configured with eDRX\_IDLE. When UE is configured with eDRX\_IDLE, the requirements defined in section 4.7.2.1.3 shall apply with Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate, E-UTRAN\_inter\_NC defined in Table 4A.2.3.1.3-1.

Table 4A.2.3.1.3-1: Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate, E-UTRAN\_inter\_NC for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX\_INACTIVE cycle length [s] | Tdetect,EUTRAN\_Inter\_NC [s] (number of DRX cycles) | Tmeasure,EUTRAN\_Inter\_NC [s] (number of DRX cycles) | Tevaluate,E-UTRAN\_Inter\_NC  [s] (number of DRX cycles) |
| 5.12 ≤eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | 11.52 (36) | 1.28 (4) | 5.12 (16) |
| 0.64 | 17.92 (28) | 1.28 (2) | 5.12 (8) |
| 1.28 | 32(25) | 1.28 (1) | 6.4 (5) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |
| 5.12 | 117.76 (23) | 5.12 (1) | 15.36 (3) |
| 10.24 Note 1 | 235.52 (23) | 10.24 (1) | 30.72 (3) |
| Note 1: DRX\_INACTIVE cycle length of 10.24s applies when eDRX\_IDLE cycle length is >= 10.24s. | | | | |

##### 4A.2.3.1.4 Maximum allowed layers for multiple monitoring for UE category M1 in normal coverage

The requirements defined in section 4.7.2.1.4 shall apply.

##### 4A.2.3.1.5 Maximum interruption in paging reception for Category M1 UEs in normal coverage

The requirements defined in section 4.7.2.1.5 shall apply.

4A.2.3.2 Cell Re-selection requirements for UE category M1 in enhanced coverage

4A.2.3.2.1 Measurement and evaluation of serving cell for UE category M1 in enhanced coverage

The requirements defined in section 4.7.2.2.1 shall apply when UE is not configured with eDRX\_IDLE. When UE is configured with eDRX\_IDLE, the requirements defined in section 4.7.2.2.1 shall apply with Nserv\_EC is defined in Table 4A.2.3.2.1-1.

Table 4A.2.3.2.1-1: Nserv\_ECfor UE configured with eDRX\_IDLE cycle

|  |  |  |
| --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX\_INACTIVE cycle length [s] | Nserv [number of DRX cycles] |
| 5.12 ≤eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | 8 |
| 0.64 | 8 |
| 1.28 | 4 |
| 2.56 | 4 |
| 5.12 | 4 |
| 10.24 Note 1 | 4 |
| Note 1: DRX\_INACTIVE cycle length of 10.24s applies when eDRX\_IDLE cycle length is >= 10.24s. | | |

4A.2.3.2.2 Measurements of intra-frequency cells for UE category M1 in enhanced coverage

The requirements defined in section 4.7.2.2.2 shall apply when UE is not configured with eDRX\_IDLE. When UE is configured with eDRX\_IDLE, the requirements defined in section 4.7.2.2.2 shall apply with Tdetect,EUTRAN\_Intra\_EC, Tmeasure,EUTRAN\_Intra\_ EC and Tevaluate,E-UTRAN\_Intra\_ EC are defined in Table 4A.2.3.2.2-1.

Table 4A.2.3.2.2-1: Tdetect,EUTRAN\_Intra\_EC, Tmeasure,EUTRAN\_Intra\_EC and Tevaluate,E-UTRAN\_Intra\_EC for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| SCH Ês/Iot of neighboring cell: Q2 [dB] | eDRX\_IDLE cycle length [s] | DRX\_INACTIVE cycle length [s] | Tdetect,EUTRAN\_Intra\_EC [s] (number of DRX cycles) | Tmeasure,EUTRAN\_Intra\_EC [s] (number of DRX cycles) | Tevaluate,E-UTRAN\_intra\_EC  [s] (number of DRX cycles) | Tevaluate,E-UTRAN\_intra\_EC\_RSS  [s] (number of DRX cycles) |
| -15≤ Q2 < -6 | 5.12 ≤eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | 330.24 (1032) | 1.28 (4) | 10.24 (32) | 6.4 (20) |
| 0.64 | 330.24 (516) | 1.28 (2) | 10.24 (16) | 6.4 (10) |
| 1.28 | 524.8 (410) | 1.28 (1) | 12.8 (10) | 6.4 (5) |
| 2.56 | 1039.36 (406) | 2.56 (1) | 15.36 (6) | 12.8 (5) |
| 5.12 | 2078.72 (406) | 5.12 (1) | 30.72 (6) | 25.6 (5) |
| 10.24 Note 1 | 4157.44 (406) | 10.24 (1) | 61.44 (6) | 51.2 (5) |
| Q2≥-6 | 0.32 | 16.64 (52) | 1.28 (4) | 10.24 (32) | 6.4 (20) |
| 0.64 | 23.04 (36) | 1.28 (2) | 10.24 (16) | 6.4 (10) |
| 1.28 | 38.4 (30) | 1.28 (1) | 12.8 (10) | 6.4 (5) |
| 2.56 | 66.56 (26) | 2.56 (1) | 15.36 (6) | 12.8 (5) |
| 5.12 | 337.92 (26) | 5.12 (1) | 30.72 (6) | 25.6 (5) |
| 10.24 Note 1 | 675.84 (26) | 10.24 (1) | 61.44 (6) | 51.2 (5) |
| Note 1: DRX\_INACTIVE cycle length of 10.24s applies when eDRX\_IDLE cycle length is >= 10.24s. | | | | | | |

4A.2.3.2.3 Measurements of inter-frequency cells for UE category M1 in enhanced coverage

The requirements defined in section 4.7.2.2.3 shall apply when UE is not configured with eDRX\_IDLE. When UE is configured with eDRX\_IDLE, the requirements defined in section 4.7.2.2.3 shall apply with Tdetect,EUTRAN\_Inter\_EC, Tmeasure,EUTRAN\_Inter\_ EC and Tevaluate, E-UTRAN\_inter\_ EC defined in Table 4A.2.3.2.3-1.

Table 4A.2.3.2.3-1: Tdetect,EUTRAN\_Inter\_ EC, Tmeasure,EUTRAN\_Inter\_ EC and Tevaluate, E-UTRAN\_inter\_ EC for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| SCH Ês/Iot of neighboring cell: Q2 [dB] | eDRX\_IDLE cycle length [s] | DRX\_INACTIVE cycle length [s] | Tdetect,EUTRAN\_Inter\_EC [s] (number of DRX cycles) | Tmeasure,EUTRAN\_Inter\_EC [s] (number of DRX cycles) | Tevaluate,E-UTRAN\_inter\_EC  [s] (number of DRX cycles) |
| -15≤ Q2 < -6 | 5.12 ≤eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | 330.24 (1032) | 1.28 (4) | 10.24 (32) |
| 0.64 | 330.24 (516) | 1.28 (2) | 10.24 (16) |
| 1.28 | 524.8 (410) | 1.28 (1) | 12.8 (10) |
| 2.56 | 1039.36 (406) | 2.56 (1) | 15.36 (6) |
| 5.12 | 2078.72 (406) | 5.12 (1) | 30.72 (6) |
| 10.24 Note 1 | 4157.44 (406) | 10.24 (1) | 61.44 (6) |
| Q2≥-6 | 0.32 | 16.64 (52) | 1.28 (4) | 10.24 (32) |
| 0.64 | 23.04 (36) | 1.28 (2) | 10.24 (16) |
| 1.28 | 38.4 (30) | 1.28 (1) | 12.8 (10) |
| 2.56 | 66.56 (26) | 2.56 (1) | 15.36 (6) |
| 5.12 | 337.92 (26) | 5.12 (1) | 30.72 (6) |
| 10.24 Note 1 | 675.84 (26) | 10.24 (1) | 61.44 (6) |
| Note 1: DRX\_INACTIVE cycle length of 10.24s applies when eDRX\_IDLE cycle length is >= 10.24s. | | | | | |

4A.2.3.2.4 Maximum allowed layers for multiple monitoring for UE category M1 in enhanced coverage

The requirements defined in section 4.7.2.2.4 shall apply.

4A.2.3.2.5 Maximum interruption in paging reception for Category M1 UEs in enhanced coverage

The requirements defined in section 4.7.2.2.5 shall apply.

### 4A.2.4 Channel quality report for UE Category M1 in idle mode

The requirements defined in section 4.7.3 shall apply.

# 5 E-UTRAN RRC\_CONNECTED state mobility

Note 1: For the performance requirements specified hereafter, the state when no DRX is used is defined as follows:

- DRX and eDRX\_CONN parameters are not configured; or

- DRX or eDRX\_CONN parameters are configured and

○ drx-InactivityTimer is running; or

○ drx-RetransmissionTimer is running; or

○ mac-ContentionResolutionTimer is running; or

○ a Scheduling Request sent on PUCCH/SPUCCH is pending; or

○ an uplink grant for a pending HARQ retransmission can occur and there is data in the corresponding HARQ buffer; or

○ a PDCCH/SPDCCH indicating a new transmission addressed to the C-RNTI of the UE has not been received after successful reception of a Random Access Response for the explicitly signaled preamble (only applicable to UEs in RRC\_CONNECTED).

Otherwise

- It is the state when DRX is used.

Note 2: Unless otherwise stated, the requirements in sections 5.1, 5.1.2.2, 5.1.2.3, 5.1.2.4, 5.3 and 5.4 are also applicable when a UE is configured with Scell(s) or PSCell.

## 5.1 E-UTRAN Handover

### 5.1.1 Introduction

The requirements in this clause are applicable to handover and conditional handover.

### 5.1.2 Requirements

#### 5.1.2.1 E-UTRAN FDD – FDD

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers.

##### 5.1.2.1.1 Handover delay

Procedure delays for all procedures that can command a handover are specified in TS 36.331 [2].

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within Dhandover seconds from the end of the last TTI containing the RRC command when UE is configured with normal or make-before-break handover.

When the UE receives a RRC message implying handover, the UE shall be ready to start the transmission of the new uplink PUSCH channel within Dhandover seconds from the end of the last TTI containing the RRC command when UE is configured with RACH-less or combination of RACH-less and make-before-break handover.

Where:

Dhandover equals the maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2] plus the interruption time stated in clause 5.1.2.1.2.1.

Dhandover equals the maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2] plus the interruption time stated in clause 5.1.2.1.2.2 when UE is configured with RACH-less handover.

Dhandover equals the maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2] plus the interruption time stated in clause 5.1.2.1.2.1 when UE is configured with make-before-break handover.

Dhandover equals the maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2] plus the interruption time stated in clause 5.1.2.1.2.2 when UE is configured with combination of make-before-break and RACH-less handover.

##### 5.1.2.1.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH when UE is configured with normal or make-before-break handover, or the time the UE starts transmission of new PUSCH when UE is configured with RACH-less or combination of make-before-break and RACH-less handover, excluding the RRC procedure delay. This requirement applies when UE is not required to perform any synchronisation procedure before transmitting on the new PRACH or on the new PUSCH.

5.1.2.1.2.1 Interruption time for normal handover

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + 20 ms

Where:

Tsearch is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then Tsearch = 0 ms. If the target cell is unknown and signal quality is sufficient for successful cell detection on the first attempt, then Tsearch = 80 ms. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to 30 ms.

NOTE: The actual value of TIU shall depend upon the PRACH configuration used in the target cell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 8.1.2.2.1 for intra-frequency handover and Clause 8.1.2.3.1 for inter-frequency handover.

5.1.2.1.2.2 Interruption time for RACH-less handover

When intra-frequency or inter-frequency RACH-less handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + 20 ms

Where:

Tsearch is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then Tsearch = 0 ms. If the target cell is unknown and signal quality is sufficient for successful cell detection on the first attempt, then Tsearch = 80 ms. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

TIU is the interruption uncertainty in acquiring the first PUSCH transmission occasion when UE is configured with RACH-less handover in the new cell.

- TIU can be up to 10 ms if UL grant is configured in RRC command.

NOTE: The actual value of TIU shall depend upon the UL grant configuration in RRC command.

- TIU can be up to TUL\_grant if UL grant is not configured in RRC command.

NOTE: TUL\_grant is the time required to acquire and process uplink grant from the target Pcell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 8.1.2.2.1 for intra-frequency handover and Clause 8.1.2.3.1 for inter-frequency handover.

5.1.2.1.2.3 Interruption time for make-before-break handover

When intra-frequency make-before-break handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = 5 ms

NOTE: The same bandwidth of source cell and target cell is assumed.

5.1.2.1.2.4 Interruption time for combination of make-before-break and RACH-less handover

When intra-frequency combination of make-before-break and RACH-less handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = 5 + TUL\_grant ms

Where:

- TUL\_grant = 0 ms if UL grant is provided in RRC command.

- TUL\_grant is the time required to acquire and process uplink grant from the target Pcell if UL grant is not provided in RRC command.

NOTE: The same bandwidth of source cell and target cell is assumed.

#### 5.1.2.2 E-UTRAN FDD – TDD

The requirements in this clause are applicable to handover from FDD to TDD. The requirements in this clause shall apply to UE supporting FDD and TDD.

The requirements in clause 5.1.2.4 apply for this section.

##### 5.1.2.2.1 (Void)

##### 5.1.2.2.2 (Void)

#### 5.1.2.3 E-UTRAN TDD – FDD

The requirements in this clause are applicable to handover from TDD to FDD. The requirements in this clause shall apply to UE supporting FDD and TDD.

The requirements in clause 5.1.2.1 apply for this section.

##### 5.1.2.3.1 (Void)

##### 5.1.2.3.2 (Void)

#### 5.1.2.4 E-UTRAN TDD – TDD

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers.

#### 5.1.2.4.1 Handover delay

Procedure delays for all procedures that can command a handover are specified in TS 36.331 [2].

When the UE receives a RRC message implying handover, the UE shall be ready to start the transmission of the new uplink PRACH channel within Dhandover seconds from the end of the last TTI containing the RRC command when UE is configured with normal or make-before-break handover.

When the UE receives a RRC message implying handover, the UE shall be ready to start the transmission of the new uplink PUSCH channel within Dhandover seconds from the end of the last TTI containing the RRC command when UE is configured with RACH-less or combination of RACH-less and make-before-break handover.

Where:

Dhandover equals the maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2] plus the interruption time stated in clause 5.1.2.4.2.1.

Dhandover equals the maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2] plus the interruption time stated in clause 5.1.2.4.2.2 when UE is configured with RACH-less handover.

Dhandover equals the maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2] plus the interruption time stated in clause 5.1.2.4.2.1 when UE is configured with make-before-break handover.

Dhandover equals the maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2] plus the interruption time stated in clause 5.1.2.4.2.2 when UE is configured with combination of make-before-break and RACH-less handover.

##### 5.1.2.4.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH when UE is configured with normal or make-before-break handover, or the time the UE starts transmission of new PUSCH when UE is configured with RACH-less or combination of make-before-break and RACH-less handover, excluding the RRC procedure delay. This requirement applies when UE is not required to perform any synchronisation procedure before transmitting on the new PRACH or on the new PUSCH.

5.1.2.4.2.1 Interruption time for normal handover

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + 20 ms

Where

Tsearch is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then Tsearch = 0 ms. If the target cell is unknown and signal quality is sufficient for successful cell detection on the first attempt, then Tsearch = 80 ms. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to 30 ms.

NOTE: The actual value of TIU shall depend upon the PRACH configuration used in the target cell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 8.1.2.2.2 for intra-frequency handover and Clause 8.1.2.3.4 for inter-frequency handover.

5.1.2.4.2.2 Interruption time for RACH-less handover

When intra-frequency or inter-frequency RACH-less handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + 20 ms

Where:

Tsearch is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then Tsearch = 0 ms. If the target cell is unknown and signal quality is sufficient for successful cell detection on the first attempt, then Tsearch = 80 ms. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

TIU is the interruption uncertainty in acquiring the first PUSCH transmission occasion when UE is configured with RACH-less handover in the new cell.

- TIU can be up to 10 ms if UL grant is configured in RRC command.

NOTE: The actual value of TIU shall depend upon the UL grant configuration in RRC command.

- TIU can be up to TUL\_grant if UL grant is not configured in RRC command.

NOTE: TUL\_grant is the time required to acquire and process uplink grant from the target Pcell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 8.1.2.2.2 for intra-frequency handover and Clause 8.1.2.3.2 for inter-frequency handover.

5. 2.2.4.2.3 Interruption time for make-before-break handover

When intra-frequency make-before-break handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = 5 ms

NOTE: The same bandwidth of source cell and target cell is assumed.

5. 2.2.4.2.4 Interruption time for combination of make-before-break and RACH-less handover

When intra-frequency combination of make-before-break and RACH-less handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = 5 + TUL\_grant ms

Where:

- TUL\_grant = 0 ms if UL grant is provided in RRC command.

- TUL\_grant is the time required to acquire and process uplink grant from the target Pcell if UL grant is not provided in RRC command.

NOTE: The same bandwidth of source cell and target cell is assumed.

#### 5.1.2.5 E-UTRAN HD–FDD

The requirements in this clause are applicable to intra-frequency handovers.

##### 5.1.2.5.1 Handover delay

Procedure delays for all procedures that can command a handover are specified in TS 36.331 [2].

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within Dhandover seconds from the end of the last TTI containing the RRC command when UE is configured with normal or make-before-break handover.

When the UE receives a RRC message implying handover, the UE shall be ready to start the transmission of the new uplink PUSCH channel within Dhandover seconds from the end of the last TTI containing the RRC command when UE is configured with RACH-less or combination of RACH-less and make-before-break handover.

Where:

Dhandover equals the maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2] plus the interruption time stated in clause 5.1.2.5.2.1.

Dhandover equals the maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2] plus the interruption time stated in clause 5.1.2.5.2.2 when UE is configured with RACH-less handover.

Dhandover equals the maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2] plus the interruption time stated in clause 5.1.2.5.2.1 when UE is configured with make-before-break handover.

Dhandover equals the maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2] plus the interruption time stated in clause 5.1.2.5.2.2 when UE is configured with combination of make-before-break and RACH-less handover.

##### 5.1.2.5.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH when UE is configured with normal or make-before-break handover, or the time the UE starts transmission of new PUSCH when UE is configured with RACH-less or combination of make-before-break and RACH-less handover, excluding the RRC procedure delay. This requirement applies when UE is not required to perform any synchronisation procedure before transmitting on the new PRACH or on the new PUSCH.

5.1.2.5.2.1 Interruption time for normal handover

When intra-frequency handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + 20 ms

Where:

Tsearch is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then Tsearch = 0 ms. If the target cell is unknown and signal quality is sufficient for successful cell detection on the first attempt, then Tsearch = 80 ms. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to 30 ms.

NOTE: The actual value of TIU shall depend upon the PRACH configuration used in the target cell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 8.5.2.1.2 for intra-frequency handover.

5.1.2.5.2.2 Interruption time for RACH-less handover

When intra-frequency RACH-less handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + 20 ms

Where:

Tsearch is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then Tsearch = 0 ms. If the target cell is unknown and signal quality is sufficient for successful cell detection on the first attempt, then Tsearch = 80 ms. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

TIU is the interruption uncertainty in acquiring the first PUSCH transmission occasion when UE is configured with RACH-less handover in the new cell.

- TIU can be up to 10 ms if UL grant is configured in RRC command.

NOTE: The actual value of TIU shall depend upon the UL grant configuration in RRC command.

- TIU can be up to TUL\_grant if UL grant is not configured in RRC command.

NOTE: TUL\_grant is the time required to acquire and process uplink grant from the target Pcell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 8.5.2.1.2 for intra-frequency handover.

5. 2.2.5.2.3 Interruption time for make-before-break handover

When intra-frequency make-before-break handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = 5 ms

NOTE: The same bandwidth of source cell and target cell is assumed.

5. 2.2.5.2.4 Interruption time for combination of make-before-break and RACH-less handover

When intra-frequency combination of make-before-break and RACH-less handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = 5 + TUL\_grant ms

Where:

- TUL\_grant = 0 ms if UL grant is provided in RRC command.

- TUL\_grant is the time required to acquire and process uplink grant from the target Pcell if UL grant is not provided in RRC command.

NOTE: The same bandwidth of source cell and target cell is assumed.

#### 5.1.2.6 E-UTRAN FDD – FDD conditional handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency conditional handovers.

##### 5.1.2.6.1 Handover delay

Procedure delays for all procedures that can command a conditional handover are specified in TS 36.331 [2].

When the UE receives a RRC message implying conditional handover the UE shall be ready to start the transmission of the new uplink PRACH channel within Dhandover seconds from the end of the last TTI containing the RRC command.

Dhandover = TRRC + TEvent\_DU + Tmeasure + TCHO\_execution + Tinterrupt

Where:

TRRC is the maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2].

TEvent\_DU is the delay uncertainty which is the time from when the UE successfully decodes a conditional handover command until a condition exists at the measurement reference point which will trigger the conditional handover.

Tmeasure is the measurements time stated in clause 5.1.2.6.2.

TCHO\_execution is the conditional execution preparation time in clause 5.1.2.6.3.

Tinterrupt is the interruption time stated in clause 5.1.2.6.4.

##### 5.1.2.6.2 Measurement time

The measurement time delay Tmeasure is defined as the time period from the end of TEvent\_DU until the UE begins the preparation time for handover execution .

The measurement event evaluation delay measured without Time To Trigger (TTT) and L3 filtering shall be less than T identify intra defined in clause 8.1.2.2.1 (FDD) and 8.1.2.2.2 (TDD) for intra-frequency conditional handover or T identify inter defined in clause 8.1.2.3.1 (FDD) and 8.1.2.3.2 (TDD) for inter-frequency conditional handover. When TTT or L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission of ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra defined in clause 8.1.2.2.1. (FDD) and 8.1.2.2.2 (TDD) or T identify inter defined in clause 8.1.2.3.1 (FDD) and 8.1.2.3.2 (TDD) becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers a handover, the measurement time delay shall be less than TMeasurement\_Period, Intra or TMeasurement\_Period, Inter provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 5.1.2.6.3 Preparation time

Preparation time is the time when the UE prepares the target cell for conditional handover. It begins after measurement time.

TCHO\_execution is the time needed for preparing the conditional handover to the target cell.

TCHO\_execution can be up to 10 ms.

##### 5.1.2.6.4 Interruption time

The interruption time is the time between when the UE completes the preparation time TCHO\_execution and the time when the UE starts the transmission of the PRACH to the target cell.

For intra-frequency or inter-frequency conditional handover, the interruption time shall be less than

Tinterrupt = TIU + 20 ms

Where:

TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to 30 ms.

NOTE: The actual value of TIU shall depend upon the PRACH configuration used in the target cell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 8.1.2.2.1 (FDD) and 8.1.2.2.2 (TDD) (FDD) and 8.1.2.2.2 (TDD) for intra-frequency conditional handover and Clause 8.1.2.3.1 (FDD) and 8.1.2.3.2 (TDD) for inter-frequency conditional handover.

#### 5.1.2.7 E-UTRAN FDD – TDD conditional handover

The requirements in this clause are applicable to conditional handover from FDD to TDD. The requirements in this clause shall apply to UE supporting FDD and TDD.

The requirements in clause 5.1.2.6 apply for this section.

#### 5.1.2.8 E-UTRAN TDD – FDD conditional handover

The requirements in this clause are applicable to conditional handover from TDD to FDD. The requirements in this clause shall apply to UE supporting FDD and TDD.

The requirements in clause 5.1.2.6 apply for this section.

#### 5.1.2.9 E-UTRAN TDD – TDD conditional handover

The requirements in this clause are applicable to handover from TDD to TDD. The requirements in this clause shall apply to UE supporting TDD.

The requirements in clause 5.1.2.6 apply for this section.

## 5.2 Void

## 5.3 Handover to other RATs

### 5.3.1 E-UTRAN - UTRAN FDD Handover

#### 5.3.1.1 Introduction

The purpose of inter-RAT handover from E-UTRAN to UTRAN FDD is to change the radio access mode from E-UTRAN to UTRAN FDD. The handover procedure is initiated from E-UTRAN with a RRC message that implies a hard handover as described in TS 36.331 [2].

##### 5.3.1.1.1 Handover delay

When the UE receives a RRC message implying handover to UTRAN the UE shall be ready to start the transmission of the new UTRA uplink DPCCH within Dhandover seconds from the end of the last E-UTRAN TTI containing the RRC MOBILITY FROM E-UTRA command.

where:

- Dhandover equals the RRC procedure delay, which is 50 ms plus the interruption time stated in clause 5.3.1.1.2.

##### 5.3.1.1.2 Interruption time

The interruption time is the time between the end of the last TTI containing the RRC command on the E-UTRAN PDSCH and the time the UE starts transmission on the uplink DPCCH in UTRAN FDD, excluding the RRC procedure delay. The interruption time depends on whether the target cell is known to the UE or not.

The target cell is known if it has been measured by the UE during the last 5 seconds otherwise it is unknown. The UE shall always perform a UTRA synchronisation procedure as part of the handover procedure.

If the target cell is known the interruption time shall be less than Tinterrupt1

Tinterrupt1 = TIU+Tsync+50+ 10\*Fmax + TMC ms

If the target cell is unknown the interruption time shall be less than Tinterrupt2

Tinterrupt2 = TIU+Tsync+150 + 10\*Fmax + TMC ms

This requirement shall be met, provided that there is one target cell in the MOBILITY FROM E-UTRA command. Performance requirements for E-UTRA to UTRA soft handover are not specified. When UE is connected to an E-UTRA cell, UTRA SFN timing measurements are not reported. This implies that the timing of the DPCH of the UTRA target cells in the active set cannot be configured by UTRAN to guarantee that all target cells fall within the UE reception window of T0 +/- 148 chips.

Where:

TIU is the interruption uncertainty when changing the timing from the E-UTRAN to the new UTRAN cell. TIU can be up to one UTRA frame (10 ms).

Fmax denotes the maximum number of radio frames within the transmission time intervals of all transport channels that are multiplexed into the same CCTrCH on the UTRA target cell. If HS-PDSCH is configured in the UTRA target cell, Fmax is 4 radio frames.

Tsync is the time required for measuring the downlink DPCCH channel as stated in TS 25.214 [20], clause 4.3.1.2. In case higher layers indicate the usage of a post-verification period Tsync=0 ms. Otherwise Tsync=40 ms.

TMC TMC is 0ms if a single UTRA cell is configured as the handover target, otherwise 20ms if handover to UTRA with 1, 2 or 3 UTRA carriers with secondary HS-PDSCH is configured.

The phase reference is the primary CPICH.

The requirements in this clause assume that N312 has the smallest possible value i.e. only one insync is required.

### 5.3.2 E-UTRAN - UTRAN TDD Handover

#### 5.3.2.1 Introduction

The purpose of inter-RAT handover from E-UTRAN to UTRAN TDD is to change the radio access mode from E-UTRAN to UTRAN TDD. The handover procedure is initiated from E-UTRAN with a RRC message that implies a hard handover as described in TS 36.331 [2].

#### 5.3.2.2 Requirements

The requirements in this clause shall apply to UE supporting E-UTRAN and UTRAN TDD.

##### 5.3.2.2.1 Handover delay

When the UE receives a RRC message implying E-UTRAN/UTRAN TDD handover the UE shall be ready to start the transmission of the SYNC-UL within Dhandover seconds from the end of the last TTI containing the RRC MOBILITY FROM E-UTRA command.

Where:

- Dhandover equals the RRC procedure delay, which is 50 ms plus the interruption time stated in clause 5.3.2.2.2.

##### 5.3.2.2.2 Interruption time

The interruption time is the time between the end of the last TTI containing the RRC command on the E-UTRAN PDSCH and the time the UE starts transmission on the SYNC-UL in UTRAN TDD, excluding the RRC procedure delay. The interruption time depends on whether the target cell is known to the UE or not.

The UE shall always perform a UTRA synchronisation procedure as part of the handover procedure.

If the target cell has been measured by the UE during the last 5 seconds, the interruption time shall be less than Tinterrupt1

Tinterrupt1= Toffset+TUL+30\*FSFN+20 ms

If the target cell has not been measured by the UE during the last 5 seconds, the interruption time shall be less than Tinterrupt2

Tinterrupt2= Toffset+TUL+30\*FSFN+180 ms

Where:

Toffset Equal to 10 ms, the frame timing uncertainty between the old cell and the target cell and the time that can elapse until the appearance of a Beacon channel

TUL Equal to 10 ms, the time that can elapse until the appearance of the UL timeslot in the target cell

FSFN Equal to 1 if SFN decoding is required and equal to 0 otherwise

The interruption time requirements for an unknown target cell shall apply only if the signal quality of the unknown target cell is sufficient for successful synchronisation with one attempt.

### 5.3.3 E-UTRAN - GSM Handover

#### 5.3.3.1 Introduction

The purpose of inter-RAT handover from E-UTRAN to GSM is to transfer a connection between the UE and E-UTRAN to GSM. The handover procedure is initiated from E-UTRAN with a RRC message (MOBILITY FROM E-UTRA). The procedure is described in in TS 36.331 [2].

#### 5.3.3.2 Requirements

The requirements in this clause shall apply to UE supporting E-UTRAN and GSM.

The requirements given below in Tables 5.3.3.2.1-1 and 5.3.3.2.2-1 for the case where the UE has not synchronised to the GSM cell before receiving the RRC MOBILITY FROM E-UTRA command are valid when the signal quality of the GSM cell is sufficient for successful synchronisation with one attempt. If the UE is unable to synchronise to the GSM cell on the first attempt, it shall continue to search for synchronisation information for up to 800 ms duration. If after 800 ms the UE has not synchronised to the GSM cell it shall follow the handover failure procedure specified in TS 36.331 [2].

##### 5.3.3.2.1 Handover delay

When the UE receives a RRC MOBILITY FROM E-UTRA command the UE shall be ready to transmit (as specified in [10]) on the channel of the new RAT within the value in table 5.3.3.2.1-1 from the end of the last TTI containing the RRC command. The UE shall process the RRC procedures for the MOBILITY FROM E-UTRA command within 50 ms, which is noted as RRC procedure delay.

Table 5.3.3.2.1-1: E-UTRAN/GSM handover - handover delay

|  |  |
| --- | --- |
| UE synchronisation status | handover delay [ms] |
| The UE has synchronised to the GSM cell before the RRC MOBILITY FROM E-UTRA COMMAND is received | 90 |
| The UE has not synchronised to the GSM cell before the RRC MOBILITY FROM E-UTRA COMMAND is received | 190 |

##### 5.3.3.2.2 Interruption time

The interruption time is the time between the end of the last TTI containing the RRC command on the E-UTRAN PDSCH and the time the UE starts transmission on the uplink channel in GSM, excluding the RRC procedure delay. The interruption time depends on whether the UE has synchronized to the target GSM cell or not and shall be less than the value specified in table 5.3.3.2.2-1.

Table 5.3.3.2.2-1: E-UTRAN/GSM handover - interruption time

|  |  |
| --- | --- |
| Synchronisation status | Interruption time [ms] |
| The UE has synchronised to the GSM cell before the RRC MOBILITY FROM E-UTRA COMMAND is received | 40 |
| The UE has not synchronised to the GSM cell before the RRC MOBILITY FROM E-UTRA COMMAND is received | 140 |

### 5.3.4 E-UTRAN - NR FR1 Handover

#### 5.3.4.1 Introduction

The purpose of inter-RAT handover from E-UTRAN to NR in FR1 is to transfer a connection between the UE and E-UTRAN to NR in FR1. The handover procedure is initiated from E-UTRAN with a RRC message (MOBILITY FROM E-UTRA). The procedure is described in in TS 36.331 [2].

#### 5.3.4.2 Handover delay

When the UE receives a RRC message implying inter-RAT handover to the UE shall be ready to start the transmission of the uplink PRACH channel in NR within Dhandover seconds from the end of the last TTI containing the RRC command. Dhandover is defined as

Dhandover = TRRC\_procedure\_delay + Tinterruption

Where:

TRRC\_procedure\_delay: it is the RRC procedure delay which is 50 ms.

Tinterruption: it is the time between end of the last TTI containing the RRC command on the PDSCH in E-UTRAN and the time the UE starts transmission of the PRACH in NR, excluding TRRC\_procedure\_delay. Tinterruption is defined in clause 5.3.4.3.

#### 5.3.4.3 Interruption time

When inter-RAT handover to NR is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + Trs + Tprocessing + Tmargin ms

Where:

Tsearch is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then Tsearch = 0 ms. If the target cell is an unknown cell and target cell Es/Iot ≥ -2 dB, then Tsearch = 3▪Trs ms. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

Tprocessing is time for UE processing. Tprocessing can be up to 20 ms.

Tmargin is time for SSB post-processing. Tmargin can be up to 2 ms.

TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [39].

NOTE: The actual value of TIU shall depend upon the PRACH configuration used in the target cell.

Trs is the SMTC period of the taget NR cell if the UE has been provided with an SMTC configuration for the target cell prior to, or in the handover command, otherwise Trs is the target cell SSB transmission period, if such is provided. If the UE is not provided with an SMTC configuration or SSB transmission period, the requirement in this section is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms. If UE is provided with both SMTC configuration and SSB transmission period the requirement shall be based on SMTC periodicity.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in clause 8.1.2.4.21 and 8.1.2.4.22.

### 5.3.4A E-UTRAN - NR FR1 Handover to target cell using CCA

#### 5.3.4A.1 Introduction

The purpose of inter-RAT handover from E-UTRAN to NR in FR1 in carrier frequencies with CCA is to transfer a connection between the UE and E-UTRAN to NR in FR1 carrier frequencies with CCA. The handover procedure is initiated from E-UTRAN with an RRC message (MOBILITY FROM E-UTRA). The procedure is described in TS 36.331 [2].

In the requirements of clause 5.3.4A, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding detection or time tracking period; otherwise the SMTC occasion is considered as available at the UE.

In the requirements of clause 5.3.4A, the term PRACH occasion unavailable for transmission refers to when the PRACH occasion is configured by gNB at the UE but not transmitted by the UE during the corresponding period due to UL CCA failures at the UE; otherwise the PRACH occasion is considered as available for transmission.

#### 5.3.4A.2 Handover delay

When the UE receives an RRC message implying inter-RAT handover to the UE shall be ready to start the transmission of the uplink PRACH channel in NR within Dhandover seconds from the end of the last TTI containing the RRC command. Dhandover is defined as

Dhandover = TRRC\_procedure\_delay + Tinterruption

Where:

TRRC\_procedure\_delay: it is the RRC procedure delay which is [50] ms.

Tinterruption: it is the time between end of the last TTI containing the RRC command on the PDSCH in E-UTRAN and the time the UE starts transmission of the PRACH in NR, excluding TRRC\_procedure\_delay. Tinterrupt is defined in clause 5.3.4A.3.

#### 5.3.4A.3 Interruption time

When inter-RAT handover to NR is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + Trs + Tprocessing + Tmargin ms

Where:

Tsearch is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then Tsearch = 0 ms. If the target cell is an unknown cell and target cell Es/Iot ≥ [-2] dB, then Tsearch = (3+L1´) \*Trs ms. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

L1´ is the number of SMTC occasions not available at the UE during the inter-RAT detection period. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

Tprocessing is time for UE processing. Tprocessing can be up to 20 ms.

Tmargin is time for SSB post-processing. Tmargin can be up to 2 ms.

TIU is the interruption uncertainty due to the random access procedure when sending PRACH to the new cell. TIU can be up to: (1+ L3)\*TSSB,RO + 10 ms; where TSSB,RO is the SSB to PRACH occasion association period as defined in Table 8.1-1 of TS 38.213 [39] and L3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failures. L3 = 0 for Type 2C UL channel access procedure as defined in TS 37.213 [57].When the UE is configured with both the UL BWP with PRACH occasion on the target cell and UL LBT failure detection/recovery, the interruption can be longer.

NOTE 1: The actual value of TIU shall depend upon the PRACH configuration used in the target cell.

NOTE 2: The interruption time extended by L1´and L3 parameters, and by the UL LBT failure detection/recovery mechanism is limited by the T304 timer. The UE behaviour at the T304 timer expiry is specified in TS 38.331 [38].

Trs is the SMTC period of the taget NR cell if the UE has been provided with an SMTC configuration for the target cell prior to, or in the handover command, otherwise Trs is the target cell SSB transmission period, if such is provided. If the UE is not provided with an SMTC configuration or SSB transmission period, the requirement in this section is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms. If UE is provided with both SMTC configuration and SSB transmission period the requirement shall be based on SMTC periodicity.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in clause 8.1.2.4.21A, and 8.1.2.4.22A.

### 5.3.4B E-UTRAN - NR FR1 Handover for RedCap

#### 5.3.4B.1 Introduction

The purpose of inter-RAT handover from E-UTRAN to NR in FR1 is to transfer a connection between the RedCap UE and E-UTRAN to NR in FR1. The handover procedure is initiated from E-UTRAN with a RRC message (MOBILITY FROM E-UTRA). The procedure is described in in TS 36.331 [2].

#### 5.3.4B.2 Requirements

The requirements in clause 6.1C.1.2 in [50] shall apply.

### 5.3.5 E-UTRAN - NR FR2 Handover

#### 5.3.5.1 Introduction

The purpose of inter-RAT handover from E-UTRAN to NR in FR2 is to transfer a connection between the UE and E-UTRAN to NR in FR2. The handover procedure is initiated from E-UTRAN with a RRC message (MOBILITY FROM E-UTRA). The procedure is described in in TS 36.331 [2].

#### 5.3.5.2 Handover delay

When the UE receives a RRC message implying inter-RAT handover to the UE shall be ready to start the transmission of the uplink PRACH channel in NR within Dhandover seconds from the end of the last TTI containing the RRC command. Dhandover is defined as

Dhandover = TRRC\_procedure\_delay + Tinterruption

Where:

TRRC\_procedure\_delay: it is the RRC procedure delay which is 50 ms.

Tinterruption: it is the time between end of the last TTI containing the RRC command on the PDSCH in E-UTRAN and the time the UE starts transmission of the PRACH in NR, excluding TRRC\_procedure\_delay. Tinterruption is defined in clause 5.3.5.3.

#### 5.3.5.3 Interruption time

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + Trs + Tprocessing + Tmargin ms

Where:

Tsearch is the time required to search the target cell when the handover command is received by the UE. If the target cell is a known cell, then Tsearch = 0 ms. If the target cell is unknown and the target cell Es/Iot ≥ -2 dB, then Tsearch = 24 ▪Trs periodicity. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

Tprocessing is time for UE processing. Tprocessing can be up to 40 ms.

Tmargin is time for SSB post-processing. Tmargin can be up to 2 ms.

TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [39].

NOTE: The actual value of TIU shall depend upon the PRACH configuration used in the target cell.

Trs is the SMTC period of the taget NR cell if the UE has been provided with an SMTC configuration for the target cell prior to, or in the handover command, otherwise Trs is the taget cell SSB transmission period, if such is provided. If the UE is not provided with an SMTC configuration or SSB transmission period, the requirement in this section is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms. If UE is provided with both SMTC configuration and SSB transmission period the requirement shall be based on SMTC periodicity.

Relevant cell identification requirements are described in clause 8.1.2.4.20, 8.1.2.4.22, 8.1.2.4.22 and 8.1.2.4.20.

In FR2, the target cell is known if it has been meeting the following conditions:

During the last 5 seconds before the reception of the handover command:

- the UE has sent a valid measurement report for the target cell and

- One of the SSBs measured from the NR target cell being configured remains detectable according to the cell identification conditions specified in clause 9.3 of TS 38.133 [29],

- One of the SSBs measured from the target cell also remains detectable during the handover delay according to the cell identification conditions specified in clause 9.3 of TS 38.133 [29].

otherwise it is unknown.

## 5.4 Handover to Non-3GPP RATs

### 5.4.1 E-UTRAN – HRPD Handover

##### 5.4.1.1 Introduction

The handover procedure from E-UTRAN to HRPD is initiated when E-UTRAN sends handover command to the UE through dedicated RRC signalling.

##### 5.4.1.1.1 Handover delay

The handover delay (Dhandover) is defined as the sum of the RRC procedure delay, which is 50 ms and the interruption time specified in clause 5.4.1.1.2.

When the UE receives a RRC message implying handover to HRPD, the UE shall be ready to start the transmission of the new reverse control channel in HRPD within Dhandover from the end of the last E-UTRAN TTI containing the RRC command.

##### 5.4.1.1.2 Interruption time

The interruption time is the time between the end of the last TTI containing the RRC command on the E-UTRAN PDSCH and the time the UE starts transmission of the reverse control channel in HRPD, excluding the RRC procedure delay. The interruption time depends on whether the target cell is known to the UE or not.

An HRPD cell is known if it has been measured by the UE during the last 5 seconds otherwise it is unknown. Under the reference conditions specified in sub-clause 6.6 of [13], the interruption time shall be less than Tinterrupt

Tinterrupt = TIU + 40 + 10\*KC\*SWK + 10\*OC\*SWO ms

Where:

TIU It is the interruption uncertainty when changing the timing from the E-UTRAN to the new HRPD cell. TIU can be up to one HRPD frame (26.66 ms).

SWK is SWK = where srch\_win\_k is the number of HRPD chips indicated by the search window for known target HRPD cells in the message

SWO is SWO = where srch\_win\_o is the number of HRPD chips indicated by the search window for unknown target HRPD cells in the message

KC It is the number of known target HRPD cells in the message, and

OC It is the number of unknown target HRPD cells in the message.

Note: An additional delay in the interruption time may occur due to the reverse link silence interval [11], which is specific to HRPD.

### 5.4.2 E-UTRAN – cdma2000 1X Handover

##### 5.4.2.1 Introduction

The handover procedure from E-UTRAN to cdma2000 1X is initiated when E-UTRAN sends handover command to the UE through dedicated RRC signalling.

##### 5.4.2.1.1 Handover delay

The handover delay (Dhandover) is defined as the sum of the RRC procedure delay, which is 130 ms and the interruption time specified in clause 5.4.2.1.2.

When the UE receives a RRC message implying handover to cdma2000 1X, the UE shall be ready to start the transmission of the new reverse control channel in cdma2000 1X within Dhandover from the end of the last E-UTRAN TTI containing the RRC command.

##### 5.4.2.1.2 Interruption time

The interruption time is the time between the end of the last TTI containing the RRC command on the E-UTRAN PDSCH and the time the UE starts transmission of the reverse control channel in cdma2000 1X, excluding the RRC procedure delay. The interruption time depends on whether the target cell is known to the UE or not.

A cdma2000 1X cell is known if it has been measured by the UE during the last 5 seconds otherwise it is unknown. Under the reference conditions specified in sub-clause 4.2.1 of [14], the interruption time shall be less than Tinterrupt:

Tinterrupt = TIU + 140 + 10\*KC\*SWK + 10\*OC\*SWO ms

Where:

TIU It is the interruption uncertainty when changing the timing from the E-UTRAN to the new cdma2000 1X cell. TIU can be up to one cdma2000 1X frame (20 ms).

SWK is SWK = where srch\_win\_k is the number of cdma2000 1x chips indicated by the search window for known target cdma2000 1x cells in the message

SWO is SWO = where srch\_win\_o is the number of cdma2000 1x chips indicated by the search window for unknown target cdma2000 1x cells in the message

KC It is the number of known target cdma2000 1X cells in the message, and

OC It is the number of unknown target cdma2000 1X cells in the message.

## 5.5 E-UTRAN Handover for Cat-M1 UEs

### 5.5.1 Introduction

This section defines the E-UTRAN intra-frequency handover requirements and inter-frequency handover requirements for Cat-M1 UEs in CEModeA as required by TS 36.300 [25].

### 5.5.2 Requirements in CEModeA

#### 5.5.2.1 E-UTRAN FDD – FDD for Cat-M1 FDD UEs

The requirements in this clause are applicable to FDD intra-frequency handovers and FDD inter-frequency handovers for a Cat-M1 FDD UE in CEModeA.

##### 5.5.2.1.1 Handover delay

Procedure delays for all procedures that can command a handover are specified in TS 36.331 [2].

When the UE receives a RRC message implying handover the UE shall finish the transmission of all repetitions of the new uplink PRACH channel within Dhandover seconds from the end of the last TTI containing the RRC command,

Where:

Dhandover equals the maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2] plus the interruption time stated in clause 5.5.2.1.2.

##### 5.5.2.1.2 Interruption time

The interruption time is the time between the end of the last TTI containing the RRC command on the old PDSCH and the moment the UE has transmitted all repetitions of PRACH in the target cell, excluding the RRC procedure delay. This requirement applies when UE is not required to perform any synchronisation procedure before transmitting on the new PRACH.

When intra-frequency handover or inter-frequency handover is commanded and the field *sameSFN-Indication* and *mib-RepetitionStatus* [2] are included in the handover command then the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + 20 ms

When intra-frequency handover or inter-frequency handover is commanded and the field *sameSFN-Indication* or *mib-RepetitionStatus* [2] is not included in the handover command then UE the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TMIB + TIU + 20 ms

Where:

- Tsearch is the time required to search the target cell when the handover command is received by the UE. If the target cell is known, then Tsearch = 0 ms. If the target cell is unknown and signal quality is sufficient for successful cell detection on the first attempt, then Tsearch = 80 ms. Otherwise, Tsearch shall be according to the non-DRX cell identification requirements specified in Clause 8.13.2.1 for intra-frequency handover for a UE configured with CEModeA or Tsearch shall be according to the non-DRX cell identification requirements specified in Clause 8.13.2.6 for inter-frequency handover for a UE configured with CEModeA. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

- TMIB is the time required for acquiring the MIB information of the target cell.

- TIU is the time required to complete the transmission of PRACH in the target cell. The actual value of TIU shall depend upon the uncertainity in acquiring the first available PRACH occasion based on the PRACH configuration used in the target cell and the PRACH coverage enhancement level used by the UE for sending the random access preamble to the target cell.

- In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement for a time duration equal or longer than the time duration required for the cell identification. Otherwise, it is unknown. For intra-frequency handover the time duration required for the cell identification is specified in relevant intra-frequency cell identification requirements as described in Clause 8.13.2.1 for CEModeA. For inter-frequency handover the time duration required for the cell identification is specified in relevant inter-frequency cell identification requirements as described in Clause 8.13.2.6 for CEModeA.

#### 5.5.2.2 E-UTRAN FDD – FDD for Cat-M1 HD – FDD UEs

The requirements defined in clause 5.5.2.1 are applicable to FDD intra-frequency handovers and FDD inter-frequency handovers for a Cat-M1 HD-FDD UE in CEModeA.

#### 5.5.2.3 E-UTRAN TDD – TDD for Cat-M1 TDD UEs

The requirements defined in clause 5.5.2.1 are applicable to TDD intra-frequency handovers and TDD inter-frequency handovers for a Cat-M1 TDD UE in CEModeA.

##### 5.5.2.3.1 Void

##### 5.5.2.3.2 Void

### 5.5.3 Requirements in CEModeB

#### 5.5.3.1 E-UTRAN FDD – FDD for Cat-M1 FDD UEs

The requirements in this clause are applicable to FDD intra-frequency handovers and FDD inter-frequency handover for a Cat-M1 FDD UE configured with CEModeB.

##### 5.5.3.1.1 Handover delay

Procedure delays for all procedures that can command a handover are specified in TS 36.331 [2].

When the UE receives a RRC message implying handover the UE shall finish the transmission of all repetitions of the new uplink PRACH channel within Dhandover seconds from the end of the last TTI containing the RRC command,

Where:

Dhandover equals the maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2] plus the interruption time stated in clause 5.5.3.1.2.

##### 5.5.3.1.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay. This requirement applies when UE is not required to perform any synchronisation procedure before transmitting on the new PRACH.

When intra-frequency handover or inter-frequency handover is commanded and the field *sameSFN-Indication* and *mib-RepetitionStatus* [2] are included in the handover command then the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + 20 ms

When intra-frequency handover or inter-frequency handover is commanded and the field *sameSFN-Indication* or *mib-RepetitionStatus* [2] is not included in the handover command then the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TMIB + TIU + 20 ms

Where:

- Tsearch is the time required to search the target cell when the handover command is received by the UE. If the target cell is known, then Tsearch = 0 ms. If the target cell is unknown and signal quality is sufficient for successful cell detection on the first attempt, then Tsearch = 80 ms. Otherwise, Tsearch shall be according to the non-DRX cell identification requirements specified in Clause 8.13.3.1 for intra-frequency handover for a UE configured with CEModeB or Tsearch shall be according to the non-DRX cell identification requirements specified in Clause 8.13.3.5 for inter-frequency handover for a UE configured with CEModeB. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

- TMIB is the time required for acquiring the MIB information of the target cell.

- TIU is the time required to complete the transmission of PRACH in the target cell. The actual value of TIU shall depend upon the uncertainity in acquiring the first available PRACH occasion based on the PRACH configuration used in the target cell and the PRACH coverage enhancement level used by the UE for sending the random access preamble to the target cell.

- In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement for a time duration equal or longer than the time duration required for the cell identification. Otherwise, it is unknown. For intra-frequency handover the time duration required for the cell identification is specified in relevant intra-frequency cell identification requirements as described in Clause 8.13.3.1 for CEModeB. For inter-frequency handover the time duration required for the cell identification is specified in relevant inter-frequency cell identification requirements as described in Clause 8.13.3.5 for CEModeB.

#### 5.5.3.2 E-UTRAN FDD – FDD for Cat-M1 HD – FDD UEs

The requirements defined in clause 5.5.3.1 are applicable to FDD intra-frequency handovers and FDD inter-frequency handovers for a Cat-M1 HD-FDD UE configured with CEModeB.

#### 5.5.3.3 E-UTRAN TDD – TDD for Cat-M1 TDD UEs

The requirements defined in clause 5.5.3.1 are applicable to TDD intra-frequency handovers and TDD inter-frequency handovers for a Cat-M1 TDD UE configured with CEModeB.

## 5.6 Void

## 5.7 E-UTRAN DAPS Handover

### 5.7.1 Introduction

The purpose of DAPS handover is to change the PCell to another cell.

A DAPS handover is synchronous if it meets the conditions in Table 5.7.1-1, otherwise it is asynchronous.

**Table 5.7.1-1: Synchronous conditions for DAPS handover**

|  |  |  |
| --- | --- | --- |
| Type of handover | Maximum receive timing difference between source and target cells (µs) for sync DAPS handover | Maximum transmit timing difference between source and target cells (µs) for sync DAPS handover |
| Intra-frequencyNote 1,2,3 | 6µs | 8.21 µs |
| Intra-band inter-frequency Note 1,2,3 | 6µs | 8.21 µs |
| Inter-band inter-frequency | 33 µs | 35.21 µs |
| Note 1: For synchronous DAPS handover, if the receive time difference exceeds the cyclic prefix length, demodulation performance degradation is expected for the first symbol of the slot. For asynchronous DAPS handover, if the receive time difference exceeds the cyclic prefix length, interruptions may occur depending on UE implementation. The duration and frequency of occurrence of such interruptions is not specified.  Note 2: For DAPS handover on a TDD band, after starting RACH procedure, a UE is not required to transmit in the uplink to any of source and target cells earlier than 20usafter the end of the last received downlink symbol from any of source and target cells in the same TDD band.  Note 3: For DAPS handover on a TDD band, after starting RACH procedure, a UE is not required to receive in the downlink from any of source and target cells earlier than 20us after the end of the last transmitted uplink symbol to any of source and target cells in the same TDD band. | | |

### 5.7.2 Requirements

#### 5.7.2.1 E-UTRAN FDD – FDD

The requirements in this clause are applicable to both intra-frequency and inter-frequency DAPS handovers.

##### 5.7.2.1.1 DAPS Handover delay

Procedure delays for the procedure that can command a DAPS handover are specified in TS 36.331 [2]. DAPS delay is comprised of Dhandover1 and Dhandover2.

When the UE receives an RRC message implying handover, the UE shall be ready to start the transmission of the new uplink PRACH channel within Dhandover1 seconds from the end of the last TTI containing the RRC command when UE is configured with dual active protocol stack handover.

Dhandover1 = TRRC\_procedure+ Tsearch + TIU + 20 ms

Where

TRRC\_procedure is the maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2].

Tsearch is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then Tsearch = 0 ms. If the target cell is unknown and signal quality is sufficient for successful cell detection on the first attempt, then Tsearch = 80 ms. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

TIU is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. TIU can be up to 30 ms.

NOTE: The actual value of TIU shall depend upon the PRACH configuration used in the target cell.

A cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 8.1.2.2.1 (FDD) and Clause 8.1.2.2.2 (TDD) for intra-frequency handover and Clause 8.1.2.3.1 (FDD) and Clause 8.1.2.3.2 (TDD) for inter-frequency handover.

After successful RACH procedure of the target cell, when the UE receives an RRC message implying source cell release command, the UE shall accomplish the release actions specified in TS 36.331 [2] within Dhandover2.

Dhandover2 = TRRC\_procedure+ Tinterrupt2

Where:

TRRC\_procedure is the maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2].

Tinterrupt2 is defined in clause 5.7.2.1.2.

##### 5.7.2.1.2 Interruption time

During Dhandover1 the UE is allowed an interruption of up to Tinterrupt1 on source cell:

- Tinterrupt1 is 1 ms for synchronous intra-frequency DAPS handover and 2ms for asynchronous intra-frequency DAPS handover, when the bandwidth of target cell is no larger than the bandwidth of source cell,

- Tinterrupt1 is 2ms for synchronous intra-frequency DAPS handover and 3ms for asynchronous intra-frequency DAPS handover, when the bandwidth of target cell is larger than the bandwidth of source cell,

- Tinterrupt1 is 5 ms for synchronous intra-band inter-frequency DAPS handover and 6 ms for asynchronous intra-band inter-frequency DAPS handover

- Tinterrupt1 is 1 ms for synchronous inter-band inter-frequency DAPS handover and 2 ms for asynchronous inter-band inter-frequency DAPS handover.

During Dhandover2 the UE is allowed an interruption of up to Tinterrupt2 on target cell:

- Tinterrupt2 is 2 ms for synchronous intra-frequency DAPS handover and 3 ms for asynchronous intra-frequency DAPS handover, when the bandwidth of target cell is smaller than the bandwidth of source cell.

- Tinterrupt2 is 1 ms for synchronous intra-frequency DAPS handover and 2 ms for asynchronous intra-frequency DAPS handover, when the bandwidth of target cell is not smaller than the bandwidth of source cell

- Tinterrupt2 is 5 ms for synchronous intra-band inter-frequency DAPS handover and 6 ms for asynchronous intra-band inter-frequency DAPS handover.

- Tinterrupt2 is 1 ms for synchronous inter-band inter-frequency DAPS handover and 2ms for asynchronous inter-band inter-frequency DAPS handover.

#### 5.7.2.2 E-UTRAN FDD – TDD

The requirements in this clause are applicable to DAPS handover from FDD to TDD. The requirements in this clause shall apply to UE supporting FDD and TDD.

The requirements in clause 5.7.2.1 apply for this section.

#### 5.7.2.3 E-UTRAN TDD – FDD

The requirements in this clause are applicable to DAPS handover from TDD to FDD. The requirements in this clause shall apply to UE supporting FDD and TDD.

The requirements in clause 5.7.2.1 apply for this section.

#### 5.7.2.4 E-UTRAN TDD – TDD

The requirements in this clause are applicable to DAPS handover from TDD to TDD. The requirements in this clause shall apply to UE supporting TDD.

The requirements in clause 5.7.2.1 apply for this section.

## 5.8 EN-DC Handover with PSCell

### 5.8.1 Introduction

When the UE receives a RRC message implying handover with PSCell change, the UE shall be ready to start the transmission of the new uplink PRACH channel on target E-UTRA PCell within DHOwithPSCell\_PCell ms from the end of the last TTI containing the RRC command, and UE shall be ready to start the transmission of the new uplink PRACH channel on target NR PSCell within DHOwithPSCell\_PSCell ms from the end of the last TTI containing the RRC command.

Where

DHOwithPSCell\_PCell equals the maximum RRC procedure delay defined in clause 11.2 in TS 36.331 [2] plus the interruption time stated in clause 5.8.1.1.

DHOwithPSCell\_PSCell is the PSCell addition delay stated in clause 5.8.1.2.

#### 5.8.1.1 Handover with PSCell Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH excluding the RRC procedure delay. This requirement applies when UE is not required to perform any synchronisation procedure before transmitting on the new PRACH or on the new PUSCH.

When Handover with PSCell is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + Tprocessing­­­ ms

Where:

Tsearch is same as the Tsearch defined in section 5.1.2.1.2.1.

TIU is same as the one defined in section 5.1.2.1.2.1.

Tprocessing is the SW processing time needed by UE, including RF warm up period. Tprocessing­­­ = 25 ms if source NR PSCell and target NR PSCell are in the same FR. Tprocessing­­­ = 45 ms if source NR PSCell and target NR PSCell are in the different FR.

NOTE: The actual value of TIU shall depend upon the PRACH configuration used in the target cell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 8.1.2.2.1 for intra-frequency handover and Clause 8.1.2.3.1 for inter-frequency handover.

#### 5.8.1.2 Handover with PSCell - NR PSCell Changing Delay requirements

When Handover with PSCell is commanded, the NR PSCell changing delay shall be less than DHOwithPSCell\_PSCell:

DHOwithPSCell\_PSCell = TRRC\_delay + Tprocessing + Tsearch + T∆ + TPSCell\_ DU + TPCell\_DU + 2 ms

TRRC\_delay is maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2].

Tprocessing is the SW processing time needed by UE, including RF warm up period. Tprocessing­­­ = 25 ms if source NR PSCell and target NR PSCell are in the same FR. Tprocessing­­­ = 45 ms if source NR PSCell and target NR PSCell are in the different FR.

Tsearch is same as Tsearch in section 7.31.2

T∆ is same as T∆ in section 7.31.2.

TPSCell\_DU is same as TPSCell\_ DU in section 7.31.2.

TPCell\_DU is the delay uncertainty due to PCell RACH preamble transmission if the FR1 NR PSCell PRACH occasion is colliding with PCell UL channels and the FR1 NR PSCell PRACH cannot be transmitted as defined in TS38.213 [39] section 7.6.1; otherwise TPCell\_DU = 0.

The Trs definition from clause 7.31.2 is modified as following for requirements in this section:

- Trs is the SMTC periodicity of the target NR cell if target NR PSCell is unknown and SMTC configuration of target unknown NR PSCell is present in *RRCConnectionReconfiguration*, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the measObjectNRs having the same SSB frequency and subcarrier spacing configured by MN and SN have different SMTC, Trs is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this section is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

In FR1 and FR2, the NR PSCell is known if it has been meeting the following conditions:

- During the last 5 seconds before the reception of the HO with PSCell command:

- the UE has sent a valid measurement report for the NR PSCell being configured and

- One of the SSBs measured from the NR PSCell being configured remains detectable according to the cell identification conditions specified in section 9.3 of TS 38.133 [50],

- One of the SSBs measured from NR PSCell being configured also remains detectable during the NR PSCell configuration delay according to the cell identification conditions specified in section 9.3 of TS 38.133 [50].

otherwise it is unknown.

## 5.9 EN-DC Handover with PSCell using CCA

### 5.9.1 Introduction

When the UE receives a RRC message implying handover with PSCell change, the UE shall be ready to start the transmission of the new uplink PRACH channel on target E-UTRA PCell within DHOwithPSCell\_PCell ms from the end of the last TTI containing the RRC command, and UE shall be ready to start the transmission of the new uplink PRACH channel on a target PSCell on a carrier frequency with CCA within DHOwithPSCell\_PSCell seconds and from the end of the last TTI containing the RRC command.

Where:

- DHOwithPSCell\_PCell equals the maximum RRC procedure delay defined in clause 11.2 in TS 36.331 [2] plus the interruption time stated in clause 5.9.1.1.

- DHOwithPSCell\_PSCell is the PSCell addition delay stated in clause 5.9.1.2.

#### 5.9.1.1 Handover with PSCell – E-UTRA HO Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH excluding the RRC procedure delay. This requirement applies when UE is not required to perform any synchronisation procedure before transmitting on the new PRACH or on the new PUSCH.

When Handover with PSCell is commanded, the interruption time shall be less than Tinterrupt

Tinterrupt = Tsearch + TIU + Tprocessing ms

Where:

- Tsearch is same as the Tsearch defined in section 5.1.2.1.2

- TIU is same as the one defined in section 5.1.2.1.2.

- Tprocessing is the SW processing time needed by UE, including RF warm up period. Tprocessing­­­ = 25 ms.

NOTE: The actual value of TIU shall depend upon the PRACH configuration used in the target E-UTRA cell.

In the interruption requirement, a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds. Otherwise, it is unknown. Relevant cell identification requirements are described in Clause 8.1.2.2.1 for intra-frequency handover and Clause 8.1.2.3.1 for inter-frequency handover.

#### 5.9.1.2 Handover with PSCell - NR PSCell Change Delay requirements

When Handover with PSCell is commanded, the NR PSCell on a carrier frequency with CCA changing delay shall be less than DHOwithPSCell\_PSCell:

DHOwithPSCell\_PSCell = TRRC\_delay + Tprocessing + Tsearch + T∆ + TIU\_PSCell + 2 ms

Where:

TRRC\_delay is maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2].

Tsearch is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then Tsearch = 0 ms. If the target cell is an unknown cell and target cell Es/Iot ≥ [-2] dB, then Tsearch = (3+L1) \*Trs ms. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

L1 is the number of SMTC occasions not available at the UE during the inter-RAT detection period. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

T∆ is time for fine time tracking and acquiring full timing information of the target cell. T∆ = (1+ L2) \*Trs ms for a known or an unknown PSCell, where L2 is the number of SMTC occasions not available at the UE during the time tracking period.

Tprocessing is time for UE processing. Tprocessing can be up to 25 ms.

Tmargin is time for SSB post-processing. Tmargin can be up to 2 ms.

TIU\_PSCell is the delay uncertainty due to the random-access procedure when sending PRACH to the new cell. TIU\_PSCell can be up to: (1+ L3) \*TSSB,RO + 10 ms; where TSSB,RO is the SSB to PRACH occasion association period as defined in Table 8.1-1 of TS 38.213 [39] and L3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failures or RACH collision between PCell and PSCell. L3 = 0 for Type 2C UL channel access procedure as defined in TS 37.213 [57] and when there are no RACH collisions between PCell and PSCell. When the UE is configured with both the UL BWP with PRACH occasion on the target cell and UL LBT failure detection/recovery, the interruption can be longer.

NOTE 1: The actual value of TIU\_PSCell shall depend upon the PRACH configuration used in the target cell.

NOTE 2: The interruption time extended by L1, L2and L3 parameters, and by the UL LBT failure detection/recovery mechanism is limited by the T304 timer. The UE behaviour at the T304 timer expiry is specified in TS 38.331 [38].

- Trs is the SMTC periodicity of the target NR cell if target NR PSCell is unknown and SMTC configuration of target unknown NR PSCell is present in *RRCConnectionReconfiguration*, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the measObjectNRs having the same SSB frequency and subcarrier spacing configured by MN and SN have different SMTC, Trs is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this section is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

- A cell on a carrier frequency with CCA is known if it has been meeting the relevant cell identification requirement during the last 5 seconds. Otherwise, it is unknown. Relevant cell identification requirements are described in clause 8.1.2.4.21A, and 8.1.2.4.22A.

# 6 RRC Connection Mobility Control

## 6.1 RRC Re-establishment

The requirements in this clause are applicable to both E-UTRAN FDD and TDD.

### 6.1.1 Introduction

RRC connection re-establishment is initiated when a UE in RRC connected mode looses RRC connection due to any of these reasons: radio link failure, handover failure or radio link problem. The RRC es-tablishment procedure is specified in clause 5.3.7 in TS 36.331 [2].

### 6.1.2 Requirements

In RRC connected mode the UE shall be capable of sending *RRCConnectionReestablishmentRequest* message within Tre-establish\_delay seconds from the moment it detects a loss in RRC connection. The total RRC connection delay (Tre-establish\_delay) shall be less than:

Tre-establish\_delay = TUL\_grant + TUE\_re-establish\_delay

TUL\_grant: It is the time required to acquire and process uplink grant from the target PCell. The uplink grant is required to transmit *RRCConnectionReestablishmentRequest* message.

The UE re-establishment delay (TUE\_re-establish\_delay) is specified in clause 6.1.2.1.

#### 6.1.2.1 UE Re-establishment delay requirement

The UE re-establishment delay (TUE\_re-establish\_delay) is the time between the moments when any of the conditions requiring RRC re-establishment as defined in clause 5.3.7 in TS 36.331 [2] is detected by the UE to the time when the UE sends PRACH to the target PCell. The UE re-establishment delay (TUE\_re-establish\_delay) requirement shall be less than:

TUE-re-establish\_delay = 50 ms + Nfreq\*Tsearch + TSI + TPRACH

Tsearc*h*: It is the time required by the UE to search the target PCell.

Tsearch = It is 100 ms if the target PCell is known by the UE; the target PCell is known if it has been measured by the UE in the last 5 seconds.

Tsearc*h* = It is 800 ms if the target PCell is unknown by the UE; the target PCell is unknown if it has not been measured by the UE in the last 5 seconds.

TSI = It is the time required for receiving all the relevant system information according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 36.331 [2] for the target PCell.

TPRACH = The additional delay caused by the random access procedure; it will be at least 10 ms due to random access occasion and there might be additional delay due to ramping procedure.

Nfreq: It is the total number of E-UTRA frequencies to be monitored for RRC re-establishment; Nfreq = 1 if the target PCell is known.

There is no requirement if the target cell does not contain the UE context.

## 6.2 Random Access

### 6.2.1 Introduction

The random access procedure is used when establishing the layer 1 communication between the UE and E-UTRAN. The random access is specified in clause 6 of TS 36.213[3] and the control of the RACH transmission is specified in clause 5.1 of TS 36.321[17]. Contention based random access procedures can only be carried out on PCell and PSCell, while non-contention based random access procedures can be carried out on PCell, one or two activated SCell(s), and PSCell. For UEs supporting CA with FS3 SCells, the random access procedures can only be carried out on PCell.

### 6.2.2 Requirements

The UE shall have capability to calculate PRACH transmission power according to the PRACH power formula defined in TS 36.213[3] and apply this power level at the first preamble or additional preambles. The absolute power applied to the first preamble shall have an accuracy as specified in table 6.3.5.1.1-1 of TS 36.101[5]. The relative power applied to additional preambles shall have an accuracy as specified in table 6.3.5.2.1-1 of 36.101[5].

The UE shall indicate a Random Access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on PCell or PSCell as specified in clause 5.1.4 in TS 36.321 [17].

The UE shall stop preamble transmission if maximum number of preamble transmission counter has been reached for the random access procedure on an activated Scell as specified in clause 5.1.4 in TS 36.321 [17].

#### 6.2.2.1 Contention based random access

##### 6.2.2.1.1 Correct behaviour when receiving Random Access Response reception

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall re-select a preamble and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

##### 6.2.2.1.2 Correct behaviour when not receiving Random Access Response reception

The UE shall re-select a preamble and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window defined in clause 5.1.4 TS 36.321.

##### 6.2.2.1.3 Correct behaviour when receiving a NACK on msg3

The UE shall re-transmit the msg3 upon the reception of a NACK on msg3.

##### 6.2.2.1.4 Void

##### 6.2.2.1.5 Correct behaviour when receiving a message over Temporary C-RNTI

The UE shall send ACK if the Contention Resolution is successful.

The UE shall re-select a preamble and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

##### 6.2.2.1.6 Correct behaviour when contention Resolution timer expires

The UE shall re-select a preamble and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

#### 6.2.2.2 Non-Contention based random access

##### 6.2.2.2.1 Correct behaviour when receiving Random Access Response

The UE may stop monitoring for Random Access Response(s) if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall re-transmit the preamblewith the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

The UE is not allowed to re-transmit the preamble on SCells without PUSCH on the SCCs to which SRS carrier based switching is performed, even if all received Random Access Responses contain Random Access Preamble identifiers do not match the transmitted Random Access Preamble, unless the UE receives the corresponding new PDCCH order.

##### 6.2.2.2.2 Correct behaviour when not receiving Random Access Response

The UE shall re-transmit the preamble with the calculated PRACH transmission power.

The UE is not allowed to re-transmit the preamble on SCells without PUSCH on the SCCs to which SRS carrier based switching is performed, unless the UE receives the corresponding new PDCCH order.

### 6.2.3 Requirements for Cat-M1 UEs

In addition to the requirements defined in 6.2.1 and 6.2.2, a Cat-M1 UE shall also execute the random access procedure defined in clause 5.1 in TS 36.321 [17] using the PRACH configuration contained in *PRACH-ConfigSIB* in TS 36.331 [2]

- Determines the enhanced coverage level based on the RSRP measurement and the configured criterion (*RSRP-ThresholdsPrach* [2]) as defined in section 5.1.1, TS 36,321 [17],

- Selects PRACH resources [2] configured for the corresponding enhanced coverage level as determined in the previous step and;

- Transmits or re- transmits PRACH preamble using the selected PRACH resources and PRACH configuration.

## 6.3 RRC Connection Release with Redirection

### 6.3.1 Introduction

RRC connection release with redirection is initiated by the UE upon receiving the “*RRCConnectionRelease*” message from the E-UTRAN, TS 36.331 [2]. The RRC connection release with redirection procedure is specified in clause 5.3.8 in TS 36.331 [2].

The requirements in this clause are applicable to both E-UTRAN FDD and TDD.

### 6.3.2 Requirements

#### 6.3.2.1 RRC connection release with redirection to UTRAN FDD

The UE shall be capable of performing the RRC connection release with redirection to the target UTRAN FDD cell within Tconnection\_release\_redirect\_UTRA FDD.

The time delay (Tconnection\_release\_redirect\_UTRA FDD) is the time between the end of the last TTI containing the RRC command, “*RRCConnectionRelease*” (TS 36.331 [2]) on the E-UTRAN PDSCH and the time the UE starts to send random access to the target UTRA FDD cell. The time delay (Tconnection\_release\_redirect\_UTRA FDD) shall be less than:

Tconnection\_release\_redirect\_UTRA FDD = TRRC\_procedure\_delay + Tidentify-UTRA FDD + TSI-UTRA FDD + TRA

The target UTRA FDD cell shall be considered detectable when:

- CPICH Ec/Io > -15 dB,

- SCH\_Ec/Io > -15 dB for at least one channel tap and SCH\_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code.

TRRC\_procedure\_delay: It is the RRC procedure for processing the received message “*RRCConnectionRelease*”. It shall be less than 110 ms.

Tidentify-UTRA FDD: It is the time to identify the target UTRA FDD cell. It shall be less than 500 ms.

TSI-UTRA FDD: It is the time required for acquiring all the relevant system information of the target UTRA FDD cell. This time depends upon whether the UE is provided with the relevant system information of the target UTRA FDD cell or not by the E-UTRAN before the RRC connection is released.

TRA: It is the delay caused due to the random access procedure when sending random access to the target UTRA FDD cell.

#### 6.3.2.2 RRC connection release with redirection to GERAN

The UE shall be capable of performing the RRC connection release with redirection to the target GERAN cell within Tconnection\_release\_redirect\_GERAN.

The time delay (Tconnection\_release\_redirect\_GERAN) is the time between the end of the last TTI containing the RRC command, “*RRCConnectionRelease*” (TS 36.331 [2]) on the E-UTRAN PDSCH and the time the UE starts to send random access to the target GERAN cell. The time delay (Tconnection\_release\_redirect\_GERAN) shall be less than:

Tconnection\_release\_redirect\_ GERAN = TRRC\_procedure\_delay + Tidentify-GERAN + TSI-GERAN + TRA

The target GERAN cell shall be considered detectable when the UE receives the GERAN cell at levels down to 10 dB + the reference sensitivity level or reference interference levels as specified in [9].

TRRC\_procedure\_delay: It is the RRC procedure for processing the received message “*RRCConnectionRelease*”. It shall be less than 110 ms.

Tidentify-UTRA GERAN: It is the time to identify the BSIC of the target GERAN cell. It shall be less than 1 second.

TSI-UTRA GERAN: It is the time required for acquiring all the relevant system information of the target GERAN cell. This time depends upon whether the UE is provided with the relevant system information of the target GERAN cell or not by the E-UTRAN before the RRC connection is released.

TRA: It is the delay caused due to the random access procedure when sending random access burst to the target GERAN cell.

#### 6.3.2.3 RRC connection release with redirection to UTRAN TDD

The UE shall be capable of performing the RRC connection release with redirection to the target UTRAN TDD cell within Tconnection\_release\_redirect\_UTRA TDD.

The time delay (Tconnection\_release\_redirect\_UTRA TDD) is the time between the end of the last TTI containing the RRC command, “*RRCConnectionRelease*” (TS 36.331 [2]) on the E-UTRAN PDSCH and the time the UE starts to send random access to the target UTRA TDD cell. The time delay (Tconnection\_release\_redirect\_UTRA TDD) shall be less than:

Tconnection\_release\_redirect\_UTRA TDD = TRRC\_procedure\_delay + Tidentify-UTRA TDD\* Nredirect-UTRA TDD + TSI-UTRA TDD + TRA

The target UTRA TDD cell shall be considered detectable when:

- P-CCPCH Ec/Io > -6 dB,

- DwPCH\_Ec/Io > -1 dB.

TRRC\_procedure\_delay: It is the RRC procedure for processing the received message “*RRCConnectionRelease*”. It shall be less than 110 ms.

Tidentify-UTRA TDD: It is the time to identify the target UTRA TDD cell. It shall be less than 500 ms.

TSI-UTRA TDD: It is the time required for acquiring all the relevant system information of the target UTRA TDD cell. This time depends upon whether the UE is provided with the relevant system information of the target UTRA TDD cell or not by the E-UTRAN before the RRC connection is released.

TRA: It is the delay caused due to the random access procedure when sending random access to the target UTRA TDD cell.

Nredirect-UTRA TDD: It is the total number of target UTRA TDD frequencies included in RedirectedCarrierInfo in “*RRCConnectionRelease*” message. It can be up to 4 UTRA TDD frequencies.

#### 6.3.2.4 RRC connection release with redirection to NR

The UE shall be capable of performing the RRC connection release with redirection to the target NR cell within Tconnection\_release\_redirect\_NR.

The time delay (Tconnection\_release\_redirect\_\_NR) is the time between the end of the last TTI containing the RRC command, “*RRCConnectionRelease*” (TS 36.331 [2]) on the E-UTRAN PDSCH and the time the UE starts to send random access to the target NR cell. The time delay (Tconnection\_release\_redirect\_NR) shall be less than:

Tconnection\_release\_redirect\_NR = TRRC\_procedure\_delay + Tidentify-NR + TSI-NR + TRACH

The target NR cell shall be considered detectable when for each relevant SSB:

- SSB\_RP and SSB Ês/Iot according to Annex B.2.5 of TS 38.133 [50] for a corresponding NR Band.

TRRC\_procedure\_delay: It is the RRC procedure delay for processing the received message “*RRCConnectionRelease*” as defined in clause 6.2.2 of TS 36.331 [2]. It shall be less than 110 ms.

Tidentify-NR: It is the time to identify the target NR cell and depends on the frequency range (FR) of the target NR cell. It is defined in table 6.3.2.4-1. Tidentify-NR = TPSS/SSS-sync + Tmeas, whereTPSS/SSS-sync is the cell search time and Tmeas is the measurement time due to cell selection criteria evaluation.

TSI-NR: It is the time required for acquiring all the relevant system information of the target NR cell. This time depends upon whether the UE is provided with the relevant system information of the target NR cell or not by the old NR cell before the RRC connection is released.

TRACH: It is the delay caused due to the random access procedure when sending random access to the target NR cell. TRACH can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [39].

Trs is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the redirection command, otherwise Trs is the SMTC periodicity configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing configured for the RRC connection release with redirection. If the measObjectNRs having the same SSB frequency and subcarrier spacing configured by MN and SN have different SMTC, Trs is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided with SMTC configuration or measurement object for the frequency which is also configured for the RRC connection release with redirection then:

- the requirement in this section is applied with Trs = 20 ms assuming the SSB transmission periodicity is not larger than 20 ms,

- there is no requirement if the SSB transmission periodicity is larger than 20 ms.

Table 6.3.2.4-1: Time to identify target NR cell for RRC connection release with redirection to NR

|  |  |
| --- | --- |
| Frequency range (FR) of target NR cell | Tidentify-NR |
| FR1 | MAX (680 ms, 11 x Trs) |
| FR2 | MAX (880 ms, 88 x Trs) |

#### 6.3.2.5 RRC connection release with redirection to NR carrier subject to CCA

The UE shall be capable of performing the RRC connection release with redirection to the target NR cell subject to CCA within Tconnection\_release\_redirect\_NR\_CCA.

The time delay (Tconnection\_release\_redirect\_NR\_CCA) is the time between the end of the last TTI containing the RRC command, “*RRCConnectionRelease*” (TS 36.331 [2]) on the E-UTRAN PDSCH and the time the UE starts to send random access to the target NR cell. The time delay (Tconnection\_release\_redirect\_NR\_CCA) shall be less than:

Tconnection\_release\_redirect\_NR\_CCA = TRRC\_procedure\_delay + Tidentify-NR\_CCA + TSI-NR\_CCA + TRACH\_CCA

The target NR cell shall be considered detetable when for each relevant SSB, the side conditions should be met that,

- the conditions of SSB\_RP and SSB Ês/Iot according to Annex B.2.5 of TS 38.133 [50] for a corresponding NR Band are fulfilled.

TRRC\_procedure\_delay: It is the RRC procedure delay for processing the received message “*RRCConnectionRelease*” as defined in clause 6.2.2 of TS 36.331 [2].

Tidentify-NR\_CCA: It is the time to identify the target NR cell and is defined as:

- Tidentify-NR\_CCA = TPSS/SSS-sync + Tmeas; TPSS/SSS-sync is the cell search time and Tmeas is the measurement time due to cell selection criteria evaluation.

- Tidentify-NR\_CCA = MAX (680 ms, (L1+11) × Trs); where L1 is the number of SMTC occasions not available at the UE due to DL CCA failures. If L1 > L1,max then the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 36.304 [1]; where L1,max is defined in Table 6.3.2.5-1.

In the requirements of clause 6.3.2.5, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding period; otherwise the SMTC occasion is considered as available at the UE.

TSI-NR\_CCA: It is the time required for acquiring all the relevant system information of the target NR cell. This time depends upon whether the UE is provided with the relevant system information of the target NR cell or not by the old NR cell before the RRC connection is released.

TRACH\_CCA: It is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell:

- TRACH\_CCA = (1+L2)×TSSB,RO + 10 ms; where:

- L2 is the consecutive number of SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failures. L2 = 0 for Type 2C UL channel access procedure as defined in TS 37.213 [57].

- TSSB,RO is the SSB to PRACH occasion association period as defined in the table 8.1-1 of TS 38.213 [39].

- The value of L2 is limited by *PREAMBLE\_TRANSMISSION\_COUNTER*, which is increased when PRACH occasion is unavailable for PRACH transmission due to UL CCA failure as specified in TS 38.321 [43]. The UE behaviour when *PREAMBLE\_TRANSMISSION\_COUNTER* reaches the *preambleTransMax* is specified in TS 38.321 [43].

In the requirements of clause 6.3.2.5, the term PRACH occasion unavailable for transmission refers to when the PRACH occasion is configured by gNB at the UE but not transmitted by the UE during the corresponding period due to UL CCA failure at the UE.

Trs is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the redirection command, otherwise Trs is the SMTC periodicity configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing configured for the RRC connection release with redirection. If the UE is not provided with SMTC configuration or measurement object for the frequency which is also configured for the RRC connection release with redirection then:

- the requirement in this clause is applied with Trs = 20 ms if the SSB transmission periodicity is not larger than 20 ms; otherwise,

- there is no requirement if the SSB transmission periodicity is larger than 20ms.

Table 6.3.2.5-1: Maximum allowed number of missed SMTC occasions during cell identification

|  |  |
| --- | --- |
| SMTC periodicity (Trs) [ms] | Maximum allowed number of missed SMTC occasions (L1,max) |
| Trs ≤ 40 | 8 |
| Trs > 40 | 4 |

#### 6.3.2.6 RRC connection release with redirection to NR Redcap

The RedCap UE shall be capable of performing the RRC connection release with redirection to the target NR cell within Tconnection\_release\_redirect\_NR\_RedCap.

The time delay (Tconnection\_release\_redirect\_NR\_RedCap) is the time between the end of the last TTI containing the RRC command, “*RRCConnectionRelease*” (TS 36.331 [2]) on the E-UTRAN PDSCH and the time the UE starts to send random access to the target NR cell. The time delay (Tconnection\_release\_redirect\_NR\_RedCap) shall be less than:

Tconnection\_release\_redirect\_NR\_RedCap = TRRC\_procedure\_delay + Tidentify-NR\_Redcap + TSI-NR\_RedCap + TRACH\_RedCap

The target NR cell shall be considered detectable for 1 Rx RedCap when for each relevant SSB:

- SSB\_RP and SSB Ês/Iot according to Annex B.2.X of TS 38.133 [50] for a corresponding NR Band.

The target NR cell shall be considered detectable for 2 Rx RedCap when for each relevant SSB:

- SSB\_RP and SSB Ês/Iot according to Annex B.2.X of TS 38.133 [50] for a corresponding NR Band.

TRRC\_procedure\_delay: It is the RRC procedure delay for processing the received message “*RRCConnectionRelease*” as defined in clause 6.2.2 of TS 36.331 [2]. It shall be less than 110 ms.

Tidentify-NR\_RedCap: It is the time to identify the target NR cell and depends on the frequency range (FR) of the target NR cell. It is defined in table 6.3.2.6-1 for 1 Rx RedCap for FR1 and in table 6.3.2.6-2 for 2 Rx RedCap. Tidentify-NR\_RedCap = TPSS/SSS-sync\_RedCap + Tmeas\_RedCap, whereTPSS/SSS-sync\_RedCap is the cell search time and Tmeas\_RedCap is the measurement time due to cell selection criteria evaluation. The RedCap UE operating in NR HD-FDD shall meet the requirements in this section provided that the SSB is available at the UE at least once every SMTC period during Tidentify-NR\_RedCap.

TSI-NR\_RedCap: It is the time required for acquiring all the relevant system information of the target NR cell. This time depends upon whether the UE is provided with the relevant system information of the target NR cell or not by the old NR cell before the RRC connection is released.

TRACH\_RedCap: It is the delay caused due to the random access procedure when sending random access to the target NR cell. TRACH\_RedCap can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [39]. The RedCap UE operating in NR HD-FDD mode shall perform the PRACH transmission on the PRACH resource of the target NR cell provided that the UE has received at least one SSB associated with the PRACH resource during the last [TBD] period in the target NR cell.

Trs is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the redirection command, otherwise Trs is the SMTC periodicity configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing configured for the RRC connection release with redirection. If the UE is not provided with SMTC configuration or measurement object for the frequency which is also configured for the RRC connection release with redirection then:

- the requirement in this section is applied with Trs = 20 ms assuming the SSB transmission periodicity is not larger than 20 ms,

- there is no requirement if the SSB transmission periodicity is larger than 20 ms.

Table 6.3.2.6-1: Time to identify target NR cell for RRC connection release with redirection to NR for 1 Rx RedCap

|  |  |
| --- | --- |
| Frequency range (FR) of target NR cell | Tidentify-NR\_RedCap |
| FR1 | MAX (680 ms, 12 x Trs) |

Table 6.3.2.6-2: Time to identify target NR cell for RRC connection release with redirection to NR for 2 Rx RedCap

|  |  |
| --- | --- |
| Frequency range (FR) of target NR cell | Tidentify-NR\_RedCap |
| FR1 | MAX (680 ms, 11 x Trs) |
| FR2 | MAX (880 ms, 88 x Trs) |

## 6.4 CSG Proximity Indication for E-UTRAN and UTRAN

### 6.4.1 Introduction

The requirements defined in this section are applicable to a UE supporting and configured with CSG proximity indication and are valid when a UE is entering the proximity of one or more CSG member cell(s) or leaving the proximity of all CSG member cell(s) on a UTRA or E-UTRA frequency as specified in [2].

The detection of CSG proximity is based on a UE autonomous search function.

### 6.4.2 Requirements

The UE shall initiate transmission of the ProximityIndication message with “entering” according to [2] within 6 minutes after entering the proximity of one or more CSG member cell(s) on a UTRA or E-UTRA frequency.

The UE shall initiate transmission of the ProximityIndication message with “leaving” according to [2] within 6 minutes after leaving the proximity of all CSG member cell(s) on a UTRA or E-UTRA frequency.

There is no need for statistical testing of this requirement.

NOTE: Entering the proximity of one or more CSG member cell(s) means that the UE is near a cell whose CSG ID is in the UE’s permitted CSG list (as determined based on autonomous search procedures). Leaving the proximity of one or more CSG member cell(s) means that the UE is no longer near any cell whose CSG ID is in the UE’s permitted CSG list.

## 6.5 RRC Re-establishment for NB-IoT UEs

### 6.5.1 Introduction

RRC connection re-establishment is initiated when a UE in RRC connected mode loses RRC connection due to any of these reasons: radio link failure or radio link problem. The RRC re-establishment procedure is specified in clause 5.3.7 in TS 36.331 [2].

### 6.5.2 Requirements

In RRC connected mode the UE shall be capable of sending *RRCConnectionReestablishmentRequest* message within Tre-establish\_delay\_NB-IoT seconds from the moment it detects a loss in RRC connection. The total RRC connection delay (Tre-establish\_delay\_NB-IoT) shall be less than:

Tre-establish\_delay\_NB-IoT = TUL\_grant + TUE\_re-establish\_delay\_NB-IoT

TUL\_grant: It is the time required to acquire and process uplink grant from the target cell. The uplink grant is required to transmit *RRCConnectionReestablishmentRequest* message.

The UE re-establishment delay (TUE\_re-establish\_delay\_NB-IoT) is specified in clause 6.5.2.1 for a UE in normal coverage and in clause 6.5.2.2 for a UE in enhanced coverage.

These requirements are not applicable for UEs that only support the Control Plane CIoT EPS optimisation (see TS 24.301). Connection control in NB-IoT is defined in Clause 5.3.1.4 in TS 36.331 [2].

#### 6.5.2.1 UE Re-establishment delay requirement in normal coverage

The UE re-establishment delay (TUE\_re-establish\_delay\_NB-IoT) is the time between the moments when any of the conditions requiring RRC re-establishment as defined in clause 5.3.7 in TS 36.331 [2] is detected by the UE to the time when the UE sends PRACH preamble to the target cell. The UE re-establishment delay (TUE\_re-establish\_delay\_NB-IoT) requirement shall be less than:

TUE-re-establish\_delay\_NB-IoT = 100 ms + NNB-Iot-freq\*Tsearch\_NB1-NC + TSI\_NB1-NC + TPRACH\_NB-IoT

Tsearch\_NB1-NC: It is the time required by the UE to search the target cell:

If the target cell is known, then Tsearch\_NB1-NC = 0 ms. If the target cell is unknown and signal quality is sufficient for successful cell detection on the first attempt, then Tsearch\_NB1-NC = 80 ms. Otherwise, Tsearch\_NB1-NC = 1400 ms.

TSI\_NB1-NC: It is the time required for receiving all the relevant system information according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 36.331 [2] for the target cell for a UE in normal coverage.

TPRACH\_NB-IoT: The additional delay caused by the random access procedure. The actual value of TPRACH\_NB-IoT shall depend upon the NPRACH configuration used in the target cell and the number of repetition used by UE for sending random access to the target cell. There might be additional delay due to ramping procedure.

NNB-Iot-freq: It is the total number of NB-IoT frequencies to be monitored for RRC re-establishment; NNB-Iot-freq = 1 if the target cell is known.

There is no requirement if the target cell does not contain the UE context.

#### 6.5.2.2 UE Re-establishment delay requirement in enhanced coverage

The UE re-establishment delay (TUE\_re-establish\_delay\_NB-IoT) is the time between the moments when any of the conditions requiring RRC re-establishment as defined in clause 5.3.7 in TS 36.331 [2] is detected by the UE to the time when the UE sends PRACH preamble to the target cell. The UE re-establishment delay (TUE\_re-establish\_delay\_NB-IoT) requirement shall be less than:

TUE-re-establish\_delay\_NB-IoT = 100 ms + NNB-Iot-freq\*Tsearch\_NB1-EC + TSI\_NB1-EC + TPRACH\_NB-IoT

- Tsearch\_NB1-EC: It is the time required by the UE to search the target cell:

- If the target cell is known, then Tsearch\_NB1-EC = 0 ms. If the target cell is unknown and signal quality is sufficient for successful cell detection on the first attempt, then Tsearch\_NB1-EC = 80 ms. Otherwise, Tsearch\_NB1-EC = 14800 ms.

- TSI\_NB1-EC: It is the time required for receiving all the relevant system information according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 36.331 [2] for the target cell for a UE in enhanced coverage.

- TPRACH\_NB-IoT: The additional delay caused by the random access procedure. The actual value of TPRACH\_NB-IoT shall depend upon the NPRACH configuration used in the target cell and the number of repetition used by UE for sending random access to the target cell. There might be additional delay due to ramping procedure.

- NNB-Iot-freq: It is the total number of NB-IoT frequencies to be monitored for RRC re-establishment; NNB-Iot-freq = 1 if the target cell is known.

There is no requirement if the target cell does not contain the UE context.

## 6.6 Random Access for UE category NB1

### 6.6.1 Introduction

The random access procedure is used when establishing the layer 1 communication between the UE and NB-IoT. The random access is specified in clause 6 of TS 36.213[3] and the control of the RACH transmission is specified in clause 5.1 of TS 36.321[17]. The UE category NB1 supports only contention-based random access transmission on anchor carrier and on non-anchor carrier.

The requirements in this section are applicable for the random access transmission by the UE category NB1 to an anchor carrier or to a non-anchor carrier under the following conditions:

- The anchor and non-anchor carrier frequencies are within 20 MHz and

- The anchor and the non-anchor carrier frequencies are in the same base station or in co-located base stations.

### 6.6.2 Requirements

The UE shall have capability to calculate NPRACH transmission power according to the NPRACH power formula defined in TS 36.213[3] and apply this power level at the first preamble or additional preambles. The absolute power applied to the first preamble shall have an accuracy as specified in TS 36.101[5]. The relative power applied to additional preambles shall have an accuracy as specified in 36.101[5].

The UE shall indicate a Random Access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on target cell as specified in clause 5.1.4 in TS 36.321 [17].

#### 6.6.2.1 Correct behaviour when receiving Random Access Response reception

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall re-select a preamble and transmit with the calculated NPRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

#### 6.6.2.2 Correct behaviour when not receiving Random Access Response reception

The UE shall re-select a preamble and transmit with the calculated NPRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window defined in clause 5.1.4 TS 36.321.

#### 6.6.2.3 Correct behaviour when receiving a NACK on msg3

The UE shall re-transmit the msg3 upon the reception of a NACK on msg3.

#### 6.6.2.4 Correct behaviour when receiving a message over Temporary C-RNTI

The UE shall send ACK if the Contention Resolution is successful.

The UE shall re-select a preamble and transmit with the calculated NPRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

#### 6.6.2.5 Correct behaviour when contention Resolution timer expires

The UE shall re-select a preamble and transmit with the calculated NPRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

#### 6.6.2.6 MSG3-based channel quality report for UE Category NB1

The requirements in this clause shall apply for UE supporting DL channel quality reporting for UE Category NB1 as defined in TS 36.331 [2] section 5.3.3.3, 5.3.3.3a, and 5.3.7.4.

The DL channel quality provides the serving eNB with information about the minimum NPDCCH repetition level to satisfy the hypothetical NPDCCH block error rate of 1% with the parameters specified in Table 6.6.2.6-1.

Table 6.6.2.6-1: NPDCCH transmission parameters for downlink quality reporting.

|  |  |
| --- | --- |
| Parameters | Values |
| DCI format | Format N1 |
| Number of information bits (excluding CRC) | 23bits |
| System bandwidth | 200kHz |
| Aggregation level | 2 |
| DRX | OFF |

For channel quality reporting in the anchor carrier, the reported NPDCCH repetition level shall be derived from the channel quality measured in the period T1 or T2 in the carrier where the random access response is transmitted, where

- T1 is the period before NPRACH transmission used for NRSRP measurement for enhanced coverage level estimation

- T2 is the period from the beginning of the random access response to the beginning of PUSCH format 1 for DL channel quality reporting.

For channel quality reporting in the non-anchor carrier, the reported NPDCCH repetition level shall be derived from the channel quality measured in the period T2 in the carrier where UE monitors Random Access Response where T2 is defined above.

The NPDCCH repetition level for CQI-NPDCCH-NB and CQI-NPDCCH-Short-NB is chosen from the supported NPDCCH repetition levels [3]. The report mapping is defined in 9.1.22.15.

The UE shall satisfy the downlink channel quality measurement accuracy requirements as specified in 9.1.22.16.

### 6.6.3 Requirements for NPRACH configuration

In addition to the requirements defined in 6.6.2, UE shall also execute the random access procedure defined in clause 5.1 in TS 36.321 [17] using the NPRACH configuration contained in *NPRACH-ConfigSIB-NB* in TS 36.331 [2].

The UE shall apply the following procedure:

- Determines the enhanced coverage level based on the NRSRP intra-frequency measurement performed on the anchor carrier, for NPRACH transmission to the anchor carrier or for NPRACH transmission to the non-anchor carrier, and the configured criterion as defined in section 5.1.1, TS 36,321 [17],

- Selects NPRACH resources [2] configured for the corresponding enhanced coverage level as determined in the previous step and;

- Transmits or re-transmits NPRACH preamble using the selected NPRACH resources and NPRACH configuration.

## 6.7 RRC Re-establishment for Cat-M1 UEs

### 6.7.1 Introduction

RRC connection re-establishment is initiated when a Cat-M1 UE either configured with CEModeA or CEModeB in RRC connected mode looses RRC connection due to any of these reasons: radio link failure or radio link problem. The RRC re-establishment procedure is specified in clause 5.3.7 in TS 36.331 [2].

### 6.7.2 Requirements

In RRC connected mode the UE shall be capable of sending *RRCConnectionReestablishmentRequest* message within Tre-establish\_delay seconds from the moment it detects a loss in RRC connection. The total RRC connection delay (Tre-establish\_delay) shall be less than:

Tre-establish\_delay = TUL\_grant + TUE\_re-establish\_delay

TUL\_grant: It is the time required to acquire and process uplink grant from the target cell. The uplink grant is required to transmit *RRCConnectionReestablishmentRequest* message.

The UE re-establishment delay (TUE\_re-establish\_delay) is specified in clause 6.7.2.1 for a UE configured with CEModeA and in clause 6.7.2.2 for a UE configured with CEModeB.

#### 6.7.2.1 UE Re-establishment delay requirement for CEModeA

The UE re-establishment delay (TUE\_re-establish\_delay) is the time between the moments when any of the conditions requiring RRC re-establishment as defined in clause 5.3.7 in TS 36.331 [2] is detected by the UE to the moment the UE has transmitted all repetitions of the PRACH preamble to the target cell. The UE re-establishment delay (TUE\_re-establish\_delay) requirement for a UE configured with CEModeA shall be less than:

TUE-re-establish\_delay=50 ms + Nfreq\*Tsearch + TSI-EUTRA-M1-CEModeA + TPRACH

- Tsearch is the time required by the UE to search the target cell. Tsearch =100 ms if the target cell is known by the UE. Otherwise, Tsearch is specified in relevant intra-frequency cell identification requirements as described in Clause 8.13.2.1 for a UE configured with CEModeA. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

In the above requirement, a cell is known if it has been meeting the relevant cell identification requirement for a time duration equal to or longer than the time duration required for the cell identification. Otherwise, it is unknown.

- TSI: It is the time required for receiving all the relevant system information according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 36.331 [2] for the target cell for a UE configured with CEModeA. TSI-EUTRA-M1-CEModeA includes the time to acquire the MIB and all the relevant SIBs of the target cell.

- TPRACH is the interruption uncertainty in acquiring the first available PRACH occasion in the target cell. The actual value of TPRACH shall depend upon the PRACH configuration used in the target cell and the PRACH coverage enhancement level used by the UE for sending the random access to the target cell.

- Nfreq: It is the total number of frequencies to be monitored for RRC re-establishment; Nfreq = 1 if the target cell is known.

There is no requirement if the target cell does not contain the UE context.

#### 6.7.2.2 UE Re-establishment delay requirement for CEModeB

The UE re-establishment delay (TUE\_re-establish\_delay) is the time between the moments when any of the conditions requiring RRC re-establishment as defined in clause 5.3.7 in TS 36.331 [2] is detected by the UE to the moment the UE has transmitted all repetitions of PRACH preamble to the target cell. The UE re-establishment delay (TUE\_re-establish\_delay) requirement for a UE configured with CEModeB shall be less than:

TUE-re-establish\_delay = 50 ms + Nfreq\*Tsearch + TSI-EUTRA-M1-CEModeB + TPRACH

- Tsearch is the time required by the UE to search the target cell. Tsearch =100 ms if the target cell is known by the UE. Otherwise, Tsearch is specified in relevant intra-frequency cell identification requirements as described in Clause 8.13.3.1 for a UE configured with CEModeB. Regardless of whether DRX is in use by the UE, Tsearch shall still be based on non-DRX target cell search times.

In the above requirement, a cell is known if it has been meeting the relevant cell identification requirement for a time duration equal to or longer than the time duration required for the cell identification. Otherwise, it is unknown.

- TSI-EUTRA-M1-CEModeB: It is the time required for receiving all the relevant system information according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 36.331 [2] for the target cell for a UE configured with CEModeA; TSI-EUTRA-M1-CEModeB includes the time to acquire the MIB and all the relevant SIBs of the target cell.

- TPRACH is the interruption uncertainty in acquiring the first available PRACH occasion in the target cell. The actual value of TPRACH shall depend upon the PRACH configuration used in the target cell and the PRACH coverage enhancement level used by the UE for sending the random access to the target cell.

- Nfreq: It is the total number of frequencies to be monitored for RRC re-establishment; Nfreq = 1 if the target cell is known.

There is no requirement if the target cell does not contain the UE context.

## 6.8 RRC Connection Release with Redirection for Cat-M1 UEs

### 6.8.1 Introduction

RRC connection release with redirection is initiated by the UE upon receiving the “*RRCConnectionRelease*” message from the E-UTRAN, TS 36.331 [2]. The RRC connection release with redirection procedure is specified in clause 5.3.8 in TS 36.331 [2].

The requirements in this clause are applicable for UE caterory M1 capable of E-UTRA FDD, TDD or HD-FDD operation.

### 6.8.2 Requirements

#### 6.8.2.1 RRC connection release with redirection to E-UTRAN with CE Mode A

The UE shall be capable of performing the RRC connection release with redirection to the target E-UTRA cell within Tconnection\_release\_redirect\_E-UTRA cat-M1.

The time delay (Tconnection\_release\_redirect\_E-UTRA cat-M1) is the time between the end of the last subframe in the repetition period of PDSCH containing the IE, “*RRCConnectionRelease*” and the end of the last subframe in the repetition period of the PRACH transmission to the target E-UTRA cell. The time delay (Tconnection\_release\_redirect\_E-UTRA cat-M1) shall be less than:

Tconnection\_release\_redirect\_E-UTRA cat-M1 = TRRC\_procedure\_delay + Tidentify-E-UTRA cat-M1 + TSI-E-UTRA cat-M1 + TRA cat-M1

The target E-UTRA FDD or TDD cell shall be considered detectable for a category M1 UE capable of E-UTRA FDD or TDD provided that:

- RSRP related side conditions given in Section 9.1.21.2 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-1 for a corresponding Band.

The target E-UTRA FDD cell shall be considered detectable for a category M1 UE capable of E-UTRA HD-FDD provided that:

- RSRP related side conditions given in Section 9.1.21.2 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-2 for a corresponding Band.

TRRC\_procedure\_delay: It is the RRC procedure for processing the received message “*RRCConnectionRelease*”. It shall be less than 110 ms.

Tidentify-E-UTRA cat-M1: It is the time required to identify the target E-UTRA cell. It shall be less than 960 ms.

TSI-E-UTRA cat-M1: It is the time required for acquiring all the relevant system information (SI) of the target E-UTRA cell. If old E-UTRA serving cell, before the release of the RRC connection, provides the UE with the SI (including MIB and all relevant SIBs) of the target E-UTRA cell, then TSI-E-UTRA FDD = 0 ms. The value of TSI-E-UTRA cat-M1 depends on the repetitions of PBCH and PDSCH used in the target cell.

TRA cat-M1: It is the delay caused due to the random access procedure when sending random access to the target E-UTRA cell. The value of TRA depends on the PRACH configuration and the repetition used in the target cell.

## 6.9 RRC Connection Redirection to Non-anchor Carrier in NB-IoT

### 6.9.1 Introduction

RRC connection redirection to a non-anchor carrier is initiated by the UE upon receiving the IE, “*CarrierConfigDedicated-NB*”, from the E-UTRAN, TS 36.331 [2]. The RRC redirection to procedure is specified in clause 6.7.3.2 in TS 36.331 [2].

The requirements in this section are applicable under the following conditions:

- The anchor and non-anchor carrier frequencies are within 20 MHz and

- The anchor and the non-anchor carrier frequencies are in the same base station or in co-located base stations.

### 6.9.2 Requirements

The UE shall be capable of performing the RRC connection redirection to the non-anchor carrier within Tconnection\_redirect\_non-anchor.

The time delay (Tconnection\_redirect\_non-anchor) is the time between the end of the last subframe in the repetition period of NPDSCH containing the IE, “*CarrierConfigDedicated-NB*” received on the anchor carrier and the end of the last subframe in the repetition period of NPUSCH transmitted on the target non-anchor carrier. The time delay (Tconnection\_redirect\_non-anchor) shall be less than:

Tconnection\_redirect\_non-anchor = TRRC\_procedure\_delay + Tperiod\_DL\_bitmap + TUL\_grant + TDL-UL switch + TNPUSCH

TRRC\_procedure\_delay: It is the RRC procedure for processing the received message “*CarrierConfigDedicated-NB*”. It shall be less than 110 ms.

Tperiod\_DL\_bitmap: It is the periodicity of the downlink subframe configuration for downlink transmission on the non-anchor carrier. It is configured via IE *DL-Bitmap-NB* [2] and can be 10 ms or 40 ms.

TUL\_grant: It is the time required to acquire uplink grant from the non-anchor carrier for transmitting NPUSCH on the non-anchor carrier. The value of TUL\_grant depends on Tperiod\_DL\_bitmap and the number of repetitions of NPDCCH used in the non-anchor carrier.

TDL-UL switch: It is the time between the end of the last subframe in the repetition period of NPDCCH received on the non-anchor carrier and the start of the first subframe in the repetition period of the corresponding NPUSCH transmitted on the non-anchor carrier. TDL-UL switch is 8 ms.

TNPUSCH: It is the time required to transmit NPUSCH on the non-anchor carrier. The value of TNPUSCH depends on the number of repetitions of NPUSCH used in the non-anchor carrier.

When the NPUSCH ACK transmission for the received RRC message takes longer than 110ms, the overall RRC connection redirection delay may be extended.

# 7 Timing and signalling characteristics

## 7.1 UE transmit timing

### 7.1.1 Introduction

The UE shall have capability to follow the frame timing change of the connected eNode B. The uplink frame transmission takes place before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell. The UE shall be configured with a pTAG containing the PCell. The pTAG may also contain up to six SCells, if configured. The UE capable of supporting multiple timing advances [2] may also be configured with one or two serving cells with uplink in one or two sTAG and pTAG.

The other downlink SCell(s), if configured, will be contained in either the pTAG or the sTAG(s). In pTAG, UE shall use the PCell as the reference cell for deriving the UE transmit timing for cells in the pTAG. When the UE capable of supporting multiple timing advance [2] is configured with one or two sTAG(s), the UE shall use an activated SCell from the sTAG for deriving the UE transmit timing for cells in the sTAG. UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are defined in the following requirements. The requirements in clause 7 apply to all TAGs.

The UE capable of supporting dual connectivity shall be configured with one pTAG and may also be configured with one psTAG. The pTAG shall contain the PCell and may also contain one SCell, if configured. The psTAG shall contain the PSCell and may also contain one SCell, if configured. In pTAG, UE shall use the PCell as the reference cell for deriving the UE transmit timing for pTAG, and in psTAG, UE shall use the PSCell as the reference cell for deriving the UE transmit timing for psTAG. UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are defined in the following requirements. The requirements in clause 7 apply to both TAGs.

The UE supporting carrier aggregation with FS3 SCells shall be configured with one pTAG and may also be configured with one sTAG. The pTAG shall contain the PCell and may also contain up to six FS3 or non-FS3 SCells. In pTAG, UE shall use the PCell as the reference cell for deriving the UE transmit timing for the cells in the pTAG. When the UE capable of supporting multiple timing advance [2] is configured with an sTAG, the sTAG shall contain at least one non-FS3 SCell and the UE shall use an activated non-FS3 SCell for deriving the UE transmit timing for cells in the sTAG. UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are defined in the following requirements. The requirements in clause 7 apply to all TAGs.

### 7.1.2 Requirements

The UE initial transmission timing error shall be less than or equal to ±Te where the timing error limit value Te is specified in Table 7.1.2-1. This requirement applies when it is the first transmission in a DRX, eDRX\_CONN cycle for PUCCH, SPUCCH, PUSCH of subframe, slot or subslot duration and SRS, or it is the first transmission after RACH-less handover, or it is the PRACH transmission. The reference point for the UE initial transmit timing control requirement shall be the downlink timing of the reference cell minus . The downlink timing is defined as the time when the first detected path (in time) of the corresponding downlink frame is received from the reference cell. *N*TA\_Ref for PRACH is defined as 0.  (in *Ts* units) for other channels is the difference between UE transmission timing and the Downlink timing immediately after when the last timing advance in clause 7.3 was applied. *N*TA\_Ref for other channels is not changed until next timing advance is received.

Table 7.1.2-1: Te Timing Error Limit

|  |  |
| --- | --- |
| Downlink Bandwidth (MHz) | Te\_ |
| 1.4 | 24\*TS |
| ≥3 | 12\*TS |
| Note: TS is the basic timing unit defined in TS 36.211 | |

When it is not the first transmission in a DRX or eDRX\_CONN cycle or there is no DRX or no eDRX\_CONN cycle, and when it is the transmission for PUCCH, SPUCCH, PUSCH of subframe, slot or subslot duration and SRS transmission or it is not the first transmission after RACH-less handover, the UE shall be capable of changing the transmission timing according to the received downlink frame of the reference cell except when the timing advance in clause 7.3 is applied.

When in a TAG the transmission timing error between the UE and the reference timing exceeds ±Te, or in a sTAG the UE changes the downlink SCell for deriving the UE transmit timing for cells in the sTAG configured with one or two uplinks, the UE is required to adjust its timing to within ±Te in that TAG, as long as,

- the UE is configured with a pTAG and one or two sTAG, the transmission timing difference between TAGs does not exceed the maximum transmission timing difference (i.e., 32.47us) after such adjustment, or

- the UE is configured with synchronous dual connectivity, the transmission timing difference between pTAG and psTAG does not exceed the maximum transmission timing difference (i.e., 35.21us) after such adjustment.

If the transmission timing difference after such adjustment is bigger than the maximum transmission timing difference UE may stop adjustment in this TAG. For a UE configured with more than one serving cell and with *ShortTTI -r15* or with *ShortProcessingTime=TRUE*, UE may stop the transmit timing adjustment if the conditions specified in the subclause B.7.1 cannot be fulfilled after such adjustment. The reference timing shall be  before the downlink timing of the reference cell. All adjustments made to the UE uplink timing under the above mentioned scenarios shall follow these rules:

1) The maximum amount of the magnitude of the timing change in one adjustment shall be Tq seconds.

2) The minimum aggregate adjustment rate shall be 7\*TS per second.

3) The maximum aggregate adjustment rate shall be Tq per 200ms.

If the UE is not configured with *highSpeedEnhMeasFlag2-r16* then the maximum autonomous time adjustment step Tq is specified in Table 7.1.2-2.

If the UE is configured with *highSpeedEnhMeasFlag2-r16* then the maximum autonomous time adjustment step Tq is specified in Table 7.1.2-3. The requirements in Table 7.1.2-3 shall apply provided that the UE is configured with only PCell.

Table 7.1.2-2: Tq Maximum Autonomous Time Adjustment Step when the UE is not configured with *highSpeedEnhMeasFlag2-r16*

|  |  |
| --- | --- |
| Downlink Bandwidth (MHz) | Tq\_ |
| 1.4 | 17.5\*TS |
| 3 | 9.5\*TS |
| 5 | 5.5\*TS |
| ≥10 | 3.5\*TS |
| Note: TS is the basic timing unit defined in TS 36.211 | |

Table 7.1.2-3: Tq Maximum Autonomous Time Adjustment Step when the UE is configured with *highSpeedEnhMeasFlag2-r16*

|  |  |
| --- | --- |
| Downlink Bandwidth (MHz) | Tq\_ |
| 1.4 | 17.5\*TS |
| 3 | 9.5\*TS |
| ≥ 5 | 5.5\*TS |
| Note: TS is the basic timing unit defined in TS 36.211 | |

## 7.2 UE timer accuracy

### 7.2.1 Introduction

UE timers are used in different protocol entities to control the UE behaviour.

### 7.2.2 Requirements

For UE timers specified in TS 36.331 [2], UE shall comply with the timer accuracies according to Table 7.2.2-1.

The requirements are only related to the actual timing measurements internally in the UE. They do not include the following:

- Inaccuracy in the start and stop conditions of a timer (e.g. UE reaction time to detect that start and stop conditions of a timer is fulfilled), or

- Inaccuracies due to restrictions in observability of start and stop conditions of a UE timer (e.g. TTI alignment when UE sends messages at timer expiry).

Table 7.2.2-1

|  |  |
| --- | --- |
| Timer value [s] | Accuracy |
| timer value < 4 | ± 0.1s |
| timer value ≥ 4 | ± 2.5% |

## 7.3 Timing Advance

### 7.3.1 Introduction

The timing advance is initiated from E-UTRAN with MAC message that implies and adjustment of the timing advance, see TS 36.321 [17] clause 5.2.

### 7.3.2 Requirements

#### 7.3.2.1 Timing Advance adjustment delay

When *ShortTTI-r15* is not configured and *ShortProcessingTime=FALSE*, the UE shall adjust the timing of its uplink transmission timing at sub-frame *n*+6 for a timing advance command received in sub-frame *n*.

When *ShortTTI-r15* is configured or *ShortProcessingTime=TRUE* and the TA command is received at subframe /slot/ subslot *n*, the timing advance adjustment delay is shown in Table 7.3.2.1-1. The UE shall adjust the uplink timing at the first subframe boundary following the time shown in Table 7.3.2.1-1.

The same requirement applies also when the UE is not able to transmit a configured uplink transmission due to the channel assessment procedure.

Table 7.3.2.1-1: Timing advance adjustment delay requirement for sTTI and for *ShortProcessingTime=TRUE [2]*

|  |  |  |  |
| --- | --- | --- | --- |
| TTI duration | Processing time | Requirement to update timing | Units |
| *ShortTTI-*r15not configured Note 1 | *ShortProcessingTime=TRUE* | n+5 | Subframe |
| *dl-STTI-Length-r15*=slot Note 1 | N/A | n+8 | Slot |
| *dl-STTI-Length-r15*=subslot Note 1 | *proc-Timeline-r15*= nplus4set1 | n+16 | Subslot |
| *dl-STTI-Length-r15*=subslot Note 1 | *proc-Timeline-r15*= nplus6set1 or  *proc-Timeline-r15*= nplus6set2 | n+18 | Subslot |
| *dl-STTI-Length-r15*=subslot Note 1 | *proc-Timeline-r15*= nplus8set2 | n+20 | Subslot |
| Note 1: If the PDSCH HARQ processing time is modified by RRC signalling during an ongoing connection, the requirement to update timing is not defined from the time when the RRC command is received by the UE until the UE has applied the updated PDSCH HARQ processing time | | | |

#### 7.3.2.2 Timing Advance adjustment accuracy

The UE shall adjust the timing of its transmissions with a relative accuracy better than or equal to ±4\* TS seconds to the signalled timing advance value compared to the timing of preceding uplink transmission. The timing advance command is expressed in multiples of 16\* TS and is relative to the current uplink timing.

## 7.4 Cell phase synchronization accuracy (TDD)

### 7.4.1 Definition

Cell phase synchronization accuracy is defined as the maximum absolute deviation in frame start timing between any pair of cells on the same frequency that have overlapping coverage areas.

### 7.4.2 Minimum requirements

For Wide Area BS, the cell phase synchronization accuracy measured at BS antenna connectors shall be better than the requirement specified in table 7.4.2-1. If a cell’s coverage area overlaps with another cell with different cell radius then the cell phase synchronization accuracy corresponding to the larger of the two cell sizes applies to the overlapping cells with different radii.

Table 7.4.2-1 Cell phase synchronization requirement for wide area BS (TDD)

|  |  |  |
| --- | --- | --- |
| Cell Type | Cell Radius | Requirement |
| Small cell | ≤ 3 km | ≤ 3 μs |
| Large cell | > 3 km | ≤ 10 μs |

For Home BS, the cell phase synchronization accuracy measured at BS antenna connectors shall be better than the requirement specified in table 7.4.2-2.

Table 7.4.2-2 Cell phase synchronization requirement for Home BS (TDD)

|  |  |  |
| --- | --- | --- |
| Source Cell Type | Propagation Distance | Requirement |
| Small cell | ≤ 500 m | ≤ 3 μs |
| Large cell | > 500 m | ≤1.33 + *Tpropagation* μs |

Note 1: *Tpropagation* is the propagation delay between the Home BS and the cell selected as the network listening synchronization source. In terms of the network listening synchronization source selection, the best accurate synchronization source to GNSS should be selected.

Note 2: If the Home BS obtains synchronization without using network listening, the small cell requirement applies.

## 7.5 Synchronization Requirements for E-UTRAN to 1xRTT and HRPD Handovers

### 7.5.1 Introduction

This clause contains the synchronization requirements for eNodeB capable of supporting E-UTRAN to CDMA 1xRTT and HRPD handovers. To facilitate E-UTRAN to CDMA 1xRTT and HRPD handovers, the CDMA System Time reference needs to be provided to the UE in order for the UE to report the pilot PN phases of the target 1xRTT or HRPD cells. This is achieved through the SIB8 message broadcasted by the serving eNodeB:

If the eNodeB is synchronized to the GPS time and the LTE system frame is aligned with the start of CDMA System Time, then the size of CDMA System Time information is 39 bits and the unit is 10 ms based on a 1.2288 Mcps chip rate.

If the eNodeB is not synchronized to the GPS time or if the eNodeB is synchronized to the GPS time but its LTE system frame not aligned with the start of CDMA System time, then the size of CDMA System Time information is 49 bits and the unit is 8 CDMA chips based on 1.2288 Mcps chip rate.

The CDMA system time reference provided by the serving eNodeB has to be within a certain level of accuracy in order to facilitate accurate reporting of the pilot PN phases of the target 1xRTT or HRPD cells and enable reliable handover to the 1xRTT or HRPD networks.

### 7.5.2 eNodeB Synchronization Requirements

#### 7.5.2.1 Synchronized E-UTRAN

The eNodeB shall be synchronized to the GPS time. With external source of CDMA System Time disconnected, the eNodeB shall maintain the timing accuracy within ±10 μs of CDMA System Time for a period of not less than 8 hours.

The timing deviation between the SFN boundary at or immediately after the ending boundary of the SI-window in which *SystemInformationBlockType8* is transmitted and the broadcasted CDMA System Time shall be within 10 s.

#### 7.5.2.2 Non-Synchronized E-UTRAN

The timing deviation between the SFN boundary at or immediately after the end of the boundary of the SI-window in which *SystemInformationBlockType8* is transmitted and the broadcasted CDMA System Time shall be within 10 s. With external source of CDMA System Time disconnected the SFN boundary at or immediately after the broadcasted CDMA System Time in the SIB8 message shall maintain the timing accuracy within ±10 μs of CDMA System Time for a period of not less than 8 hours.

## 7.6 Radio Link Monitoring

### 7.6.1 Introduction

The UE shall meet the radio link monitoring requirements specified for PSCell in section 7.6 provided that the UE is configured with the parameters T313, N313 and N314 defined in [2].

The UE shall monitor the downlink link quality based on the cell-specific reference signal in order to detect the downlink radio link quality of the PCell and PSCell as specified in [3].

The UE shall estimate the downlink radio link quality and compare it to the thresholds Qout and Qin for the purpose of monitoring downlink radio link quality of the PCell and PSCell.

The threshold Qout is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to 10% block error rate of a hypothetical PDCCH transmission taking into account the PCFICH errors with transmission parameters specified in Table 7.6.1-1.

The threshold Qin is defined as the level at which the downlink radio link quality can be significantly more reliably received than at Qout and shall correspond to 2% block error rate of a hypothetical PDCCH transmission taking into account the PCFICH errors with transmission parameters specified in Table 7.6.1-2.

When higher-layer signalling indicates certain subframes for restricted radio link monitoring, the radio link quality shall be monitored as specified in [3].

The requirements in sections 7.6.2.1, 7.6.2.2 and 7.6.2.3 shall also apply when a time domain measurement resource restriction pattern for performing radio link monitoring measurements is configured by higher layers (TS 36.331 [2]), with or without CRS assistance information, provided that also the following additional condition is fulfilled:

The time domain measurement resource restriction pattern configured for the measured cell indicates at least one subframe per radio frame for performing the radio link monitoring measurements,

When the CRS assistance information is provided, the transmission bandwidth [30] in all intra-frequency cells in the CRS assistance information [2] is the same or larger than the transmission bandwidth of the PCell for which radio link monitoring is performed.

When the CRS assistance information is provided, the requirements in Section 7.6 shall also be met when the number of transmit antenna ports [16] of one or more cells whose CRS assistance information is provided [2] is different from the number of transmit antenna ports of the cell for which radio link monitoring is performed.

NOTE: If the UE is not provided with the CRS assistance information (TS 36.331 [2]) or the CRS assistance data is not valid throughout the entire evaluation period, then similar Release 8 and 9 requirements apply for time domain measurements restriction under colliding CRS with ABS configured in non-MBSFN subframes.

The UE capable of SRS carrier based switching when configured to perform SRS carrier based switching for transmitting SRS and/or RACH over one or more SCells without PUSCH shall perform radio link monitoring and meet the requirements defined in Section 7.6 provided the following condition is met:

- at least one downlink subframe is available for doing radio link monitoring at the UE in the PCell;

- at least one downlink subframe is available for doing radio link monitoring at the UE in the PSCell if the UE is configured with PSCell.

Table 7.6.1-1 PDCCH/PCFICH transmission parameters for out-of-sync

|  |  |
| --- | --- |
| Attribute | **Value** |
| DCI format | 1A |
| Number of control OFDM symbols | 2; Bandwidth ≥ 10 MHz  3; 3 MHz ≤ Bandwidth ≤ 10 MHz  4; Bandwidth = 1.4 MHz |
| Aggregation level (CCE) | 4; Bandwidth = 1.4 MHz  8; Bandwidth ≥ 3 MHz |
| Ratio of PDCCH RE energy to average RS RE energy | 4 dB; when single antenna port is used for cell-specific reference signal transmission by the PCell or PSCell.  1 dB; when two or four antenna ports are used for cell-specific reference signal transmission by the PCell or PSCell. |
| Ratio of PCFICH RE energy to average RS RE energy | 4 dB; when single antenna port is used for cell-specific reference signal transmission by the PCell or PSCell.  1 dB; when two or four antenna ports are used for cell-specific reference signal transmission by the PCell or PSCell. |
| Note 1: DCI format 1A is defined in clause 5.3.3.1.3 in TS 36.212 [21].  Note 2: A hypothetical PCFICH transmission corresponding to the number of control symbols shall be assumed. | |

Table 7.6.1-2 PDCCH/PCFICH transmission parameters for in-sync

|  |  |
| --- | --- |
| Attribute | Value |
| DCI format | 1C |
| Number of control OFDM symbols | 2; Bandwidth ≥ 10 MHz  3; 3 MHz ≤ Bandwidth ≤ 10 MHz  4; Bandwidth = 1.4 MHz |
| Aggregation level (CCE) | 4 |
| Ratio of PDCCH RE energy to average RS RE energy | 0 dB; when single antenna port is used for cell-specific reference signal transmission by the PCell or PSCell.  -3 dB; when two or four antenna ports are used for cell-specific reference signal transmission by the PCell or PSCell. |
| Ratio of PCFICH RE energy to average RS RE energy | 4 dB; when single antenna port is used for cell-specific reference signal transmission by the PCell or PSCell.  1 dB; when two or four antenna ports are used for cell-specific reference signal transmission by the PCell or PSCell. |
| Note 1: DCI format 1C is defined in clause 5.3.3.1.4 in TS 36.212 [21].  Note 2: A hypothetical PCFICH transmission corresponding to the number of control symbols shall be assumed. | |

### 7.6.2 Requirements

#### 7.6.2.1 Minimum requirement when no DRX is used

When the downlink radio link quality of the PCell or PSCell estimated over the last 200 ms period becomes worse than the threshold Qout, Layer 1 of the UE shall send an out-of-sync indication for the PCell or PSCell to the higher layers within 200 ms Qout evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the PCell or PSCell estimated over the last 100 ms period becomes better than the threshold Qin, Layer 1 of the UE shall send an in-sync indication for the PCell or PSCell to the higher layers within 100 ms Qin evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

When the UE creates autonomous gaps for identification the CGI of an E-UTRA intra-frequency cell or an E-UTRA inter-frequency cell and when higher-layer signalling indicates certain subframes for restricted radio link monitoring, the UE shall also perform radio link monitoring. In this case, the Qout evaluation period (TEvaluate\_Qout) is 200 ms, and the Qin evaluation period (TEvaluate\_Qin) is 100 ms Note 1.

Note 1: This RLM requirement does not need to be tested.

The out-of-sync and in-sync evaluations of the PCell or PSCell shall be performed as specified in clause 4.2.1 in [3]. Two successive indications from Layer 1 shall be separated by at least 10 ms.

The transmitter power of the UE shall be turned off within 40 ms after expiry of T310 timer and the transmitter power of PSCell if configured shall be turned off within 40 ms after expiry of T313 timer as specified in clause 5.3.11 in TS 36.331 [2]. The UE shall not perform LBT procedure on any of FS3 SCell after the expiry of T310.

#### 7.6.2.2 Minimum requirement when DRX is used

When DRX is used the Qout evaluation period (TEvaluate\_Qout\_DRX) and the Qin evaluation period (TEvaluate\_Qin\_DRX) specified in Table 7.6.2.2-1 will be used.

When higher-layer signalling indicates certain subframes for restricted radio link monitoring, the Qout evaluation period (TEvaluate\_Qout\_DRX) and the Qin evaluation period (TEvaluate\_Qin\_DRX) specified in Table 7.6.2.2-2 will be used.

When eDRX\_CONN cycle is used, the Qout evaluation period (TEvaluate\_Qout\_DRX) and the Qin evaluation period (TEvaluate\_Qin\_DRX) specified in Table 7.6.2.2-3 will be used.

When the UE creates autonomous gaps for identification the CGI of an E-UTRA intra-frequency cell or an E-UTRA inter-frequency cell and when higher-layer signalling indicates certain subframes for restricted radio link monitoring, the UE shall also perform radio link monitoring. In this case, the Qout evaluation period (TEvaluate\_Qout\_DRX) and the Qin evaluation period (TEvaluate\_Qin\_DRX) specified in Table 7.6.2.2-2 will be used Note 1.

Note 1: This RLM requirement does not need to be tested.

When the downlink radio link quality of the PCell or PSCell estimated over the last TEvaluate\_Qout\_DRX [s] period becomes worse than the threshold Qout, Layer 1 of the UE shall send out-of-sync indication for the PCell or PSCell to the higher layers within TEvaluate\_Qout\_DRX [s] evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the PCell or PSCell estimated over the last TEvaluate\_Qin\_DRX [s] period becomes better than the threshold Qin, Layer 1 of the UE shall send in-sync indications for the PCell or PSCell to the higher layers within TEvaluate\_Qin\_DRX [s] evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the PCell or PSCell shall be performed as specified in clause 4.2.1 in [3]. When DRX is used, two successive indications from Layer 1 shall be separated by at least max(10 ms, DRX\_cycle\_length). When the UE is configured with dual connectivity, then two successive indications from Layer 1 shall be separated by at least max(10 ms, MCG\_DRX\_cycle\_length) for PCell and by at least max(10 ms, SCG\_DRX\_cycle\_length) for PSCell. When eDRX\_CONN is used, two successive indications from Layer 1 shall be separated by at least max(10 ms, eDRX\_CONN cycle length).

Upon start of T310 timer or T313 timer as specified in clause 5.3.11 in TS 36.331 [2], the UE shall monitor the link of PCell or PSCell for recovery using the evaluation period and Layer 1 indication interval corresponding to the non-DRX mode until the expiry or stop of T310 timer or T313 timer. While the T310 or T313 timer is running, the UE capable of supporting network-based CRS interference mitigation can assume that the inactive time periods T2 specified in Section 3.6.1.1 for network-based CRS interference mitigation are not configured, regardless of the most recent DRX configuration.

The transmitter power of the UE shall be turned off within 40 ms after expiry of T310 timer and the transmitter power of PSCell if configured shall be turned off within 40 ms after expiry of T313 timer as specified in clause 5.3.11 in TS 36.331 [2]. The UE shall not perform LBT procedure on any of FS3 SCells after the expiry of T310.

Table 7.6.2.2-1: Qout and Qin Evaluation Period in DRX

|  |  |
| --- | --- |
| DRX cycle length (s) | TEvaluate\_Qout\_DRX and TEvaluate\_Qin\_DRX (s) Note 1 |
| ≤ 0.01 | Non-DRX requirements in clause 7.6.2.1 are applicable. |
| 0.01 < DRX cycle ≤0.04 | 20 \* TDRX |
| 0.04 < DRX cycle ≤ 0. 64 | 10 \* TDRX |
| 0.64 < DRX cycle ≤ 2.56 | 5 \* TDRX |
| Note 1: Evaluation period length in time depends on the length of the DRX cycle in use. TDRX is the DRX cycle length.  Note 2: MCG’s DRX configuration is applied for PCell RLM evaluation and SCG’s DRX configuration is applied for PSCell RLM evaluation | | |

Table 7.6.2.2-2: Qout and Qin Evaluation Period in DRX when higher-layer signalling restricted measurement resource

|  |  |
| --- | --- |
| DRX cycle length (s) | TEvaluate\_Qout\_DRX and TEvaluate\_Qin\_DRX (s) Note 1 |
| ≤ 0.01 | Non-DRX requirements in clause 7.6.2.1 are applicable. |
| 0.01 < DRX cycle ≤0.04 | 40 \* TDRX |
| 0.04 < DRX cycle ≤ 0. 16 | 20 \* TDRX |
| 0. 16 < DRX cycle ≤ 0.64 | 10 \* TDRX |
| 0.64 < DRX cycle ≤ 2.56 | 5 \* TDRX |
| Note 1: Evaluation period length in time depends on the length of the DRX cycle in use. TDRX is the DRX cycle length.  Note 2: MCG’s DRX configuration is applied for PCell RLM evaluation and SCG’s DRX configuration is applied for PSCell RLM evaluation | | |

Table 7.6.2.2-3: Qout and Qin Evaluation Period when eDRX\_CONN cycle is configured

|  |  |
| --- | --- |
| eDRX\_CONN cycle length [s] | TEvaluate\_Qout\_DRX and TEvaluate\_Qin\_DRX [s] Note |
| 2.56 < eDRX\_CONN cycle ≤ 10.24 | 5 \* TeDRX\_CONN |
| Note: Evaluation period length in time depends on the length of the eDRX\_CONN cycle in use. TeDRX\_CONN is the eDRX\_CONN cycle length. | |

#### 7.6.2.3 Minimum requirement at transitions

When the UE transitions between any two of DRX, eDRX\_CONN and non-DRX or when DRX or eDRX\_CONN cycle periodicity changes, for a duration of time equal to the evaluation period corresponding to the second mode after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation periods corresponding to the first mode and the second mode. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second mode. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the PCell and PSCell.

#### 7.6.2.4 Minimum requirement during SI Acquisition with autonomous gaps

For E-UTRAN FDD-UTRAN FDD measurements with autonomous gaps, for identification of the CGI of a UTRA FDD cell (clause 8.1.2.4.17), the UE shall also perform radio link monitoring. In this case the out-of sync and in-sync evaluation periods can be longer than those defined in sections 7.6.2.1-7.6.2.3.

For E-UTRAN TDD-UTRAN FDD measurements with autonomous gaps, for identification of the CGI of a UTRA FDD cell (clause 8.1.2.4.18), the UE shall also perform radio link monitoring. In this case the out-of sync and in-sync evaluation periods can be longer than those defined in sections 7.6.2.1-7.6.2.3.

For E-UTRAN FDD-NR measurements with autonomous gaps, for identification of the CGI of an NR cell (clause 8.1.2.4.27), the UE shall also perform radio link monitoring. In this case the out-of sync and in-sync evaluation periods can be longer than those defined in sections 7.6.2.1-7.6.2.3.

For E-UTRAN TDD-NR measurements with autonomous gaps, for identification of the CGI of an NR cell (clause 8.1.2.4.28), the UE shall also perform radio link monitoring. In this case the out-of sync and in-sync evaluation periods can be longer than those defined in sections 7.6.2.1-7.6.2.3.

#### 7.6.2.5 Minimum requirement under IDC Interference

When the UE is provided with IDC solution, the UE shall also perform radio link monitoring and meet the corresponding requirements in clause 7.6.2.

## 7.7 SCell Activation and Deactivation Delay for E-UTRA Carrier Aggregation

### 7.7.1 Introduction

This section defines requirements for the delay within which the UE shall be able to activate a deactivated or dormant SCell, deactivate an activated or dormant SCell, or hibernate a deactivated or activated SCell in E-UTRA carrier aggregation. The requirements are applicable to an E-UTRA carrier aggregation capable UE which has been configured with up to six downlink SCells.

This section also defines requirements for the delay within which the UE shall be able to directly activate or directly hibernate a SCell in E-UTRA carrier aggregation. The requirements for dormant SCell are applicable for up to 4 SCell(s).

If multiple downlink SCells are activated or deactivated in the same MAC control element as defined in [17], the requirements shall apply to each of the SCells in the MAC control element.

For UE configured with one or more FeMBMS/Unicast-mixed SCells, the requirements in Section 7.7 apply also when one or more FeMBMS/Unicast-mixed SCells are activated or deactivated.

### 7.7.2 SCell Activation Delay Requirement for Deactivated SCell

The requirements in this section shall apply for the UE configured with one downlink SCell. The requirements in this section are applicable for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD carrier aggregation. The requirements in this clause are also applicable for EN-DC. The requirements in this clause are also applicable for the UE operating in NE-DC.

The delay within which the UE shall be able to activate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell activation command in subframe *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command as specified in [17] for the SCell being activated no later than in subframe *n*+Nact\_known provided the following conditions are met for the SCell:

- During the period equal to max(5 measCycleSCell, 5 DRX cycles) before the reception of the SCell activation command:

- the UE has sent a valid measurement report for the SCell being activated and

- the SCell being activated remains detectable according to the cell identification conditions specified in section 8.3.3.2,

- SCell being activated also remains detectable during the SCell activation delay according to the cell identification conditions specified in section 8.3.3.2 where

Nact\_known =24;

Nact\_known =23 if the activation command is transmitted on the PDSCH with *ShortProcessingTime*=TRUE;

Nact\_known =22 if the activation command is transmitted on the PDSCH with *ShortTTI-*r15configured;

Otherwise upon receiving the SCell activation command in subframe *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command as specified in [17] for the SCell being activated no later than in subframe *n*+Nact\_unknown provided the SCell can be successfully detected on the first attempt where

Nact\_unknown =34;

Nact\_unknown =33 if the activation command is transmitted on the PDSCH with *ShortProcessingTime*=TRUE;

Nact\_unknown =32 if the activation command is transmitted on the PDSCH with *ShortTTI-*r15 configured;

If there is no reference signal received for the CSI measurement over the delay corresponding to the minimum requirements specified above, then the UE shall report corresponding valid CSI for the activated SCell on the next available uplink reporting resource after receiving the reference signal.

The SCell activation delay specified in this section can be extended with each SRS carrier based switching to any carrier occuring during the SCell activation procedure.

If there are no uplink resources for reporting the valid CSI in subframe *n*+Nact\_known or *n*+Nact\_unknown or uplink transmission is interrupted due to SRS carrier based switching then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

The valid CSI is based on the UE measurement and corresponds to any CQI value specified in [3] with the exception of CQI index = 0 (out of range) provided:

- the conditions in section 7.7 are met over the entire SCell activation delay and

- the conditions for CQI reporting defined in Section 7.2.3 of [3] are met.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in [17] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

When PCell belongs to E-UTRA FDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+9* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+8* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot;

- not occur before subframe *n+2* and not occur after subframe *n+6* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus4set1, proc-Timeline-r15= nplus6set1 or proc-Timeline-r15= nplus6set2;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus8set2,

When PCell belongs to E-UTRA TDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+11* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+10* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+9* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot.

When the UE operating in EN-DC is configured with NR PSCell and NR SCell in SCG, the interruption requirements defined above apply for PCell interruptions specified in clause 7.32.2.5 and NR PSCell and NR SCell interruptions specified in clause 8.2.1.4.2 of TS 38.133 [50].

When the UE is operating in NE-DC and has PSCell and up to one SCell configured in SCG, the interruption requirements defined above apply for PSCell interruptions specified in clause 7.36 and NR PCell and NR SCell interruptions specified TS 38.133 [50].

Starting from the subframe specified in section 4.3 of [3] and until the UE has completed the SCell activation, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for the SCell.

### 7.7.3 SCell Deactivation Delay Requirement for Activated SCell

The requirements in this section shall apply for the UE configured with one downlink SCell. The requirements in this section are applicable for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD carrier aggregation. The requirements in this clause are also applicable for EN-DC. The requirements in this clause are also applicable for the UE operating in NE-DC.

Upon receiving SCell deactivation command or upon expiry of the *sCellDeactivationTimer* in subframe *n*, the UE shall accomplish the deactivation actions specified in [17] for the SCell being deactivated no later than in subframe *n+*Ndeact where

Ndeact =8

Ndeact=7 if the deactivation command is transmitted on the PDSCH with *ShortProcessingTime*=TRUE;

Ndeact =6 if the deactivation command is transmitted on the PDSCH with *ShortTTI-*r15configured;

The SCell deactivation delay specified in this section can be extended with each SRS carrier based switching to any carrier occuring during the SCell deactivation procedure.

When PCell belongs to E-UTRA FDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+9* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+8* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot;

- not occur before subframe *n+2* and not occur after subframe *n+6* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus4set1, proc-Timeline-r15= nplus6set1 or proc-Timeline-r15= nplus6set2;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus8set2,

When PCell belongs to E-UTRA TDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+11* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+10* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+9* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot.

When the UE operating in EN-DC is configured with NR PSCell and NR SCell in SCG, the interruption requirements defined above apply for PCell interruptions specified in clause 7.32.2.5 and NR PSCell and NR SCell interruptions specified in clause 8.2.1.2.4 of TS 38.133 [50].

When the UE is operating in NE-DC and has PSCell and up to one SCell configured in SCG, the interruption requirements defined above apply for PSCell interruptions specified in clause 7.36 and NR PCell and NR SCell interruptions specified in TS 38.133 [50].

### 7.7.4 SCell Activation Delay Requirement for Deactivated SCell with Multiple Downlink SCells

The requirements in this section shall apply for the UE configured with up to six downlink SCells. The requirements in this section are applicable for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD carrier aggregation. The requirements in this clause are also applicable for EN-DC. The requirements in this clause are also applicable for the UE operating in NE-DC.

While activating a SCell if the UE does not receive any command to activate, deactivate, configure or deconfigure any other SCell during the SCell activation delay then the UE shall meet the SCell activation delay requirements specified in section 7.7.2.

While activating a SCell if any other SCell is activated, deactivated, configured or deconfigured by the UE then the UE shall meet the SCell activation delay requirements (Tactivate\_total) according to the following expression:



Where:

Tactivate\_total is the total time to activate a SCell and is expressed in subframes.

Tactivate\_basic is the SCell activation delay specified in section 7.7.2;

Ki (0 ≤ Ki ≤ 3) is the number of times the other ith SCell is activated, deactivated, configured or deconfigured while the SCell is being activated.

N (2≤N≤6) is the maximum number of SCells supported by the UE.

While activating an SCell:

- The interruption on the PCell and/or on the activated SCell due to the SCell activation specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+11* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+10* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+9* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot.

if:

- the PCell and/or the activated SCell being interrupted and the SCell being activated belong to E-UTRA TDD, or

- the activated SCell being interrupted and the SCell being activated belong to E-UTRA FDD and the PCell belongs to E-UTRA TDD.

- Otherwise, the interruption on PCell and/or on the activated SCell due to the SCell activation specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+9* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+8* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot;

- not occur before subframe *n+2* and not occur after subframe *n+6* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus4set1, proc-Timeline-r15= nplus6set1 or proc-Timeline-r15= nplus6set2;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus8set2.

When the UE operating in EN-DC is configured with NR PSCell and NR SCell in SCG, the interruption requirements defined above apply for PCell and SCell interruptions specified in clause 7.32.2.5 and NR PSCell and NR SCell interruptions specified in clause 8.2.1.2.4 of TS 38.133 [50].

When the UE is operating in NE-DC and has PSCell and up to one SCell configured in SCG, the interruption requirements defined above apply for PSCell and SCell interruptions specified in clause 7.36 and NR PCell and NR SCell interruptions specified in TS 38.133 [50].

Starting from the subframe specified in section 4.3 of [3] and until the UE has completed the SCell activation, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for an SCell.

### 7.7.5 SCell Deactivation Delay Requirement for Activated SCell with Multiple Downlink SCells

The requirements in this section shall apply for the UE configured with up to six downlink SCells. The requirements in this section are applicable for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD carrier aggregation. The requirements in this clause are also applicable for EN-DC. The requirements in this clause are also applicable for the UE operating in NE-DC.

The UE shall deactivate a SCell and meet the SCell deactivation delay requirements specified in section 7.7.3 regardless of whether any other SCell is activated, deactivated, configured or deconfigured or not by the UE during the SCell deactivation delay.

While deactivating a SCell:

- The interruption on the PCell and/or on the activated SCell due to the SCell deactivation specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+11* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+10* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+9* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot.

if:

- the PCell and/or the activated SCell being interrupted and the SCell being deactivated belong to E-UTRA TDD or

- the activated SCell being interrupted and the SCell being deactivated belong to E-UTRA FDD and the PCell belongs to E-UTRA TDD.

- Otherwise, the interruption on PCell and/or the activated SCell due to the SCell deactivation specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+9* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+8* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot;

- not occur before subframe *n+2* and not occur after subframe *n+6* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus4set1, proc-Timeline-r15= nplus6set1 or proc-Timeline-r15= nplus6set2;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus8set2.

When the UE operating in EN-DC is configured with NR PSCell and NR SCell in SCG, the interruption requirements defined above apply for PCell and SCell interruptions specified in clause 7.32.2.5 and NR PSCell and NR SCell interruptions specified in clause 8.2.1.2.4 of TS 38.133 [50].

When the UE is operating in NE-DC and has PSCell and up to one SCell configured in SCG, the interruption requirements defined above apply for PSCell and SCell interruptions specified in clause 7.36 and NR PCell and NR SCell interruptions specified in TS 38.133 [50].

### 7.7.6 SCell Activation Delay Requirement for Deactivated PUCCH SCell

The requirements in this section shall apply for the UE configured with one downlink SCell and when PUCCH is configured for the SCell being activated.

If the UE has a valid TA for transmitting on an SCell then the UE shall be able to transmit valid CSI report and apply actions related to the SCell activation command as specified in [17] for the SCell being activated on the PUCCH SCell no later than in subframe *n*+Tactivate\_basic:

Where:

- A TA is considered to be valid provided that the *TimeAlignmentTimer* [2] assocated with the TAG containing the PUCCH SCell is running.

- Tactivate\_basic is the SCell activation delay as defined in section 7.7.2.

If the UE does not have a valid TA for transmitting on an SCell then the UE shall be capable to perform downlink actions related to the SCell activation command as specified in [17] for the SCell being activated on the PUCCH SCell no later than in subframe *n*+Tactivate\_basic and shall be capable to perform uplink actions related to the SCell activation command as specified in [17] for the SCell being activated on the PUCCH SCell no later than in subframe *n*+Tdelay\_PUCCH SCell and shall transmit valid CSI report for the SCell being activated on the PUCCH SCell no later than in subframe *n*+Tdelay\_PUCCH SCell, where:

Tdelay\_PUCCH SCell = Tactivate\_basic + T1 + T2 + T3

Where:

- T1 is the delay uncertainty in acquiring the first available PRACH occasion in the PUCCH SCell. T1 is up to 25 subframes and the actual value of T1 shall depend upon the PRACH configuration used in the PUCCH SCell.

- T2 is the delay for obtaining a valid TA command for the sTAG to which the SCell configured with PUCCH belongs. T2 is up to 13 subframes.

- T3 is the delay for applying the received TA for upling transmission. T3 is 6 subframes.

The above delay requirement (Tdelay\_PUCCH SCell) shall apply provided that:

- The UE has received a PDCCH order to initiate RA procedure on the PUCCH SCell within Tactivate\_basic otherwise additional delay to activate the SCell is expected; and

- The RA on PUCCH SCell is not interrupted by the RA on PCell otherwise additional delay to activate the SCell is expected; and

- No SRS carrier based switching occurs during the SCell activation procedure otherwise the PUCCH SCell activation delay (Tdelay\_PUCCH SCell) can be extended.

The interruption on the PCell specified in section 7.8.2 shall meet all applicable requirements in clause 7.7.2.

### 7.7.7 SCell Activation Delay Requirement for Deactivated PUCCH SCell with Multiple SCells

The requirements in this section shall apply for the UE configured with up to six downlink SCells and when PUCCH is configured for the SCell being activated.

If the UE has a valid TA for transmitting on a PUCCH SCell then the UE shall be able to transmit valid CSI report and apply actions related to the SCell activation command as specified in [17] for the SCell being activated on the PUCCH SCell no later than in subframe *n*+ Tactivate\_total:

Where:

- A TA is considered to be valid provided that the *TimeAlignmentTimer* [2] assocated with the TAG containing the PUCCH SCell is running.

- Tactivate\_total is the SCell activation delay as defined in section 7.7.4.

If the UE does not have a valid TA for transmitting on an SCell then the UE shall be capable to perform downlink actions related to the SCell activation command as specified in [17] for the SCell being activated on the PUCCH SCell no later than in subframe *n*+Tactivate\_basic and shall be capable to perform uplink actions related to the SCell activation command as specified in [17] for the SCell being activated on the PUCCH SCell no later than in subframe *n*+Tdelay\_PUCCH\_multiple\_SCells and shall transmit valid CSI report for the SCell being activated on the PUCCH SCell no later than in subframe *n*+Tdelay\_PUCCH\_multiple\_SCells, where:

Tdelay\_PUCCH multiple\_SCells = Tactivate\_total + T1 + T2 + T3

Where:

- T1, T2 and T3 are defined in section 7.7.6

The above delay requirement (Tdelay\_PUCCH \_multiple\_SCells) shall apply provided that:

- The UE has received a PDCCH order to initiate RA procedure on the PUCCH SCell within Tactivate\_basic otherwise additional delay to activate the SCell is expected; and

- The RA on PUCCH SCell is not interrupted by the RA on PCell otherwise additional delay to activate the SCell is expected; and

- No SRS carrier based switching occurs during the SCell activation procedure otherwise the PUCH SCell activation delay (Tdelay\_PUCCH multiple\_SCells) can be extended.

The interruption on the PCell and/or on the activated SCell specified in section 7.8.2 shall meet all applicable requirements in clause 7.7.4.

### 7.7.8 SCell Deactivation Delay Requirement for Activated PUCCH SCell

The requirements in this section shall apply for the UE configured with one downlink SCell and when PUCCH is configured for the SCell being activated.

The UE shall deactivate a SCell configured with PUCCH and meet the SCell deactivation delay requirements specified in section 7.7.3.

The interruption on the PCell specified in section 7.8.2 shall meet all applicable requirements in clause 7.7.3.

### 7.7.9 SCell Deactivation Delay Requirement for Activated PUCCH SCell with Multiple SCells

The requirements in this section shall apply for the UE configured with up to six downlink SCells and when PUCCH is configured for the SCell being deactivated.

The UE shall deactivate a SCell configured with PUCCH and meet the SCell deactivation delay requirements specified in section 7.7.5.

The interruption on the PCell and/or on the activated SCell specified in section 7.8.2 shall meet all applicable requirements in clause 7.7.5.

### 7.7.10 SCell Activation Delay Requirement for Deactivated SCell under Frame Structure 3

The requirements in this section shall apply for E-UTRA carrier aggregation of one FDD PCell or one TDD PCell and one SCell following the frame structure type 3 [16].

The delay within which the UE shall be able to activate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell activation command in subframe *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command as specified in [17] for the SCell being activated no later than in subframe *n*+Tactivate\_basic\_FS3, provided the following conditions are met for the SCell:

- During the period equal to max(5 measCycleSCell, 5 DRX cycles) before the reception of the SCell activation command:

- the UE has sent a valid measurement report for the SCell being activated and

- the SCell being activated remains detectable according to the cell identification conditions specified in section 8.3.3.2,

- SCell being activated also remains detectable during the SCell activation delay according to the cell identification conditions specified in section 8.3.3.2.

Tactivate\_basic\_FS3 = 16 ms + TDMTC\_duration + (*L*+2) \* TDMTC\_periodicity, where

TDMTC\_duration =6 ms is the DMTC duration [2],

TDMTC\_periodicity is the periodicity of the DMTC [2],

*L* is the number of times the discovery signal occasion is not available at the UE during the SCell activation time.

Otherwise upon receiving the SCell activation command in subframe *n*, the UE shall be capable to transmit a valid CSI report and apply actions related to the activation command as specified in [17] for the SCell being activated no later than in subframe *n*+Tactivate\_basic\_FS3, provided the SCell can be successfully detected on the first attempt. In this case, Tactivate\_basic\_FS3 is defined as follows.

Tactivate\_basic\_FS3 = 16 ms + TDMTC\_duration + (*L*+3) \* TDMTC\_periodicity, where

TDMTC\_duration = 6 ms is the DMTC duration [2],

TDMTC\_periodicity is the periodicity of the DMTC [2],

*L* is the number of times the discovery signal occasion is not available at the UE during the SCell activation time.

If there is no reference signal received for the CSI measurement over the delay corresponding to the minimum requirements specified above, then the UE shall report corresponding valid CSI for the activated SCell on the next available uplink reporting resource after receiving the reference signal.

If there are no uplink resources for reporting the valid CSI in subframe *n*+ Tactivate\_basic\_FS3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

The valid CSI is based on the UE measurement and corresponds to any CQI value specified in [3] with the exception of CQI index = 0 (out of range) provided:

- the conditions in section 7.7 are met over the entire SCell activation delay and

- the conditions for CQI reporting defined in Section 7.2.3 of [3] are met.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in [17] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

When PCell belongs to E-UTRA FDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+9* if the activation command is transmitted on the PDSCH with ShortTTI- r15 not configured and ShortProcessingTime=FALSE;

- not occur before subframe *n+4* and not occur after subframe *n+8* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot;

- not occur before subframe *n+2* and not occur after subframe *n+6* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus4set1, proc-Timeline-r15= nplus6set1 or proc-Timeline-r15= nplus6set2;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus8set2,

When PCell belongs to E-UTRA TDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+11* if the activation command is transmitted on the PDSCH with ShortTTI- r15 not configured and ShortProcessingTime=FALSE;

- not occur before subframe *n+4* and not occur after subframe *n+10* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+9* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot.

Starting from the subframe specified in Section 4.3 of [3] and until the UE has completed the SCell activation, the UE shall send CSI with CQI index = 0 (out of range) if the UE has available uplink resources to report for the SCell.

### 7.7.11 SCell Deactivation Delay Requirement for Activated SCell under Frame Structure 3

The requirements in this section shall apply for the UE configured with one downlink SCell. The requirements in this section shall apply for E-UTRA carrier aggregation of one FDD PCell or one TDD PCell and the SCell following the frame structure type 3 [16].

Upon receiving SCell deactivation command or upon expiry of the *sCellDeactivationTimer* in subframe *n*, the UE shall accomplish the deactivation actions specified in [17] for the SCell being deactivated no later than in subframe *n+8*.

When PCell belongs to E-UTRA FDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+9* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+8* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot;

- not occur before subframe *n+2* and not occur after subframe *n+6* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus4set1, proc-Timeline-r15= nplus6set1 or proc-Timeline-r15= nplus6set2;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus8set2,

When PCell belongs to E-UTRA TDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+11* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+10* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+9* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot.

### 7.7.12 SCell Activation Delay Requirement for Deactivated SCell with Multiple Downlink SCells under Frame Structure 3

While activating a SCell, if any other SCell is activated, deactivated, configured or deconfigured by the UE, the UE shall meet the SCell activation delay requirements (Tactivate\_total\_FS3) according to the following expression:



where

Tactivate\_total\_FS3 is the total time to activate a SCell and is expressed in subframes,

Tactivate\_basic\_FS3\_ is the SCell activation delay for the SCell, as specified in section 7.7.10,

TDMTC\_periodicity is the periodicity of the DMTC [2],

Ki (0 ≤ Ki ≤ 3) is the number of times the other ith SCell is activated, deactivated, configured or deconfigured while the SCell is being activated,

N (2≤N≤4) is the maximum number of SCells supported by the UE.

While activating a SCell:

- When PCell belongs to E-UTRA FCC, the interruption on the PCell and/or on the activated SCell specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+9* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+8* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot;

- not occur before subframe *n+2* and not occur after subframe *n+6* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus4set1, proc-Timeline-r15= nplus6set1 or proc-Timeline-r15= nplus6set2;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus8set2,

- When the PCell belongs to E-UTRA TDD, the interruption on the PCell and/or on the activated SCell specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+11* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+10* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+9* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot.

Starting from the subframe specified in section 4.3 of [3] and until the UE has completed the SCell activation, the UE shall send CSI with CQI index = 0 (out of range) if the UE has available uplink resources to report for the SCell being activated.

### 7.7.13 SCell Deactivation Delay Requirement for Activated SCell with Multiple Downlink SCells under Frame Structure 3

The UE shall deactivate a SCell and meet the SCell deactivation delay requirements specified in section 7.7.11 regardless of whether any other SCell is activated, deactivated, configured or deconfigured or not by the UE during the SCell deactivation delay.

While deactivating a SCell:

- When PCell belongs to E-UTRA FDD, the interruption on the PCell and/or on the activated SCell specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+9* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+8* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot;

- not occur before subframe *n+2* and not occur after subframe *n+6* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus4set1, proc-Timeline-r15= nplus6set1 or proc-Timeline-r15= nplus6set2;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus8set2,

- When PCell belongs to E-UTRA TDD, the interruption on the PCell and/or on the activated SCell specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+11* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+10* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+9* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot.

### 7.7.14 SCell Activation Delay Requirement for Dormant SCell

The requirements in this section shall apply for the UE capable of supporting *dormantSCellState* [2] and configured with one downlink SCell in dormant state. The requirements in this section are applicable for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD carrier aggregation.

The delay within which the UE shall be able to activate the dormant SCell depends upon the specified conditions.

Upon receiving SCell activation command in subframe *n*, the UE shall be ready to receive the downlink grant and apply actions related to the activation command as specified in TS 36.321 [17] for the SCell being activated no later than in subframe *n*+Nact\_dormant provided the following conditions are met for the SCell:

- UE has been periodically sending a valid CQI report for the dormant SCell being activated before the reception of the SCell activation command:

- the SCell being activated remains detectable according to the cell identification conditions specified in section 8.3.3.2,

- MBSFN subframes are not configured in the PCell

- SCell being activated also remains detectable during the SCell activation delay according to the cell identification conditions specified in section 8.3.3.2 where

when PCell belongs to E-UTRAN FDD,

Nact\_dormant = 8;

Nact\_dormant = 7 if the activation command is transmitted on the PDSCH with *ShortProcessingTime*=TRUE;

Nact\_dormant = 6 if the activation command is transmitted on the PDSCH with *ShortTTI-*r15configured;

and when the PCell belongs to E-UTRAN TDD,

Nact\_dormant = 11;

Nact\_dormant = 10 if the activation command is transmitted on the PDSCH with *ShortProcessingTime*=TRUE;

Nact\_dormant = 9 if the activation command is transmitted on the PDSCH with *ShortTTI-*r15configured;

Otherwise, upon receiving the SCell activation command for a dormant SCell, the SCell activation delay requirement as specified by subclause 7.7.2 shall apply to the dormant SCell being activated.

The SCell activation delay specified in this section can be extended with each SRS carrier-based switching to any carrier occuring during the SCell activation procedure.

Scell activation delay and interruption requirements are defined assuming that MBSFN subframe(s) are not configured. Additional delay may be expected if MBSFN subframe(s) are configured.

In addition to the CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 36.321 [17] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

When PCell belongs to E-UTRA FDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+7* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+6* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+5* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot;

- not occur before subframe *n+2* and not occur after subframe *n+4* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus4set1, proc-Timeline-r15= nplus6set1 or proc-Timeline-r15= nplus6set2;

- not occur before subframe *n+3* and not occur after subframe *n+5* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus8set2,

When PCell belongs to E-UTRA TDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+10* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+9* if the activation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+8* if the activation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot.

### 7.7.15 SCell Hibernation Delay Requirement for Activated SCell

The requirements in this section shall apply for the UE capable of supporting *dormantSCellState* [2] and configured with one activated downlink SCell. The requirements in this section are applicable for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD carrier aggregation.

Upon receiving SCell hibernation command or upon expiry of the *sCellHibernationTimer* in subframe *n*, the UE shall accomplish the hibernation actions specified in TS 36.321 [17] for the SCell being hibernated no later than in subframe *n+*Nhibernate where

Nhibernate =8

Nhibernate =7 if the hibernation command is transmitted on the PDSCH with *ShortProcessingTime*=TRUE;

Nhibernate =6 if the hibernation command is transmitted on the PDSCH with *ShortTTI-*r15configured;

The PCell interruption upon receiving the hibernation command specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+9* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+8* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot;

- not occur before subframe *n+2* and not occur after subframe *n+6* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus4set1, proc-Timeline-r15= nplus6set1 or proc-Timeline-r15= nplus6set2;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus8set2,

When PCell belongs to E-UTRA TDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+11* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+10* if the deactivation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+9* if the deactivation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot.

### 7.7.16 SCell Hibernation Delay Requirement for Deactivated SCell

The requirements in this section shall apply for the UE capable of supporting *dormantSCellState* [2] and configured with one downlink SCell. The requirements in this section are applicable for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD carrier aggregation.

The delay within which the UE shall be able to hibernate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell hibernation command in subframe *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command as specified in TS 36.321 [17] for the SCell being in the dormant state no later than in subframe *n*+Nhibernate\_known provided the following conditions are met for the SCell:

- During the period equal to max(5 measCycleSCell, 5 DRX cycles) before the reception of the SCell hibernation command:

- the UE has sent a valid measurement report for the SCell being hibernated and

- the SCell being hibernated remains detectable according to the cell identification conditions specified in section 8.3.3.2,

- SCell being hibernated also remains detectable during the SCell hibernation delay according to the cell identification conditions specified in section 8.3.3.2 where

Nhibernate\_known =24;

Nhibernate\_known =23 if the hibernation command is transmitted on the PDSCH with *ShortProcessingTime*=TRUE;

Nhibernate\_known =22 if the hibernation command is transmitted on the PDSCH with *ShortTTI-*r15configured;

Otherwise upon receiving the SCell hibernation command in subframe *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the hibernation command as specified in TS 36.321 [17] for the SCell being in the dormant state no later than in subframe *n*+ Nhibernate\_unknown provided the SCell can be successfully detected on the first attempt where

Nhibernate\_unknown =34;

Nhibernate\_unknown =33 if the hibernation command is transmitted on the PDSCH with *ShortProcessingTime*=TRUE;

Nhibernate\_unknown =32 if the hibernation command is transmitted on the PDSCH with *ShortTTI-*r15 configured;

If there is no reference signal received for the CSI measurement over the delay corresponding to the minimum requirements specified above, then the UE shall report corresponding valid CSI for the dormant SCell on the next available uplink reporting resource after receiving the reference signal.

The SCell hibernation delay specified in this section can be extended with each SRS carrier based switching to any carrier occuring during the SCell activation procedure.

If there are no uplink resources for reporting the valid CSI in subframe *n*+ Nhibernate\_known or *n*+ Nhibernate\_unknown or uplink transmission is interrupted due to SRS carrier based switching then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

The valid CSI is based on the UE measurement and corresponds to any CQI value specified in TS 36.213 [3] with the exception of CQI index = 0 (out of range) provided:

- the conditions in section 7.7 are met over the entire SCell hibernation delay and

- the conditions for CQI reporting defined in Section 7.2.3 of TS 36.213 [3] are met.

In addition to CSI reporting defined above, UE shall also apply other actions related to the hibernation command specified in TS 36.321 [17] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

When PCell belongs to E-UTRA FDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+9* if the hibernation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+8* if the hibernation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the hibernation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot;

- not occur before subframe *n+2* and not occur after subframe *n+6* if the hibernation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus4set1, proc-Timeline-r15= nplus6set1 or proc-Timeline-r15= nplus6set2;

- not occur before subframe *n+3* and not occur after subframe *n+7* if the hibernation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=subslot and *proc-Timeline-r15*= nplus8set2,

When PCell belongs to E-UTRA TDD, the PCell interruption specified in section 7.8.2 shall

- not occur before subframe *n+5* and not occur after subframe *n+11* if the hibernation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=FALSE*;

- not occur before subframe *n+4* and not occur after subframe *n+10* if the hibernation command is transmitted on the PDSCH with *ShortTTI- r15* not configured and *ShortProcessingTime=TRUE*;

- not occur before subframe *n+3* and not occur after subframe *n+9* if the hibernation command is transmitted on the PDSCH with *dl-STTI-Length-r15*=slot.

Starting from the subframe specified in section 4.3 of TS 36.213 [3] and until the UE has completed the SCell hibernation, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for the SCell.

### 7.7.17 SCell Deactivation Delay Requirement for Dormant SCell

The requirements in this section shall apply for the UE capable of supporting *dormantSCellState* [2] and configured with one dormant downlink SCell. The requirements in this section are applicable for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD carrier aggregation.

The SCell deactivation delay of the dormant SCell shall meet the requirement as specified in sub-clauses 7.7.3.

### 7.7.18 Direct SCell Activation and Hibernation Delay Requirement

The requirements in this section are applicable for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD carrier aggregation.

If the parameter *sCellState* is set to *activated* for the SCell within RRC reconfiguration message [2] then the UE capable of the direct SCell activation shall configure that SCell in activated state upon successful completion of the RRC reconfiguration procedure within the specified delay. If the parameter *sCellState* is set to *dormant* for the SCell within RRC reconfiguration message [2] then the UE capable of the direct SCell hibernation shall configure that SCell in dormant state upon successful completion of the RRC reconfiguration procedure within the specified delay. The UE capable of the direct SCell activation shall support direct activation to active state within *Ndirect* for at least 1 inter-band SCell or 1 intra-band SCell. The UE capable of the direct SCell hibernation shall support direct hibernation to dormant state within *Ndirect* for at least 1 inter-band SCell or 1 intra-band SCell.

The delay within which the UE shall be able to configure one or more direct configured SCells in activated or dormant state depends upon the specified conditions.

Upon receiving directly activated or directly hibernated SCell configuration in subframe *n*, the UE shall be capable to transmit valid CSI report and apply actions as specified in [17] for the directly activated or directly hibernated SCell no later than in subframe *n*+*Ndirect*

Where:

*Ndirect* = *TRRC\_Process* +*T1* + *Ttime\_direct*

*TRRC\_Process*: It is the RRC procedure delay defined in section 11.2 of TS 36.331 [2],

*T1*: Delay from subframe n+ *TRRC\_Process* until the transmission of RRCConnectionReconfigurationComplete message

Note: *T1* is UE implementation dependent.

*Ttime\_direct* is the direct SCell activation delay.

If the SCell is known, then *Ttime\_direct* is 20ms. If the SCell is unknown, then *Ttime\_direct* is 30ms provided the SCell can be successfully detected on the first attempt.

The SCell is known provided the following conditions are met for the SCell:

- During the last 5 seconds before the reception of the direct SCell configuration command:

- the UE has sent a valid measurement report for the SCell being directly activated or directly hibernated, and

- the SCell being directly activated or directly hibernated remains detectable according to the cell identification conditions specified in section 8.3.3.2,

- SCell being directly activated or directly hibernated also remains detectable during the SCell activation delay according to the cell identification conditions specified in section 8.3.3.2

Otherwise, the SCell is unknown.

The UE capable of the direct SCell activation shall support direct activation of up to 2 SCell(s). The UE capable of the direct SCell hibernation shall support direct hibernation of up to 2 SCell(s). If more than one SCells are directly activated simultaneously to active state or directly hibernated simultaneously to dormant state, the direct activation or hibernation delay requirements shall be fulfilled for at least one of the SCells being directly activated or hibernated, and additional relaxation in the activation delay or hibernation delay is allowed for the rest of SCells being directly activated or hibernated simultaneously. Upon receiving the RRC reconfiguration message in subframe *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the RRC reconfiguration of *j*th SCell (*j* > 1) in dormant or activated state as specified in [17] no later than in subframe *n*+ *Ndirect* + (*j*-1)\**Ttime\_direct* provided the SCell can be successfully detected on the first attempt.

Where:

- *j* (1 < *j* ≤ *M*) denotes the index of SCell indicated in the RRC reconfiguration message, where *M* is the number of SCells included in the RRC reconfiguration message and shall not exceed the maximum number of SCells supported by the UE, *N*.

If there is no reference signal received for the CSI measurement over the delay corresponding to the minimum requirements specified above, then the UE shall report corresponding valid CSI for the activated SCell or hibernated SCell on the next available uplink reporting resource after receiving the reference signal.

If there are no uplink resources for reporting the valid CSI in subframe *n*+ *Ndirect* + (*j*-1)\**Ttime\_direct* for the j-th SCells being activated or hibernated or uplink transmission is interrupted due to SRS carrier-based switching, then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

The valid CSI is based on the UE measurement and corresponds to any CQI value specified in [3] with the exception of CQI index = 0 (out of range) provided:

- the conditions in section 7.7 are met over the entire SCell activation delay and

- the conditions for CQI reporting defined in Section 7.2.3 of [3] are met.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation or hibernation command specified in [17] for an SCell at the first opportunities for the corresponding actions once the SCell is activated or hibernated.

The SCell direct activation delay and direct hibernation delay specified in this section can be extended if SRS carrier-based switching occurs during the SCell direct activation or direct hibernation procedure.

If the UE is configured with only PCell then the interruption shall occur on PCell due to the direct SCell activation or hibernation of the j-th SCell as follows:

- When PCell belongs to E-UTRA FDD, the PCell interruption specified in section 7.8.2 shall not occur before subframe *n*+*TRRC\_Process* +T1 + (*j*-1)\**Ttime\_direct* and not occur after subframe *n*+*TRRC\_Process* +T1 + *Tinterupt\_window* + (*j*-1)\**Ttime\_direct*, where *Tinterupt\_window* = 5 ms.

- When PCell belongs to E-UTRA TDD, the PCell interruption specified in section 7.8.2 shall not occur before subframe *n*+*TRRC\_Process* +T1 + (*j*-1)\**Ttime\_direct* and not occur after subframe *n*+*TRRC\_Process* +T1 + *Tinterupt\_window* + (*j*-1)\**Ttime\_direct*, where *Tinterupt\_window* = 7 ms.

If the UE is configured with at least one SCell in activated state then the interruption shall occur on PCell and on all the SCells in activated state due to the direct SCell activation or hibernation of the j-th SCell as follows:

- The interruption on the PCell and/or on the SCell in activated state shall not occur before subframe *n*+*TRRC\_Process* +T1 + (*j*-1)\**Ttime\_direct* and not occur after subframe *n*+*TRRC\_Process* +T1 + *Tinterupt\_window* + (*j*-1)\**Ttime\_direct* if:

- the PCell and/or the SCell in activated state being interrupted and the SCell being configured in activated state belong to E-UTRA TDD, where *Tinterupt\_window* = 7 ms, or

- the the SCell in activated state being interrupted and the SCell being configured in activated or dormant state belong to E-UTRA FDD and the PCell belongs to E-UTRA TDD, where *Tinterupt\_window*=7ms.

- Otherwise, the interruption on PCell and/or on the SCell in activated or dormant state shall not occur before subframe *n*+*TRRC\_Process* +T1 + (*j*-1)\**Ttime\_direct* and not occur after subframe *n*+*TRRC\_Process* +T1 + *Tinterupt\_window* + (*j*-1)\**Ttime\_direct*, where *Tinterupt\_window* = 5 ms.

Starting from the subframe n+ *TRRC\_Process* +*T1* until the UE has completed the direct SCell activation to activated state or the direct SCell hibernation to dormant state, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for the SCell.

### 7.7.19 Direct SCell Activation and Hibernation Delay Requirement at RRC Reconfiguration during Handover

The requirements in this section are applicable for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD carrier aggregation. The requirements apply for when the parameter *sCellState* is included to indicate the direct SCell activation is received in a handover command.

The requirements in this section apply for normal handover.

*Editor’s Note: Requirements for RACH-less handover, Make-before-break handover and combined make-before break and RACH-less handover are FFS.*

If the parameter *sCellState* is set to *activated* for the SCell within RRC reconfiguration message [2] then the UE capable of the direct SCell activation shall configure that SCell in activated state upon successful completion of the RRC reconfiguration procedure within the specified delay. If the parameter *sCellState* is set to *dormant* for the SCell within RRC reconfiguration message [2] then the UE capable of the direct SCell hibernation shall configure that SCell in dormant state upon successful completion of the RRC reconfiguration procedure within the specified delay. The UE capable of the direct SCell activation shall support direct activation or direct hibernation of one SCell within *Ndirect.* for at least 1 inter-band SCell or 1 intra-band SCell. The UE capable of the direct SCell hibernation shall support direct hibernation to dormant state within *Ndirect* for at least 1 inter-band SCell or 1 intra-band SCell.

The delay within which the UE shall be able to configure one or more direct configured SCells in activated or dormant state depends upon the specified conditions.

Upon receiving a handover command including directly activated or directly hibernated SCell configuration in subframe *n*, the UE shall be capable to transmit valid CSI report and apply actions as specified in TS 36.321 [17] for the directly activated or directly hibernated SCell no later than in subframe *n*+*Ndirect*

where:

*Ndirect* = *TRRC\_process + Tinterrupt + T2 + T3 + Ttime\_direct*

*TRRC\_Process* =20ms which is the RRC procedure delay defined for SCell addition in section 11.2 of TS 36.331 [2],

*Tinterrupt* is the interruption time as defined in subclause 5.1.2.1.2.

*T2* is the delay for obtaining a valid TA command for the target PCell from the target PCell and the scheduling grant for sending valid CSI report in the target PCell. T2 is up to 13 subframes.

*T3* is the delay for applying the received TA for upling transmission in the target PCell, and greater than or equal to 6 subframes.

*Ttime\_direct* is the direct SCell activation delay.

If the SCell is known, then *Ttime\_direct* is 20ms. If the SCell is unknown, then *Ttime\_direct* is 30ms provided the SCell can be successfully detected on the first attempt.

The SCell is known provided the following conditions are met for the SCell:

- During the last 5 seconds before the reception of the handover including the direct SCell configuration command:

- the UE has sent a valid measurement report for the SCell being directly activated or directly hibernated, and

- the SCell being directly activated or directly hibernated remains detectable according to the cell identification conditions specified in section 8.3.3.2,

- SCell being directly activated or directly hibernated also remains detectable during the SCell activation delay according to the cell identification conditions specified in section 8.3.3.2

Otherwise, the SCell is unknown.

The UE capable of the direct SCell activation shall support direct activation in handover command of up to 2 SCell(s). The UE capable of the direct SCell hibernation shall support direct hibernation in handover command of up to 2 SCell(s). If the handover command includes that more than one SCells are directly activated simultaneously to active state or directly hibernated simultaneously to dormant state, the direct activation or hibernation delay requirements shall be fulfilled for at least one of the SCells being directly activated or hibernated, and additional relaxation in the activation delay or hibernation delay is allowed for the rest of SCells being directly activated or hibernated simultaneously. Upon receiving the handover command message in subframe *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the RRC reconfiguration of *j*th SCell (*j* > 1) in dormant or activated state as specified in TS 36.321 [17] no later than in subframe *n*+ *Ndirect* + (*j*-1)\**Ttime\_direct* provided the SCell can be successfully detected on the first attempt.

Where:

*- j* (1 < *j* ≤ *M*) denotes the index of SCell indicated in the handover command message, where *M* is the number of SCells included in the handover command message and shall not exceed the maximum number of SCells supported by the UE, *N*.

If there is no reference signal received for the CSI measurement over the delay corresponding to the minimum requirements specified above, then the UE shall report corresponding valid CSI for the activated SCell or hibernated SCell on the next available uplink reporting resource after receiving the reference signal.

If there are no uplink resources for reporting the valid CSI in subframe *n*+ *Ndirect* for the first SCell being activated or hibernated, or *n*+ *Ndirect* + (*j*-1)\**Ttime\_direct* for the j-th SCells being activated or hibernated, or uplink transmission is interrupted due to SRS carrier-based switching, then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

The valid CSI is based on the UE measurement and corresponds to any CQI value specified in TS 36.213 [3] with the exception of CQI index = 0 (out of range) provided:

- the conditions in section 7.7 are met over the entire SCell activation delay and

- the conditions for CQI reporting defined in Section 7.2.3 of TS 36.213 [3] are met.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation or hibernation command specified in TS 36.321 [17] for an SCell at the first opportunities for the corresponding actions once the SCell is activated or hibernated.

The SCell direct activation delay and direct hibernation delay specified in this section can be extended if SRS carrier-based switching occurs during the SCell direct activation or direct hibernation procedure.

Any interruption on PCell due to the direct SCell activation or hibernation of the first SCell shall occur as follows:

- When PCell belongs to E-UTRA FDD, the PCell interruption specified in section 7.8.2 shall not occur before subframe *n*+*TRRC\_Process* + *Tinterrupt + T2 + T3* and not occur after subframe *n*+*TRRC\_Process* + *Tinterrupt + T2 + T3 + Tinterupt\_window*, where *Tinterupt\_window* = 5 ms.

- When PCell belongs to E-UTRA TDD, the PCell interruption specified in section 7.8.2 shall not occur before subframe *n*+*TRRC\_Process* + *Tinterrupt + T2 + T3* and not occur after subframe *n*+*TRRC\_Process* + *Tinterrupt + T2 + T3 + Tinterupt\_window*, where *Tinterupt\_window* = 5 ms.

If the UE is configured with more than one SCell in activated or hibernation state, any interruption on PCell and on all the SCells in activated state due to the direct SCell activation or hibernation of the j-th SCell shall occur as follows:

- The interruption on the PCell and/or on the SCell in activated state shall not occur before subframe *n*+*TRRC\_Process* + *Tinterrupt + T2 + T3* + (*j*-1)\**Ttime\_direct* and not occur after subframe *n*+*TRRC\_Process* + *Tinterrupt + T2 + T3 + Tinterupt\_window* + (*j*-1)\**Ttime\_direct* if:

- the PCell and/or the SCell in activated state being interrupted and the SCell being configured in activated state belong to E-UTRA TDD, where *Tinterupt\_window*=7ms, or

- the the SCell in activated state being interrupted and the SCell being configured in activated or dormant state belong to E-UTRA FDD and the PCell belongs to E-UTRA TDD, where *Tinterupt\_window* = 7 ms.

- Otherwise, the interruption on PCell and/or on the SCell in activated or dormant state shall not occur before subframe *n*+*TRRC\_Process* + *Tinterrupt + T2 + T3* + (*j*-1)\**Ttime\_direct* and not occur after subframe *n*+*TRRC\_Process* + *Tinterrupt + T2 + T3 + Tinterupt\_window* + (*j*-1)\**Ttime\_direct*, where *Tinterupt\_window* = 5 ms.

Starting from the subframe n+ *TRRC\_Process* *+ Tinterrupt + T2 + T3 + Tinterupt\_window* until the UE has completed the direct SCell activation to activated state or the direct SCell hibernation to dormant state, the UE shall report CQI index = 0 (out of range), provided that the UE has available uplink resources to report CQI for the SCell.

## 7.8 Interruptions with Carrier Aggregation

### 7.8.1 Introduction

This section contains the requirements related to the interruptions on PCell and activated SCell if configured, when up to six SCells are configured, deconfigured, hibernated, activated, dormant or deactivated, or when SRS carrier based switching is performed between the configured component carriers. Unless explicitly stated otherwise, the requirements in Section 7.8 shall apply for:

- E-UTRA FDD CA,

- E-UTRA TDD CA,

- E-UTRA TDD-FDD CA,

- inter-band CA where PCell is FDD or TDD and all the SCells are following the frame structure type 3 [16],

- E-UTRA CA where at least one SCell is FeMBMS/Unicast-mixed SCell.

A UE causing interruptions during measurements on deactivated SCC shall indicate to the network a need for an interruption control pattern.

Note: interruptions at SCell addition and release, activation, deactivation and hibernation and during measurements on SCC may not be required by all UEs.

Note: interruptions during SRS carrier based switching between the configured component carriers may not be required by all UEs.

Editor’s Note: The interruptions shall not interrupt RRC signalling or ACK/NACKs related to RRC reconfiguration procedure [2] for SCell addition, release and hibernation or MAC control signalling [17] for SCell activation, deactivation and hibernation command. How to specify this is FFS.

### 7.8.2 Requirements

#### 7.8.2.1 Interruptions at SCell addition/release for intra-band CA

When an intra-band SCell is added or released as defined in [2] the UE is allowed an interruption of up to 5 subframes on PCell during the RRC reconfiguration procedure [2]. This interruption is for both uplink and downlink of PCell.

#### 7.8.2.2 Interruptions at SCell addition/release for inter-band CA

When an inter-band SCell is added or released as defined in [2] the UE that requires interruption is allowed an interruption of up to 1 subframe on PCell during the RRC reconfiguration procedure [2]. This interruption is for both uplink and downlink of PCell.

#### 7.8.2.3 Interruptions at SCell activation/deactivation for intra-band CA

When an intra-band SCell is activated or deactivated as defined in [17] the UE is allowed an interruption of up to 5 subframes on PCell during the activation/deactivation delay defined in Section 7.7. This interruption is for both uplink and downlink of PCell.

#### 7.8.2.4 Interruptions at SCell activation/deactivation for inter-band CA

When an inter-band SCell is activated or deactivated as defined in [17] the UE that requires interruption is allowed an interruption of up to 1 subframe on PCell during the activation/deactivation delay defined in Section 7.7. This interruption is for both uplink and downlink of PCell.

#### 7.8.2.5 Interruptions during measurements on SCC for intra-band CA

If the UE supports ncsg-r14 and has been configured with gap pattern with ID 0,1 and there is no inter-frequency and inter-RAT frequency layer to be monitored, the UE shall not make any autonomous interruptions outside of the configured gap patterns.

PCell interruptions due to measurements on SCC when the SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] is 640 ms or longer.

If indicated by the network using IE *allowInterruptions* [2], PCell interruptions due to measurements on SCC when the SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK regardless of the configured *measCycleSCell* [2].

Each interruption shall not exceed 5 subframes.

#### 7.8.2.6 Interruptions during measurements on SCC for inter-band CA

If the UE supports ncsg-r14 and has been configured with NCSG pattern with ID 0,1,2,3, the UE shall not make any autonomous interruptions outside of the configured gap patterns.

If the UE has been configured with gap pattern with ID 0,1 and there is no inter-frequency and inter-RAT frequency layer to be monitored, the UE shall not make any autonomous interruptions outside of the configured gap patterns.If the UE does not support ncsg-r14 or has not been configured with gap pattern with ID 0,1 or NCSG pattern with ID 0,1,2,3 or the UE has been configured with gap pattern with ID 0,1 to monitor inter-frequency/inter-RAT frequency layers, PCell interruptions due to measurements on SCC when the SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] is 640 ms or longer.

If the UE does not support ncsg-r14 or has not been configured with gap pattern with ID 0,1 or NCSG pattern with ID 0,1,2,3 or the UE has been configured with gap pattern with ID 0,1 to monitor inter-frequency/inter-RAT frequency layers, and if indicated by the network using IE *allowInterruptions* [2], PCell interruptions due to measurements on SCC when the SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK regardless of the configured *measCycleSCell* [2].

Each interruption shall not exceed 1 subframe.

#### 7.8.2.7 Interruptions at SCell addition/release with multiple downlink SCells

When any number of SCells between one and six is added or released using the same *RRCConnectionReconfiguration* message as defined in [2], the UE is allowed an interruption on PCell and on any activated SCell during the RRC reconfiguration procedure as follows:

- an interruption on PCell:

- of up to 1 subframe, if the PCell is not in the same band as any of the SCells being added or released, or

- of up to 5 subframes, if the PCell is in the same band as any of the SCells being added or released;

- an interruption on any activated SCell:

- of up to 1 subframe, if the activated SCell is not in the same band as any of the SCells being added or released, or

- of up to 5 subframes, if the activated SCell is in the same band as any of the SCells being added or released.

#### 7.8.2.8 Interruptions at SCell activation/deactivation with multiple downlink SCells

When any number of SCells between one and six is activated or deactivated using the same MAC control element as defined in [17], the UE is allowed an interruption on PCell and on any activated SCell during the SCell activation/deactivation procedure [17] as follows:

- an interruption on PCell:

- of up to 1 subframe, if the PCell is not in the same band as any of the SCells being activated or deactivated, or

- of up to 5 subframes, if the PCell is in the same band as any of the SCells being activated or deactivated;

- an interruption on any activated SCell:

- of up to 1 subframe, if the activated SCell is not in the same band as any of the SCells being activated or deactivated, or

- of up to 5 subframes, if the activated SCell is in the same band as any of the SCells being activated or deactivated.

#### 7.8.2.9 Interruptions during measurements on SCC with multiple downlink SCells

If the PCell is not in the same band as any of the SCells being activated or deactivated and if the UE supports ncsg-r14 and has been configured with NCSG pattern with ID 0,1,2,3, the UE shall not make any autonomous interruptions outside of the configured gap patterns.

If the PCell is not in the same band as any of the SCells being activated or deactivated and if the UE has been configured with gap pattern with ID 0,1 and there is no inter-frequency and inter-RAT frequency layer to be monitored, the UE shall not make any autonomous interruptions outside of the configured gap patterns.

If the PCell is in the same band as any of the SCells being activated or deactivated or if the UE does not support ncsg-r14 or has not been configured with gap pattern with ID 0,1 or NCSG pattern with ID 0,1,2,3 or the UE has been configured with gap pattern with ID 0,1 to monitor inter-frequency/inter-RAT frequency layers, when one SCell is deactivated, the UE is allowed due to measurements on the SCC with deactivated SCell:

- an interruption on PCell with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] for the deactivated SCell is 640 ms or longer.

- an interruption on PCell with up to 0.5% probability of missed ACK/NACK regardless of the configured *measCycleSCell* [2]for the deactivated SCell if indicated by the network using IE *allowInterruptions* [2],

Each interruption shall not exceed:

- 1 subframes if the PCell is not in the same band as the deactivated SCell

- 5 subframes if the PCell is in the same band as the deactivated SCell

- an interruption on any activated SCell with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] for the deactivated SCellis 640 ms or longer.

- an interruption on any activated SCell with up to 0.5% probability of missed ACK/NACK regardless of the configured *measCycleSCell* [2]for the deactivated SCell if indicated by the network using IE *allowInterruptions* [2].

Each interruption shall not exceed:

- 1 subframes if the activated SCell is not in the same band as the deactivated SCell

- 5 subframes if the activated SCell is in the same band as the deactivated SCell

If the PCell is in the same band as any of the SCells being activated or deactivated or if the UE does not support ncsg-r14 or has not been configured with gap pattern with ID 0,1 or NCSG pattern with ID 0,1,2,3 or the UE has been configured with gap pattern with ID 0,1 to monitor inter-frequency/inter-RAT frequency layers, when two, three, four, five, or six SCells are deactivated, the UE is allowed due to measurements on the SCCs with deactivated SCells:

- an interruption on PCell with up to 0.5% probability of missed ACK/NACK when any of the configured *measCycleSCell* [2] for the deactivated SCellsis 640 ms or longer.

- an interruption on PCell with up to 0.5% probability of missed ACK/NACK regardless of the configured *measCycleSCell* [2]for the deactivated SCells if indicated by the network using IE *allowInterruptions* [2].

- an interruption on an activated SCell with up to 0.5% probability of missed ACK/NACK when any of the configured *measCycleSCell* [2] for the deactivated SCellsis 640 ms or longer.

- an interruption on an activated SCell with up to 0.5% probability of missed ACK/NACK regardless of the configured *measCycleSCell* [2]for the deactivated SCells if indicated by the network using IE *allowInterruptions* [2].

Each interruption on the PCell shall not exceed:

- 1 subframes if the PCell is not in the same band as any of the deactivated SCells

- 5 subframes if the PCell is in the same band as any of the deactivated SCells

Each interruption on the activated Cell shall not exceed:

- 1 subframe if the activated SCell is not in the same band as any of the deactivated SCells

- 5 subframes if the the activated SCell is in the same band as any of the deactivated SCells

#### 7.8.2.10 Interruptions at overlapping addition/release/activation/deactivation of SCells

If a UE is commanded by the network to sequentially add/release/activate/deactivate SCells, and a new procedure of addition/release/activation/deactivation of SCell(s) takes place before the completion of previous procedure of addition/release/activation/deactivation of SCell(s), the interruptions on PCell due to sequential addition/release/activation/deactivation of SCells shall not exceed the sum of the allowed interruptions on the PCell caused by each of the addition/release/activation/deactivation procedures, and the interruptions on already activated SCell due to sequential addition/release/activation/deactivation of SCells shall not exceed the sum of the allowed interruptions on the SCell caused by each of the addition/release/activation/deactivation procedures, as defined in above sections.

#### 7.8.2.11 Interruptions during RSSI measurements on one SCC under Frame Structure 3

PCell interruptions due to RSSI measurements on SCC when the SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when any of the configured *rmtc-Period* [2] and *measCycleSCell* [2] is 640 ms or longer.

Each allowed interruption on the PCell shall not exceed 1 subframe.

#### 7.8.2.12 Interruptions during RSSI measurements on multiple SCCs under Frame Structure 3

If the UE supports ncsg-r14 and has been configured with NCSG pattern with ID 0,1,2,3, the UE shall not make any autonomous interruptions outside of the configured gap patterns.

If the UE has been configured with gap pattern with ID 0,1 and there is no inter-frequency and inter-RAT frequency layer to be monitored, the UE shall not make any autonomous interruptions outside of the configured gap patterns.

If the UE does not support ncsg-r14 or has not been configured with gap pattern with ID 0,1 or NCSG pattern with ID 0,1,2,3 or the UE has been configured with gap pattern with ID 0,1 to monitor inter-frequency/inter-RAT frequency layers, and if one SCell is deactivated,

- the UE is allowed due to RSSI measurements on the SCC with deactivated SCell:

- an interruption on PCell with up to 0.5% probability of missed ACK/NACK when any of the configured *rmtc-Period* [2] and the configured *measCycleSCell* [2] for the deactivated SCell is 640 ms or longer,

- an interruption on any activated SCell with up to 0.5% probability of missed ACK/NACK when any of the configured *rmtc-Period* [2] and the configured *measCycleSCell* [2] for the deactivated SCellis 640 ms or longer.

- no interruption is allowed if both of the configured *rmtc-Period* [2] and the configured *measCycleSCell* [2] for the deactivated SCellare below 640 ms.

If the UE does not support ncsg-r14 or has not been configured with gap pattern with ID 0,1 or NCSG pattern with ID 0,1,2,3 or the UE has been configured with gap pattern with ID 0,1 to monitor inter-frequency/inter-RAT frequency layers and if two, three, four, five, or six SCells are deactivated,

- the UE is allowed due to RSSI measurements on the SCCs with deactivated SCells:

- an interruption on PCell with up to 0.5% probability of missed ACK/NACK when:

any of the configured *rmtc-Period* [2] and the configured *measCycleSCell* [2] for the deactivated SCellsis 640 ms or longer, or

RSSI windows with the length of *measDuration* [2] for at least some of the SCCs with the deactivated SCells within their respective *rmtc-Period* [2] are not within 20 ms;

- an interruption on an activated SCell with up to 0.5% probability of missed ACK/NACK when:

any of the configured *rmtc-Period* [2] and the configured and the configured *measCycleSCell* [2] for the deactivated SCellsis 640 ms or longer, or

RSSI windows with the length of *measDuration* [2] for at least some of the SCCs with the deactivated SCells within their respective *rmtc-Period* [2] are not within 20 ms.

- no interruption is allowed if both of the configured *rmtc-Period* [2] and the configured *measCycleSCell* [2] for the deactivated SCellare below 640 ms and RSSI windows with the length of *measDuration* [2] for all the SCCs with the deactivated SCells within their respective *rmtc-Period* [2] are within 20 ms.

Each allowed interruption shall not exceed:

- 1 subframe on the PCell, and

- 5 subframes on the activated SCell.

#### 7.8.2.13 Interruptions at SRS carrier based switching

A PUSCH-less SCC is a TDD SCC without PUCCH/PUSCH configured. When a UE needs to transmit periodic or aperiodic SRS [16] and/or non-contention based PRACH on a PUSCH-less SCC, the UE can perform carrier based switching to one or more PUSCH-less SCCs from a CC with PUSCH or from another PUSCH-less SCC prior to transmitting SRS and/or PRACH, provided that:

- switching is from a configured CC to another activated TDD CC;

- the PUSCH-less SCCs to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission or configured via RRC [2] for periodic SRS transmission or indicated by PDCCH for PRACH;

- the serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex [2];

- the SRS switching is not colliding with any other transmission with higher priority defined in [3];

- the SRS switching is not colliding with PDCCH in subframe 0 and 5 as specified in [3];

- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 36.331 [2], and is compliant to the requirements for inter-band CA with uplink in one E-UTRA band and without simultaneous Rx/Tx specified in TS 36.101 [5], the SRS or RACH transmission are not simultaneously scheduled with DL subframe #0 or DL subframe #5 on other CCs.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

The interruption on PCC and each of the activated SCCs during the switching to the PUSCH-less SCC shall not exceed 2 subframes including the first subframe where SRS transmission is configured on the PUSCH-less SCC.

The interruption on PCC and each of the activated SCCs during the switching from the PUSCH-less SCC shall not exceed 2 subframes including the last subframe where SRS transmission is configured on the PUSCH-less SCC.

#### 7.8.2.14 Interruptions at SCell activation and deactivation of dormant SCell for intra-band CA

When an intra-band FDD dormant SCell is activated and deactivated as defined in TS 36.321 [17] the UE capable of supporting *dormantSCellState* [2] is allowed an interruption of up to 2 subframes on PCell during the activation and deactivation defined in Section 7.7, provided that MBSFN subframes are not configured in the PCell. This interruption is for both uplink and downlink of PCell.

When an intra-band TDD dormant SCell is activated and deactivated as defined in TS 36.321 [17] the UE capable of supporting *dormantSCellState* [2] is allowed an interruption of up to 5 subframes on PCell during the activation and deactivation defined in Section 7.7, provided that MBSFN subframes are not configured in the PCell. This interruption is for both uplink and downlink of PCell.

#### 7.8.2.15 Interruptions at SCell activation and deactivation of dormant SCell for inter-band CA

When an inter-band dormant SCell is activated and deactivation as defined in TS 36.321 [17] the UE that is capable of supporting *dormantSCellState* [2] and requires interruption is allowed an interruption of up to 1 subframe on PCell during the activation and deactivation defined in Section 7.7. This interruption is for both uplink and downlink of PCell.

#### 7.8.2.16 Interruptions at SCell activation and deactivation of multiple dormant SCells

When any number of SCells in a dormant state between one and six is activated or deactivated using the same MAC control element as defined in TS 36.321 [17], the UE capable of supporting *dormantSCellState* [2] is allowed an interruption on PCell and on any activated SCell during the SCell activation and deactivation procedure [17] as follows:

- an interruption on PCell:

- of up to 1 subframe, if the PCell is not in the same band as any of the SCells being activated or deactivated, or

- of up to 2 subframes, if the PCell is in the same band as any of the FDD SCells being activated or deactivated, and the PCell is not configured with the MBSFN subframes;

- of up to 5 subframes, otherwise.

- an interruption on any activated SCell:

- of up to 1 subframe, if the activated SCell is not in the same band as any of the SCells being activated or deactivated, or

- of up to 2 subframes, if the activated SCell is in the same band as any of the FDD SCells being activated or deactivated and the activated SCell is not configured with the MBSFN subframes.

- of up to 5 subframes, otherwise.

#### 7.8.2.17 Interruptions during CQI measurement on dormant SCell

For a UE capable of supporting *dormantSCellState* [2] and configured with one or more number of dormant SCell(s), an interruption on PCell or any activated SCell(s) due to the periodic CQI measurements of the dormant SCell(s) is allowed with up to 0.5% probability of missed ACK/NACK.

Each interruption shall not exceed

- 1 subframe, if the PCell or the activated SCell is not in the same band as any of the dormant SCells, or

- 2 subframes, if the PCell or the activated SCell is in the same band as any of the FDD dormant SCells, and the PCell or the activated SCell is not configured with the MBSFN subframes;

- 5 subframes, otherwise.

The interruption is for both uplink and downlink of PCell and activated SCell(s).

#### 7.8.2.18 Interruptions during RRM measurement on dormant SCell for intra-band CA

For a UE capable of supporting *dormantSCellState* [2] and configured with one or more number of dormant SCell(s), an interruption on PCell or any activated SCell(s) due to measurements of a dormant SCell(s) is allowed with up to 0.5% probability of missed ACK/NACK.

Each interruption shall not exceed

- 1 subframe, if the PCell or the activated SCell is not in the same band as any of the dormant SCells, or

- 2 subframes, if the PCell or the activated SCell is in the same band as any of the FDD dormant SCells, and the PCell or the activated SCell is not configured with the MBSFN subframes;

- 5 subframes, otherwise.

The interruption is for both uplink and downlink of PCell and activated SCell(s).

#### 7.8.2.19 Interruptions during RRM measurement on dormant SCell for inter-band CA

For a UE capable of supporting *dormantSCellState* [2] and configured with one or more number of dormant SCell(s), an interruption on PCell or any activated SCell(s) due to measurements of a dormant SCell(s) is allowed with up to 0.5% probability of missed ACK/NACK.

Each interruption shall not exceed

- 1 subframe, if the PCell or the activated SCell is not in the same band as any of the dormant SCells, or

- 2 subframes, if the PCell or the activated SCell is in the same band as any of the FDD dormant SCells, and the PCell or the activated SCell is not configured with the MBSFN subframes;

- 5 subframes, otherwise.

The interruption is for both uplink and downlink of PCell and activated SCell(s).

#### 7.8.2.20 Interruptions at SCell hibernation

When any number of SCells between one and six in a activated or deactivated state is hibernated using the same MAC control element as defined in TS 36.321 [17], the UE capable of supporting *dormantSCellState* [2] is allowed an interruption on PCell and on any activated SCell during the SCell hibernation procedure [17] as follows:

- an interruption on PCell:

- of up to 1 subframe, if the PCell is not in the same band as any of the SCells being hibernated, or

- of up to 2 subframes, if the PCell is in the same band as any of the FDD SCells being hibernated, and the PCell is not configured with the MBSFN subframes;

- of up to 5 subframes, otherwise.

- an interruption on any activated SCell:

- of up to 1 subframe, if the activated SCell is not in the same band as any of the SCells being hibernated, or

- of up to 2 subframes, if the activated SCell is in the same band as any of the FDD SCells being hibernated and the activated SCell is not configured with the MBSFN subframes.

- of up to 5 subframes, otherwise.

#### 7.8.2.21 Interruptions at direct SCell activation and hibernation

When any number of SCells between one and M is directly activated or hibernated using the same RRC message as defined in TS 36.331 [2], for each of SCell(s) to be directly activated or hibernated, the UE is allowed an interruption on PCell and on any activated SCell during the direct SCell activation and hibernation procedure [2] as follows:

- an interruption on PCell:

- of up to 2 subframe, if the PCell is not in the same band as any of the SCells being directly activated or hibernated, or

- of up to 5 subframes, if the PCell is in the same band as any of the SCells being directly activated or hibernated;

- an interruption on any activated SCell:

- of up to 2 subframe, if the activated SCell is not in the same band as any of the SCells being directly activated or hibernated, or

- of up to 5 subframes, if the activated SCell is in the same band as any of the SCells being directly activated or hibernated.

where *M* is the number of SCells included in the RRC reconfiguration message and shall not exceed the maximum number of SCells supported by the UE.

The interruption shall be within the direct SCell activation and hibernation delay as defined in 7.7.18 and 7.7.19.

## 7.9 Maximum Transmission Timing Difference in Carrier Aggregation

### 7.9.1 Introduction

A UE shall be capable of handling a relative received time difference between the PCell and SCell to be aggregated in inter-band CA and intra-band non-contiguous CA.

### 7.9.2 Minimum Requirements for Interband Carrier Aggregation

The UE shall be capable of handling at least a relative received timing difference between the subframe timing boundaries of the signals received from the PCell and the SCell at the UE receiver of up to 30.26 µs when one SCell is configured.

When two, three, or four SCells are configured, the UE shall be capable of handling at least a relative propagation delay difference between the subframe timing boundaries of the signals received from any pair of the serving cells (PCell and the SCells) at the UE receiver of up to 30.26 µs.

The UE shall be capable of handling a maximum uplink transmission timing difference between the pTAG and the sTAG of at least 32.47µs provided that the UE is:

- configured with inter-band CA and

- configured with the pTAG and the sTAG,

A UE configured with pTAG and sTAG may stop transmitting on the SCell if after timing adjusting due to received TA command the uplink transmission timing difference between PCell and SCell exceeds the maximum value the UE can handle as specified above.

The UE shall be capable of handling a maximum uplink transmission timing difference between the pTAG and any of the two sTAGs or between the two sTAGs of at least 32.47µs provided that the UE is:

- configured with inter-band CA and

- configured with the two sTAGs,

A UE configured with two sTAGs may stop transmitting on the SCell if after timing adjusting due to received TA command the uplink transmission timing difference between SCell in one sTAG and SCell in other sTAG exceeds the maximum value the UE can handle as specified above.

### 7.9.3 Minimum Requirements for Intraband non-contiguous Carrier Aggregation

The UE shall be capable of handling at least a relative received timing difference between the subframe timing boundaries of the signals received from the PCell and the SCell at the UE receiver of up to 30.26 µs.

The UE shall be capable of handling a maximum uplink transmission timing difference between the pTAG and the sTAG of at least 32.47µs provided that the UE is:

- configured with intra-band non-contiguous CA and

- configured with the pTAG and the sTAG,

A UE configured with pTAG and sTAG may stop transmitting on the SCell if after timing adjusting due to received TA command the uplink transmission timing difference between PCell and SCell exceeds the maximum value the UE can handle as specified above.

### 7.9.4 Minimum Requirements for Inter-Band Carrier Aggregation under Frame Structure 3

The UE shall be capable of handling at least a relative received timing difference between the subframe timing boundaries of the signals received from the PCell and the SCell at the UE receiver of up to 30.26 µs when one SCell is configured.

When two or three SCells are configured, the UE shall be capable of handling at least a relative propagation delay difference between the subframe timing boundaries of the signals received from any pair of the serving cells (PCell and the SCells) at the UE receiver of up to 30.26 µs.

## 7.10 Interruptions with RSTD Measurements with Carrier Aggregation

### 7.10.1 Introduction

This section contains the requirements related to the interruptions on PCell and activated SCell if configured, when performing RSTD measurements on cells belonging to at least one SCC with deactivated SCell.

Note: Interruptions during RSTD measurements on PCell and activated SCell if configured may not be required by all UEs.

### 7.10.2 Requirements

When common DRX is used, no interruption is allowed for all carrier aggregation configurations while the On Duration timer is running.

The interruption requirement considers only missed ACK/NACK due to reconfiguration of the receiver bandwidth, and not due to other causes such as RF impairments or channel conditions.

#### 7.10.2.1 Interruptions during RSTD measurements on SCC for intra-band CA with one downlink SCell

If the UE supports ncsg-r14 and has been configured with gap pattern with ID 0,1 and there is no inter-frequency and inter-RAT frequency layer to be monitored, the UE shall not make any autonomous interruptions outside of the configured gap patterns.

PCell interruptions due to RSTD measurements on SCC when the SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the the PRS periodicityis 640 ms or longer. Each interruption shall not exceed 5 subframes.

#### 7.10.2.2 Interruptions during RSTD measurements on SCC for inter-band CA with one downlink SCell

If the UE supports ncsg-r14 and has been configured with NCSG pattern with ID 0,1,2,3, the UE shall not make any autonomous interruptions outside of the configured gap patterns.

If the UE has been configured with gap pattern with ID 0,1 and there is no inter-frequency and inter-RAT frequency layer to be monitored, the UE shall not make any autonomous interruptions outside of the configured gap patterns.

If the UE does not support ncsg-r14 or has not been configured with gap pattern with ID 0,1 or NCSG pattern with ID 0,1,2,3 or the UE has been configured with gap pattern with ID 0,1 to monitor inter-frequency/inter-RAT frequency layers, PCell interruptions due to RSTD measurements on SCC when the SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the PRS periodicity  is 640 ms or longer. Each interruption shall not exceed 1 subframe.

#### 7.10.2.3 Interruptions during RSTD measurements on SCC with multiple downlink SCells

If the PCell is not in the same band as any of the SCells being activated or deactivated and if the UE supports ncsg-r14 and has been configured with NCSG pattern with ID 0,1,2,3, the UE shall not make any autonomous interruptions outside of the configured gap patterns.

If the PCell is not in the same band as any of the SCells being activated or deactivated and if the UE has been configured with gap pattern with ID 0,1 and there is no inter-frequency and inter-RAT frequency layer to be monitored, the UE shall not make any autonomous interruptions outside of the configured gap patterns.

If the PCell is in the same band as any of the SCells being activated or deactivated or if the UE does not support ncsg-r14 or has not been configured with gap pattern with ID 0,1 or NCSG pattern with ID 0,1,2,3 or the UE has been configured with gap pattern with ID 0,1 to monitor inter-frequency/inter-RAT frequency layers, when one SCell is activated and the other SCell is deactivated, then due to RSTD measurements on the SCC with deactivated SCell the UE is allowed:

● an interruption on PCell with up to 0.5% probability of missed ACK/NACK when when the PRS periodicity  is 640 ms or longer. Each interruption shall not exceed:

○ 1 subframe if the PCell is not in the same band as the deactivated SCell

○ 5 subframes if the PCell is in the same band as the deactivated SCell

● an interruption on the activated SCell with up to 0.5% probability of missed ACK/NACK when the PRS periodicityis 640 ms or longer. Each interruption shall not exceed:

○ 1 subframe if the activated SCell is not in the same band as the deactivated SCell

○ 5 subframes if the activated SCell is in the same band as the deactivated SCell

If the PCell is in the same band as any of the SCells being activated or deactivated or if the UE does not support ncsg-r14 or has not been configured with gap pattern with ID 0,1 or NCSG pattern with ID 0,1,2,3 or the UE has been configured with gap pattern with ID 0,1 to monitor inter-frequency/inter-RAT frequency layers, when both SCells are deactivated, then due to RSTD measurements on one or both SCCs with deactivated SCells the UE is allowed:

● an interruption on PCell with up to 1.0% probability of missed ACK/NACK when the configure PRS periodicityis 640 ms or longer in any of the SCCs. Each interruption shall not exceed:

○ 1 subframe if the PCell is not in the same band as any of the deactivated SCells

○ 5 subframes if the PCell is in the same band as any of the deactivated SCells

#### 7.10.2.4 Interruptions at overlapping RSTD and inter-frequency measurements

If the UE is configured for RSTD measurements on cells belonging to a SCC with deactivated SCell(s) and also with a *measCycleSCell* for performing E-UTRA carrier aggregation measurements as defined in Section 8.3 on the same SCC as configured for the RSTD measurements, then the total allowed interruption on the active serving cell(s) is the maximum of the interruption due to E-UTRA carrier aggregation measurements specified in Section 7.8 and the interruption due to the RSTD measurements on SCC specified in this Section.

## 7.11 Radio Link Monitoring for UE Category 0

### 7.11.1 Introduction

The UE category 0 applicability of the requirements for performing radio link monitoring in subclause 7.11 is defined in Section 3.6.1.

The UE shall monitor the downlink link quality based on the cell-specific reference signal in order to detect the downlink radio link quality of the PCell as specified in [3].

The UE shall estimate the downlink radio link quality and compare it to the thresholds Qout\_Cat0 and Qin\_Cat0 for the purpose of monitoring downlink radio link quality of the PCell.

The threshold Qout\_Cat0 is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to 10% block error rate of a hypothetical PDCCH transmission taking into account the PCFICH errors with transmission parameters specified in Table 7.11.1-1.

The threshold Qin\_Cat0 is defined as the level at which the downlink radio link quality can be significantly more reliably received than at Qout\_Cat0 and shall correspond to 2% block error rate of a hypothetical PDCCH transmission taking into account the PCFICH errors with transmission parameters specified in Table 7.11.1-2.

Table 7.11.1-1 PDCCH/PCFICH transmission parameters for out-of-sync for UE category 0

|  |  |
| --- | --- |
| Attribute | **Value** |
| DCI format | 1A |
| Number of control OFDM symbols | 2; Bandwidth ≥ 10 MHz  3; 3 MHz ≤ Bandwidth < 10 MHz  4; Bandwidth = 1.4 MHz |
| Aggregation level (CCE) | 4; Bandwidth = 1.4 MHz  8; Bandwidth ≥ 3 MHz |
| Ratio of PDCCH RE energy to average RS RE energy | 4 dB; when single antenna port is used for cell-specific reference signal transmission by the PCell.  4 dB: when two or four antenna ports are used for cell-specific reference signal transmission by the PCell. |
| Ratio of PCFICH RE energy to average RS RE energy | 4 dB; when single antenna port is used for cell-specific reference signal transmission by the PCell.  1 dB: when two or four antenna ports are used for cell-specific reference signal transmission by the PCell. |
| Note 1: DCI format 1A is defined in clause 5.3.3.1.3 in TS 36.212 [21].  Note 2: A hypothetical PCFICH transmission corresponding to the number of control symbols shall be assumed. | |

Table 7.11.1-2 PDCCH/PCFICH transmission parameters for in-sync for UE category 0

|  |  |
| --- | --- |
| Attribute | Value |
| DCI format | 1C |
| Number of control OFDM symbols | 2; Bandwidth ≥ 10 MHz  3; 3 MHz ≤ Bandwidth < 10 MHz  4; Bandwidth = 1.4 MHz |
| Aggregation level (CCE) | 4 |
| Ratio of PDCCH RE energy to average RS RE energy | 1 dB; when single antenna port is used for cell-specific reference signal transmission by the PCell.  1 dB; when two or four antenna ports are used for cell-specific reference signal transmission by the PCell. |
| Ratio of PCFICH RE energy to average RS RE energy | 4 dB; when single antenna port is used for cell-specific reference signal transmission by the PCell.  1 dB: when two or four antenna ports are used for cell-specific reference signal transmission by the PCell. |
| Note 1: DCI format 1C is defined in clause 5.3.3.1.4 in TS 36.212 [21].  Note 2: A hypothetical PCFICH transmission corresponding to the number of control symbols shall be assumed. | |

### 7.11.2 Requirements for FD-FDD and TDD

#### 7.11.2.1 Minimum requirement when no DRX is used

When the downlink radio link quality of the PCell estimated over the last 200 ms period becomes worse than the threshold Qout\_Cat0, Layer 1 of the UE shall send an out-of-sync indication for the PCell to the higher layers within 200ms Qout\_Cat0 evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the PCell estimated over the last 100 ms period becomes better than the threshold Qin\_Cat0, Layer 1 of the UE shall send an in-sync indication for the PCell to the higher layers within 100 ms Qin\_Cat0 evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the PCell shall be performed as specified in clause 4.2.1 in [3]. Two successive indications from Layer 1 shall be separated by at least 10ms.

The transmitter power of the UE shall be turned off within 40 ms after expiry of T310 timer as specified in clause 5.3.11 in TS 36.331 [2].

#### 7.11.2.2 Minimum requirement when DRX is used

When DRX is used for FD-FDD and TDD category 0 UEs, the Qout\_Cat0 evaluation period (TEvaluate\_Qout\_DRX\_Cat0) and the Qin\_Cat0 evaluation period (TEvaluate\_Qin\_DRX\_Cat0) specified in Table 7.11.2.2-1 will be used.

When eDRX\_CONN is used for FD-FDD and TDD category 0 UEs, the Qout\_Cat0 evaluation period (TEvaluate\_Qout\_DRX\_Cat0) and the Qin\_Cat0 evaluation period (TEvaluate\_Qin\_DRX\_Cat0) specified in Table 7.11.2.2-2 will be used.

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_DRX\_Cat0 [s] period becomes worse than the threshold Qout\_Cat0, Layer 1 of the UE shall send out-of-sync indication for the PCell to the higher layers within TEvaluate\_Qout\_DRX\_Cat0 [s] evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_DRX\_Cat0 [s] period becomes better than the threshold Qin\_Cat0, Layer 1 of the UE shall send in-sync indications for the PCell to the higher layers within TEvaluate\_Qin\_DRX\_Cat0 [s] evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the PCell shall be performed as specified in clause 4.2.1 in [3]. When DRX is used, two successive indications from Layer 1 shall be separated by at least max(10ms, DRX\_cycle\_length). When eDRX\_CONN is used, two successive indications from Layer 1 shall be separated by at least max(10ms, eDRX\_CONN cycle length).

Upon start of T310 timer as specified in clause 5.3.11 in TS 36.331 [2], the UE shall monitor the link for recovery using the evaluation period and Layer 1 indication interval corresponding to the non-DRX mode until the expiry or stop of T310 timer.

The transmitter power of the UE shall be turned off within 40 ms after expiry of T310 timer as specified in clause 5.3.11 in TS 36.331 [2].

Table 7.11.2.2-1: Qout and Qin Evaluation Period in DRX for FD-FDD and TDD UE category 0

|  |  |
| --- | --- |
| DRX cycle length (s) | TEvaluate\_Qout\_DRX\_Cat0 and TEvaluate\_Qin\_DRX\_Cat0 (s) (DRX cycles) |
| ≤ 0.01 | Non-DRX requirements in clause 7.11.2.1 are applicable. |
| 0.01 < DRX cycle ≤0.04 | Note (20) |
| 0.04 < DRX cycle ≤ 0. 64 | Note (10) |
| 0.64 < DRX cycle ≤ 2.56 | Note (5) |
| Note: Evaluation period length in time depends on the length of the DRX cycle in use | | |

Table 7.11.2.2-2: Qout and Qin Evaluation Period for FD-FDD and TDD UE category 0 when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length [s] | TEvaluate\_Qout\_DRX\_Cat0 and TEvaluate\_Qin\_DRX\_Cat0 [s] (eDRX\_CONN cycles) |
| 2.56 < eDRX\_CONN cycle ≤ 10.24 | Note (5) |
| Note: Evaluation period length in time depends on the length of the eDRX\_CONN cycle in use | | |

#### 7.11.2.3 Minimum requirement at transitions

When the UE transitions between any two of DRX, eDRX\_CONN, and non-DRX or when DRX or eDRX\_CONN cycle periodicity changes, for a duration of time equal to the evaluation period corresponding to the second mode after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation periods corresponding to the first mode and the second mode. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second mode. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the PCell.

### 7.11.3 Requirements for HD-FDD

#### 7.11.3.1 Minimum requirement when no DRX is used

The HD-FDD category 0 UE shall meet all applicable requirements specified in clause 7.11.2.1 under the following conditions

- at least 1 DL subframe per radio frame of PCell is available at the UE during Qin\_Cat0 and Qout\_Cat0 evaluation periods.

#### 7.11.3.2 Minimum requirement when DRX is used

When DRX is used for HD-FDD category 0 UEs, the Qout evaluation period (TEvaluate\_Qout\_DRX\_Cat0) and the Qin evaluation period (TEvaluate\_Qin\_DRX\_Cat0) specified in Table 7.11.3.2-1 will be used.

When eDRX\_CONN is used for HD-FDD category 0 UEs, the Qout evaluation period (TEvaluate\_Qout\_DRX\_Cat0) and the Qin evaluation period (TEvaluate\_Qin\_DRX\_Cat0) specified in Table 7.11.3.2-2 will be used.

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_DRX\_Cat0 [s] period becomes worse than the threshold Qout\_Cat0, Layer 1 of the UE shall send out-of-sync indication for the PCell to the higher layers within TEvaluate\_Qout\_DRX\_Cat0 [s] evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_DRX\_Cat0 [s] period becomes better than the threshold Qin\_Cat0, Layer 1 of the UE shall send in-sync indications for the PCell to the higher layers within TEvaluate\_Qin\_DRX\_Cat0 [s] evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the PCell shall be performed as specified in clause 4.2.1 in [3]. When DRX is used, two successive indications from Layer 1 shall be separated by at least max(10ms, DRX\_cycle\_length). When eDRX\_CONN is used, two successive indications from Layer 1 shall be separated by at least max(10ms, eDRX\_CONN cycle length).

Upon start of T310 timer as specified in clause 5.3.11 in TS 36.331 [2], the UE shall monitor the link for recovery using the evaluation period and Layer 1 indication interval corresponding to the non-DRX mode until the expiry or stop of T310 timer.

The transmitter power of the UE shall be turned off within 40 ms after expiry of T310 timer as specified in clause 5.3.11 in TS 36.331 [2].

Table 7.11.3.2-1: Qout and Qin Evaluation Period in DRX for HD-FDD UE category 0

|  |  |
| --- | --- |
| DRX cycle length (s) | TEvaluate\_Qout\_DRX and TEvaluate\_Qin\_DRX (s) (DRX cycles) |
| ≤ 0.01 | Non-DRX requirements in clause 7.11.2.1 are applicable. |
| 0.01 < DRX cycle ≤0.04 | Note (40) |
| 0.04 < DRX cycle ≤ 0. 16 | Note (20) |
| 0. 16 < DRX cycle ≤ 0.64 | Note (10) |
| 0.64 < DRX cycle ≤ 2.56 | Note (5) |
| Note: Evaluation period length in time depends on the length of the DRX cycle in use | | |

Table 7.11.3.2-2: Qout and Qin Evaluation Period for HD-FDD UE category 0 when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length [s] | TEvaluate\_Qout\_DRX and TEvaluate\_Qin\_DRX [s] (eDRX\_CONN cycles) |
| 2.56 < eDRX\_CONN cycle ≤ 10.24 | Note (5) |
| Note: Evaluation period length in time depends on the length of the eDRX\_CONN cycle in use | | |

#### 7.11.3.3 Minimum requirement at transitions

The minimum requirements at transitions defined in clause 7.11.2.3 also apply for this section under the following conditions:

at least 1 DL subframe per radio frame of PCell is available at the UE during Qin\_Cat0 and Qout\_Cat0 evaluation periods.

## 7.12 Interruptions with Dual Connectivity

### 7.12.1 Introduction

This section contains the requirements related to the interruptions on PCell, PSCell, and SCell, when

PSCell is added or released, or

transitions between active and non-active during DRX, or

transitions from non-DRX to DRX, or

SCell in either MCG or SCG is added or released, or

SCell in either MCG or SCG is activated or deactivated, or

measurements on SCC with deactivated SCell in either MCG or SCG, or

SRS carrier based switching.

The requirements shall apply for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD dual connectivity.

### 7.12.2 Requirements

#### 7.12.2.1 Interruptions at PSCell addition/release

When a PSCell is added or released as defined in [2] the UE is allowed an interruption of up to 1 subframe on PCell and the activated SCell in MCG if configured during the RRC reconfiguration procedure [2] in synchronous dual connectivity. This interruption is for both uplink and downlink of PCell.

The UE is allowed an interruption of up to 2 subframes on PCell and the activated SCell in MCG if configured during the RRC reconfiguration procedure [2] in asynchronous dual connectivity. This interruption is for both uplink and downlink of PCell.

#### 7.12.2.2 Interruptions at transitions between active and non-active during DRX

When PCell is in non-DRX and PSCell is in DRX, interruptions on PCell and the activated SCell in MCG if configured due to transitions from active to non-active and from non-active to active during PSCell DRX are allowed with up to 1% probability of missed ACK/NACK when the configured PSCell DRX cycle is less than 640 ms, and 0.625% probability of missed ACK/NACK is allowed when the configured PSCell DRX cycle is 640 ms or longer. Each interruption shall not exceed 1 subframe.

When PSCell is in non-DRX and PCell is in DRX, interruptions on PSCell on the activated SCell in SCG if configured due to transitions from active to non-active and from non-active to active during PCell DRX are allowed with up to 1 % probability of missed ACK/NACK when the configured PCell DRX cycle is less than 640 ms, and 0.625% probability of missed ACK/NACK is allowed when the configured PCell DRX cycle is 640 ms or longer. Each interruption shall not exceed 1 subframe.

When both PCell and PSCell are in DRX, no interruption is allowed.

#### 7.12.2.3 Interruptions at transitions from non-DRX to DRX

Interruption on PCell and the activated SCell in MCG if configured due to PSCell transitions from non-DRX to DRX when PCell is in non-DRX shall not exceed 1subframe.

Interruption on PSCell and the activated SCell in SCG if configured due to PCell transitions from non-DRX to DRX when PSCell is in non-DRX shall not exceed 1subframe.

#### 7.12.2.4 Interruptions at SCell addition/release

The requirements in this clause shall apply for the UE configured with PSCell.

In synchronous dual connectivity, when one SCell is added or released as defined in [2]:

- an interruption on PCell shall meet requirements in clause 7.8.2.7,

- an interruption on PSCell shall meet requirements in clause 7.8.2.7, where the term PCell in clause 7.8.2.7 shall be deemed to be replaced with PSCell.

In asynchronous dual connectivity, when one SCell belonging to MCG is added or released as defined in [2]:

- an interruption on PCell shall meet requirements in clause 7.8.2.7,

- an interruption on PSCell shall meet requirements in clause 7.8.2.7 except for the number of subframe, where the term PCell in clause 7.8.2.7 shall be deemed to be replaced with PSCell. The UE is allowed an interruption on PSCell of up to 2 subframes.

In asynchronous dual connectivity, when one SCell belonging to SCG is added or released as defined in [2]:

- an interruption on PCell shall meet requirements in clause 7.8.2.7 except for the number of subframe. The UE is allowed an interruption on PCell of up to 2 subframes.

- an interruption on PSCell shall meet requirements in clause 7.8.2.7, where the term PCell in clause 7.8.2.7 shall be deemed to be replaced with PSCell.

#### 7.12.2.5 Interruptions at SCell activation/deactivation

The requirements in this clause shall apply for the UE configured with PSCell and one SCell.

In synchronous dual connectivity, when one SCell is activated or deactivated as defined in [17]:

- an interruption on PCell shall meet requirements in clause 7.8.2.8,

- an interruption on PSCell shall meet requirements in clause 7.8.2.8, where the term PCell in clause 7.8.2.8 shall be deemed to be replaced with PSCell.

In asynchronous dual connectivity, when one SCell belonging to MCG is activated or deactivated as defined in [17]:

- an interruption on PCell shall meet requirements in clause 7.8.2.8,

- an interruption on PSCell shall meet requirements in clause 7.8.2.8 except for the number of subframe, where the term PCell in clause 7.8.2.8 shall be deemed to be replaced with PSCell. The UE is allowed an interruption on PSCell of up to 2 subframes.

In asynchronous dual connectivity, when one SCell belonging to SCG is activated or deactivated as defined in [17]:

- an interruption on PCell shall meet requirements in clause 7.8.2.8 except for the number of subframe. The UE is allowed an interruption on PCell of up to 2 subframes,

- an interruption on PSCell shall meet requirements in clause 7.8.2.8, where the term PCell in clause 7.8.2.8 shall be deemed to be replaced with PSCell.

#### 7.12.2.6 Interruptions during measurements on SCC

The requirements in this clause shall apply for the UE configured with PSCell and one SCell.

In synchronous dual connectivity, when one SCell is deactivated, the UE is allowed due to measurements on the SCC with the deactivated SCell:

- an interruption on PCell shall meet requirements in clause 7.8.2.9,

- an interruption on PSCell shall meet requirements in clause 7.8.2.9, where the term PCell in clause 7.8.2.8 shall be deemed to be replaced with PSCell.

In asynchronous dual connectivity, when one SCell belonging to MCG is deactivated, the UE is allowed due to measurements on the SCC with the deactivated SCell:

- an interruption on PCell shall meet requirements in clause 7.8.2.9,

- an interruption on PSCell shall meet requirements in clause 7.8.2.9 except for the number of subframe, where the term PCell in clause 7.8.2.9 shall be deemed to be replaced with PSCell. The UE is allowed an interruption on PSCell of up to 2 subframes.

In asynchronous dual connectivity, when one SCell belonging to SCG is deactivated, the UE is allowed due to measurements on the SCC with the deactivated SCell:

- an interruption on PCell shall meet requirements in clause 7.8.2.9 except for the number of subframe. The UE is allowed an interruption on PCell of up to 2 subframes

- an interruption on PSCell shall meet requirements in clause 7.8.2.9, where the term PCell in clause 7.8.2.9 shall be deemed to be replaced with PSCell.

#### 7.12.2.7 Interruptions at SRS carrier based switching

A PUSCH-less SCC is a TDD SCC without PUCCH/PUSCH configured. When a UE needs to transmit periodic or aperiodic SRS [16] and/or non-contention based PRACH on a PUSCH-less SCC, the UE can perform carrier based switching to one or more PUSCH-less SCCs from a CC with PUSCH or from another PUSCH-less SCC prior to transmitting SRS and/or PRACH, provided that:

- switching is from a configured CC to another activated TDD CC;

- the PUSCH-less SCCs to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission or configured via RRC [2] for periodic SRS transmission or indicated by PDCCH for PRACH;

- the serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex [2];

- the SRS switching is not colliding with any other transmission with higher priority defined in [3];

- the SRS switching is not colliding with PDCCH in subframe 0 and 5 as specified in [3];

- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 36.331 [2], and is compliant to the requirements for inter-band CA with uplink in one E-UTRA band and without simultaneous Rx/Tx specified in TS 36.101 [5], the SRS or RACH transmission are not simultaneously scheduled with DL subframe #0 or DL subframe #5 on other CCs.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

The interruption on PCC, PSCC and each of the activated SCCs during the switching to the PUSCH-less SCC shall not exceed 2 subframes including the first subframe where SRS transmission is configured on the PUSCH-less SCC.

The interruption on PCC, PSCC and each of the activated SCCs during the switching from the PUSCH-less SCC shall not exceed 2 subframes including the last subframe where SRS transmission is configured on the PUSCH-less SCC.

## 7.13 Cell phase synchronization accuracy (Synchronized mode of dual connectivity)

### 7.13.1 Definition

Cell phase synchronization accuracy is defined as the maximum absolute timing mismatch between subframes which are transmitted by MeNB and SeNB and are scheduled for the same UE. The cell phase synchronization accuracy is defined only for synchronized mode of dual connectivity operation.

### 7.13.2 Minimum requirements

The cell phase synchronization accuracy shall not exceed the sum of absolute timing accuracy values declared by the manufacturer(s) for each BS. The cell phase synchronization accuracy requirement is optional.

NOTE: The sum of absolute timing accuracy values in synchronized mode of dual connectivity is assumed to be related to MRTD according to the following inequality:

TCPSA+TRPTD ≤ MRTD at the UE

Where:

TCPSA is the sum of absolute timing accuracy values declared by the manufacturer(s).

TRPTD is the absolute propagation time difference between MeNB and SeNB, which serve the same UE.

MRTD is the Maximum Received Timing Difference at the UE. MRTD is equal to 33 µs.

## 7.14 PSCell Addition and Release Delay for E-UTRA Dual Connectivity

### 7.14.1 Introduction

This section defines requirements for the delay within which the UE shall be able to configure a PSCell in E-UTRA dual connectivity. The requirements are applicable to an E-UTRA dual connectivity capable UE. The requirements shall apply for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD dual connectivity.

### 7.14.2 PSCell Addition Delay Requirement

The requirements in this section shall apply for the UE configured with only PCell.

Upon receiving PSCell addition in subframe *n*, the UE shall be capable to transmit PRACH preamble towards PSCell no later than in subframe *n*+ Tconfig\_ PSCell:

Where:

Tconfig\_PSCell = 20ms + Tactivation\_time + 50ms + TPCell\_ DU + TPSCell\_ DU

Tactivation\_time is the PSCell activation delay. If the PSCell is known, then Tactivation\_time is 20ms. If the PSCell is unknown, then Tactivation\_time is 30ms provided the PSCell can be successfully detected on the first attempt.

TPCell\_ DU is the delay uncertainty due to PCell PRACH preamble transmission. TPCell\_ DU is up to 20ms if PSCell activation is interrupted by a PCell PRACH preamble transmission, otherwise it is 0.

TPSCell\_ DU is the delay uncertainty in acquiring the first available PRACH occasion in the PSCell. TPSCell\_ DU is up to 30ms.

PSCell is known if it has been meeting the following conditions:

During the last 5 seconds before the reception of the PSCell configuration command:

- the UE has sent a valid measurement report for the PSCell being configured and

- the PSCell being configured remains detectable according to the cell identification conditions specified in section 8.8,

- PSCell being configured also remains detectable during the PSCell configuration delay according to the cell identification conditions specified in section 8.8.

otherwise it is unknown.The PCell interruption specified in section 7.12 is allowed only during the RRC reconfiguration procedure [2].

The PSCell addition delay specified in this section can be extended if SRS carrier based switching occurs during the PSCell addition procedure.

### 7.14.3 PSCell Release Delay Requirement

The requirements in this section shall apply for a UE configured with PCell and one PSCell.

Upon receiving PSCell release in subframe *n*, the UE shall accomplish the release actions specified in [2] no later than in subframe *n+*20.

The PCell interruption specified in section 7.12 is allowed only during the RRC reconfiguration procedure [2].

The PSCell release delay specified in this section can be extended if SRS carrier based switching occurs during the PSCell release procedure.

## 7.15 Maximum Receive Timing Difference in Dual Connectivity

### 7.15.1 Introduction

A UE shall be capable of handling a relative receive timing difference between subframe timing boundaries of the PCell and PSCell to be aggregated for E-UTRA FDD-FDD, E-UTRA-TDD-TDD, E-UTRA TDD-FDD dual connectivity.

### 7.15.2 Minimum Requirements for Inter-band Dual Connectivity

The UE shall be capable of handling at least a relative receive timing difference between the subframe timing of the signals received from a cell belonging to the MCG and a cell belonging to the SCG at the UE receiver of up to 33 µs provided the UE indicates that it is capable of synchronous dual connectivity [2]. The requirements for synchronous dual connectivity are only applicable for TDD-TDD, FDD-FDD, and TDD-FDD inter-band dual connectivity.

The UE shall be capable of handling at least a relative receive timing difference between the subframe timing of the signals received from a cell belonging to the MCG and a cell belonging to the SCG at the UE receiver of up of 500 µs provided the UE indicates that it is capable of asynchronous dual connectivity [2]. The requirements for asynchronous dual connectivity are only applicable for FDD-FDD inter-band dual connectivity.

The UE shall be capable of handling a relative receive timing difference between the subframe timing of the signals received from any pair of the serving cells belonging to the same cell group according to the requirements in clause 7.9.2.

## 7.16 Proximity-based Services

### 7.16.1 Introduction

The requirements in this clause are applicable for UE performing transmissions and/or reception for ProSe Direct Discovery and/or ProSe Direct Communication in both RRC\_IDLE and RRC\_CONNECTED state.

### 7.16.2 Requirements

#### 7.16.2.1 ProSe UE transmission timing

For ProSe transmission of sidelink channels and signals, UE shall have the capability to follow the timing change of the reference synchronization source.

##### 7.16.2.1.1 Serving cell or PCell as timing reference

The requirements in this subclause are applicable when the reference timing used for ProSe transmissions is the serving cell (RRC\_IDLE) or PCell (RRC\_CONNECTED). The sidelink transmissions takes place  before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell, where is specified in Section 8.1 of [16]. The value of differs between sidelink channels and signals, and is eitheror as specified in Section 9.9 of [16].

7.16.2.1.1.1 Requirements when NTA,SL = 0

For ProSe transmission of sidelink channels and signals employing, the requirements in Section 7.1 as specified for PRACH transmissions shall apply.

7.16.2.1.1.2 Requirements when NTA,SL = NTA

For ProSe transmission of sidelink channels and signals while employing, the requirements in Section 7.1 as specified for PUSCH shall apply.

When it is the first sidelink transmission in a DRX cycle, the requirements in Section 7.1 as specified for the first PUSCH transmission in a DRX cycle shall apply. The reference point for the UE initial transmit timing control requirement shall be  seconds before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell. (in *Ts* units) for sidelink transmissions is the difference between UE transmission timing and the downlink timing immediately after when the last timing advance in Section 7.3 was applied.

When it is not the first sidelink transmission in a DRX cycle or there is no DRX cycle, the requirements as specified in Section 7.1 for PUSCH transmissions when the PUSCH transmission is not the first transmissions in a DRX cycle shall apply.

##### 7.16.2.1.2 SCell or non-serving cell as timing reference

The requirements in this subclause are applicable when the reference timing used for ProSe transmissions is either a SCell (RRC\_CONNECTED) or a non-serving cell selected on a non-serving ProSe carrier (RRC\_IDLE or RRC\_CONNECTED).

The transmission timing requirements are as specified in subclause 7.16.2.1.1, with reference cell as either the SCell or the selected non-serving cell.

### 7.16.3 Interruptions with ProSe

This section contains the requirements related to the interruptions on PCell and activated SCell(s) due ProSe Direct Discovery and ProSe Direct Communication. When ProSe is on a serving cell frequency, then the requirements in this subclause are applicable only to ProSe on E-UTRA FDD bands. When ProSe is on non-serving frequency, then the requirements are applicable to ProSe on both E-UTRA FDD and TDD bands.

When a UE capable of ProSe Direct Communication and/or ProSe Direct Discovery is configured with DRX and DRX is in use, interruptions specified in this section are not allowed while the *onDurationTimer*[17] is running.

Note: ProSe interruption requirements were derived assuming *ShortTTI-r15* is not configured and interruption duration is expected to be shorter in both UL and DL when *ShortTTI-r15* is configured.

#### 7.16.3.1 Interruptions at ProSe Direct Discovery configuration

A UE capable of ProSe Direct Discovery may indicate its interest (initiation or termination) in ProSe Direct Discovery to the connected eNodeB using IE *SidelinkUEInformation* [2].

The UE is allowed an interruption of up to 1 subframe on PCell and on any activated SCell during the RRC reconfiguration procedure that includes the ProSe Direct Discovery configuration message *sl-DiscConfig* [2] (setup and release). This interruption is for both uplink and downlink of PCell and activated SCell(s).

#### 7.16.3.2 Interruptions at ProSe Direct Communication configuration

A UE capable of ProSe Direct Communication may indicate its interest (initiation or termination) in ProSe Direct Communication to the connected eNodeB using IE *SidelinkUEInformation* [2].

The UE is allowed an interruption of up to 1 subframe on PCell and on any activated SCell during the RRC reconfiguration procedure that includes the ProSe Direct Communication configuration message *sl-CommConfig* [2] (setup and release). This interruption is for both uplink and downlink of PCell and activated SCell(s).

#### 7.16.3.3 Interruptions during ProSe Direct Discovery

When ProSe Direct Discovery operation is on a serving cell (PCell/SCell) and when no request for transmission and/or reception gaps are signalled by the ProSe UE, the UE is allowed an interruption of up to 1 subframe that is *N* subframes before and after a UL subframe configured for ProSe Direct Discovery by a serving eNodeB. For discovery period less than 320ms, the allowed interruptions are additionally limited up to 0.625%.

The value of *N* is *ceil(w1 /* 1ms*)* subframes when the parameter *discSyncWindow*[2] is configuredwith value *w1* in the sidelink synchronization resource configuration associated with the ProSe Direct Discovery subframe*.*

The value of *N* is 1 subframe otherwise.

When ProSe Direct Discovery is on a non-serving carrier, and when no request for transmission and/or reception gaps is signalled by the UE, interruptions to serving cell(s) is allowed with up to probability of missed ACK/NACK. Furthermore, when ProSe Direct Discovery is on more than one non-serving carrier, and no request for transmission and/or reception gaps is signalled by the UE, the aggregate interruptions to serving cells(s) are allowed with up to  probability of missed ACK/NACK with *N* non-serving carriers.

The interruptions are for both uplink and downlink of PCell and any activated SCell. The interruption for the ProSe UE may occur:

- while switching a receiver chain ON/OFF for ProSe Direct Discovery if the UE has a dedicated receiver chain for discovery, and/or

- while switching a transmitter chain ON/OFF for ProSe Direct Discovery transmissions on a non-serving carrier, and if the UE has a dedicated transmitted chain for discovery.

#### 7.16.3.4 Interruptions during ProSe Direct Discovery with discovery gaps

When ProSe Direct Discovery is either on a serving cell (PCell/SCell) or a non-serving frequency, and when discovery reception and/or transmission gaps are configured by the serving cell, then only the following interruptions to the PCell and any activated SCell(s) are allowed:

- Uplink interruption is allowed on a subframe configured as downlink reception gap (using *discRxGapConfig*) if either the subframe immediately preceding or immediately following that subframe is not configured as reception gap; and,

- If ProSe Direct Discovery is on a non-serving FDD carrier and that carrier is used for ProSe synchronization, then uplink interruption is additionally allowed on 1 subframe in a discovery period. The interrupted subframe(s) shall be within the subframes configured as reception gap using *discRxGapConfig*; and,

- If ProSe Direct Discovery transmissions are on carrier that is not configured for uplink, then UE is allowed to additionally interrupt the serving cell(s) on up to 2 subframes for each discovery/SLSS transmission configured in a discovery period. The interrupted subframe(s) shall be within the subframes configured as transmission gaps using *discTxGapConfig*.

NOTE: The request and grant of discovery gaps is left up to UE and eNodeB implementations, respectively. When ProSe Direct Discovery is on a non-serving carrier and that carrier is used for ProSe synchronization, then the UE requested / eNodeB configured gaps may depend if inter-frequency measurements are additionally configured for that non-serving frequency.

#### 7.16.3.5 Interruptions during ProSe Direct Communication

When ProSe Direct Communication is on a non-serving carrier and the PCell is not broadcasting SIB18, then interruptions to serving cell(s) is allowed with up to 0.5% probability of missed ACK/NACK. Furthermore, when ProSe Direct Communication is on more than one non-serving carrier, the aggregate interruptions to serving cell(s) is allowed with up to *min*(2%, 0.5%×*N*) probability of missed ACK/NACK with *N* non-serving carriers.

The interruptions are for both uplink and downlink of PCell and any activated SCell.

### 7.16.4 Cell reselection for ProSe Direct Discovery on non-serving frequency

The requirements in this subclause apply when ProSe Direct Discovery transmissions are configured on a non-serving carrier and that non-serving carrier is used for downlink synchronziation and measurements for ProSe Direct Discovery transmission, and provided the parameters required for cell selection / reselection are provided by the serving cell using *discCellSelectionInfo*.

NOTE: The requirements do not apply if the UE is required to acquire the cell selection/reselection parameters that are broadcast from the concerned cell for evaluation.

If the UE signals request for transmission and/or reception gaps, then the requirements apply if the gaps are configured as requested by the UE.

#### 7.16.4.1 Measurement and evaluation of selected cell

The UE shall measure the RSRP and RSRQ level of the selected reference cell on the non-serving carrier used for ProSe Direct Discovery synchronization and evaluate the cell selection criterion S defined in [1] for the selected cell at least every discovery period.

The UE shall filter the RSRP and RSRQ measurements of the selected cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least discPeriod / 2.

#### 7.16.4.2 Measurement of intra-frequency E-UTRAN cells

The UE shall be able to identify new intra-frequency cells on the non-serving carrier used for ProSe Direct Discovery transmission and perform RSRP and RSRQ measurements of identified intra-frequency cells.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS36.304 [1, 11.4] within Tdetect,EUTRAN\_ProSe\_Intrawhen Treselection = 0 (within *discCellSelectionInfo*). An intra frequency cell is considered to be detectable according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot defined in Annex B.1.1 for a corresponding Band.

The UE shall measure RSRP and RSRQ at least every Tmeasure,EUTRAN\_ProSe\_Intra (see table 7.16.4.2-1) for intra-frequency cells that are identified and measured according to the measurement rules.

The UE shall filter RSRP and RSRQ measurements of each measured intra-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure,EUTRAN\_ProSe\_Intra/2

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined [1] within Tevaluate,E-UTRAN\_ProSe\_Intra when Treselection = 0 (within *discCellSelectionInfo*) as specified in table 7.16.4.2-1 provided that the cell is at least 3dB better ranked. When evaluating cells for reselection, the side conditions for RSRP and SCH apply to both the non-serving cell that is currently selected and the non-serving cell being reselected to for ProSe Direct Discovery synchronization.

If Treselection timer (within *discCellSelectionInfo*) has a non-zero value and the intra-frequency cell being reselected to is better ranked than the currently selected reference cell, the UE shall evaluate this intra-frequency cell for the Treselection time. If this cell remains better ranked within this duration, then the UE shall reselect that cell.

Table 7.16.4.2-1: Tdetect,EUTRAN\_ProSe\_Intra, Tmeasure,EUTRAN\_ProSe\_Intra and Tevaluate, E-UTRAN\_ProSe\_Intra

|  |  |  |  |
| --- | --- | --- | --- |
| Discovery Period [s] | Tdetect,EUTRAN\_ProSe\_Intra (number of discovery periods) | Tmeasure,EUTRAN\_ProSe\_Intra (number of discovery periods) | Tevaluate,E-UTRAN\_ProSe\_Intra  (number of discovery periods) |
| Discovery Period≤0.32 | Note 1 (36) | Note 1 (4) | Note 1 (16) |
| 0.32<Discovery Period≤0.64 | Note 1 (28) | Note 1 (2) | Note 1 (8) |
| 0.64<Discovery Period≤1.28 | Note 1 (25) | Note 1 (1) | Note 1 (5) |
| 1.28<Discovery Period≤10.24 | Note 1 (23) | Note 1 (1) | Note 1 (3) |
| NOTE 1: Time depends upon the configured Discovery period. | | | |

### 7.16.5 Selection / Reselection of ProSe relay UE

This subclause contains the requirements related to selection and reselection of ProSe relay UE if the serving frequency is used for ProSe Direct Communication via a ProSe relay UE.

For a remote UE configured by upper layer for relay operation, when the RSRP measurement of the serving cell (RRC\_IDLE) or the PCell (RRC\_CONNECTED) is below *threshHigh* (within *remoteUE-Config*), the remote UE shall search for candidate relay UEs for selection and/or reselection every discovery period.

If the remote UE has a selected sidelink relay UE, then the remote UE shall measure the SD-RSRP of the selected relay once in every four discovery periods and evaluate if it meets the relay selection criterion as defined in [TS 36.331, 5.10.11.4].

The remote UE shall measure SD-RSRP of the candidate relay UEs every Tmeasure, ProSe\_Relay\_Intra for intra-frequency relay UEs that are detected and measured according to the measurement rules.

For an intra-frequency relay UEs that are detected, but that has not been selected or reselected to, the remote UE shall be capable of evaluating that the intra-frequency relay UE has met selection or reselection criterion defined in [2, 5.10.11.4] within Tevaluate,ProSe\_Relay\_Intra as specified in table 7.16.5-1.

The minimum requirements are required to meet when the selected and candidate relay UEs are transmitting relay discovery message every discovery period.

Table 7.16.5-1: Tmeasure, ProSe\_Relay\_Intra and Tevaluate, ProSe\_Relay\_intra

|  |  |  |
| --- | --- | --- |
| Discovery Period [s] | Tmeasure,ProSe\_Relay\_Intra [s] (number of discovery periods) | Tevaluate, ProSe\_Relay\_intra [s] (number of discovery periods) |
| 0.04≤Discovery period≤10.24 | Note 1 (4) | Note 1 (16) |
| NOTE 1: Time depends upon the configured Discovery period. | | |

### 7.16.6 ProSe operation under deactivated SCell

If the UE is configured for ProSe operation on a sidelink of an SCell then UE is allowed to perform ProSe operation on the sidelink of that SCell regardless of whether that SCell is activated or deactivated provided that there is no addional interruptions beyond what is specified in section 7.8.

## 7.17 Maximum Transmission Timing Difference in Dual Connectivity

### 7.17.1 Introduction

A UE shall be capable of handling a relative transmission timing difference between subframe timing boundaries of the PCell and PSCell to be aggregated for E-UTRA FDD-FDD, E-UTRA-TDD-TDD, E-UTRA TDD-FDD dual connectivity.

### 7.17.2 Minimum Requirements for maximum transmission timing difference Inter-band Dual Connectivity

The UE shall be capable of handling a maximum uplink transmission timing difference between PCell and PSCell of at least 35.21 µs provided the UE indicates that it is capable of synchronous dual connectivity [2]. The requirements for synchronous dual connectivity are only applicable for TDD-TDD, FDD-FDD, and TDD-FDD inter-band dual connectivity.

The UE shall be capable of handling a maximum uplink transmission timing difference between PCell and PSCell of at least 500 µs provided the UE indicates that it is capable of asynchronous dual connectivity [2]. The requirements for asynchronous dual connectivity are only applicable for FDD-FDD and inter-band dual connectivity.

If the UE is configured with higher layer parameter powerControlMode<1>, then the UE may stop transmission on the PSCell if the UL transmission timing difference exceeds 35.21µs. If a UE supports both synchronous and asynchronous dual connectivity and if the UE is configured with higher layer parameter powerControlMode<2>, then the UE needs to constitute new subframes pair if the UL transmission timing difference exceeds 500µs.7.18 SCell Activation and Deactivation Delay for E-UTRA Dual Connectivity

### 7.18.1 Introduction

This section defines requirements for the delay within which the UE shall be able to activate a deactivated SCell and deactive an activated SCell in E-UTRA dual connectivity. The requirements are applicable to an E-UTRA dual connectivity capable UE which has been configured with one SCell in either MCG or SCG and PSCell. In case where the SCell belongs to SCG, the term PCell in clause 7.7 shall be replaced with PSCell. The requirements shall apply for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD dual connectivity.

### 7.18.2 SCell Activation Delay Requirement for Deactivated SCell

The requirements in this clause shall apply for a UE configured with PSCell and one SCell.

The SCell activation delay shall meet the requirements in clause 7.7.2.

### 7.18.3 SCell Deactivation Delay Requirement for Activated SCell

The requirements in this clause shall apply for a UE configured with PSCell and one SCell.

The SCell deactivation delay shall meet the requirements in clause 7.7.3.

## 7.19 Radio Link Monitoring for UE Category M1

### 7.19.1 Introduction

The UE category M1 applicability of the requirements for performing radio link monitoring in subclause 7.19 is defined in Section 3.6.

All the requirements in Section 7.19 apply, provided that:

- the UE is not configured with any of the measurement gap patterns defined in Table 8.1.2.1-3, or

- the UE is configured with a measurement gap pattern for RSTD measurements specified in Table 8.1.2.1-3 and there is no overlap between these measurement gaps and configured MPDCCH subframes for UE monitoring.

If the UE is configured with a measurement gap pattern for RSTD measurements specified in Table 8.1.2.1-3 and there is overlap between these measurement gaps and configured MPDCCH subframes for UE monitoring, the UE shall also perform RLM according to Section 7.19, but the out-of-sync evaluation period (TEvaluate\_Qout\_CatM1) and in-sync evaluation periods can be longer than those defined in 7.19.

The UE shall monitor the downlink link quality based on the cell-specific reference signal in order to detect the downlink radio link quality of the PCell as specified in TS 36.213 [3].

### 7.19.2 Requirements for FD-FDD and TDD CE mode A

The requirements defined in this subclause 7.19.2 for performing radio link monitoring are applicable for UE category M1 defined in Section 3.6.

The UE shall estimate the downlink radio link quality and compare it to the thresholds Qout\_Cat M1 and Qin\_Cat M1 for the purpose of monitoring downlink radio link quality of the PCell.

The threshold Qout\_Cat M1 is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to 10% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.2-1.

The threshold Qin\_Cat M1 is defined as the level at which the downlink radio link quality can be significantly more reliably received than at Qout\_Cat M1 and shall correspond to 2% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.2-1.

Table 7.19.2-1 M-PDCCH transmission parameters for out-of-sync and in-sync for UE category M1 with CE mode A

|  |  |  |
| --- | --- | --- |
| Attribute | Out-of-sync | In-sync |
| DCI format | 6-1A | 6-1A |
| Starting OFDM symbols | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz |
| Maximum M-PDCCH repetition level | Rmax Note1 | Rmax /2 Note1 |
| Aggregation level (ECCE) | L’max Note2 | L’max-2Note2 |
| M-PDCCH Transmission type | Distributed | Distributed |
| NOTE 1: Rmax is determined by the configurable parameter *mPDCCH-NumRepetition* defined in 36.331 and Rmax>1.  NOTE 2: L’max and L’max-2 is derived from the configurable parameter *numberPRB-Pairs* defined in 36.331. L’max is 24, 16 and 8, if *numberPRB-Pairs* is 6, 4 and 2, respectively. L’max-2is the aggregation level two levels below L’max, and L’max-2 is 8, 4 and 2, if *numberPRB-Pairs* is 6, 4 and 2, respectively. | | |

In addition to the requirements defined above, UE configured with *rlm-ReportConfig* has to

- Estimate the downlink radio link quality and compare it to the thresholds Q E1\_out\_CatM1 and Q E2\_in\_CatM1 for the purpose of monitoring downlink radio link quality of the PCell.

The threshold QE1\_out\_CatM1 is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to 10% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.2-2.

The threshold QE2\_in\_CatM1 is defined as the level at which the downlink radio link quality can be significantly more reliably received than at QE1\_out\_CatM1 and shall correspond to 2% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.2-2.

Table 7.19.2-2 M-PDCCH transmission parameters for event E1 and event E2 for UE category M1 with CE mode A

|  |  |  |
| --- | --- | --- |
| Attribute | Event E1 | Event E2 |
| DCI format | 6-1A | 6-1A |
| Starting OFDM symbols | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz |
| Maximum M-PDCCH repetition level | Rmax/2 Note1 | Rmax/8 Note1 |
| Aggregation level (ECCE) | L’max-1Note2 | L’max-2Note2 |
| M-PDCCH Transmission type | Distributed | Distributed |
| NOTE 1: Rmax is determined by the configurable parameter *mPDCCH-NumRepetition* defined in 36.331 and Rmax ≥ 2 to trigger Event E1 and Rmax ≥ 8 to trigger Event E2.  NOTE 2: L’max-1 and L’max-2 is derived from the configurable parameter *numberPRB-Pairs* defined in 36.331. L’max-1 is 16, 8 and 4, if *numberPRB-Pairs* is 6, 4 and 2, respectively. L’max-2is the aggregation level one level below L’max-1, and L’max-2 is 8, 4 and 2, if *numberPRB-Pairs* is 6, 4 and 2, respectively. | | |

For a UE configured with *mpdcch-crs-connected-config*, threshold Qout\_Cat M1 is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to 10% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.2-3, provided:

- Out-of-sync indication is triggered in the UE.

Table 7.19.2-3 MPDCCH transmission parameters for Out-of-sync for UE category M1 with CE mode A configured with *mpdcch-crs-connected-config*

|  |  |
| --- | --- |
| Attribute | Out-of-sync |
| DCI format | 6-1A |
| Starting OFDM symbols | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz |
| Maximum MPDCCH repetition level | Rmax Note1 |
| Aggregation level (ECCE) | L’max Note2 |
| MPDCCH Transmission type | Distributed |
| Power offset between CRS and DMRS antenna ports of MPDCCH | 0dB |
| NOTE 1: Rmax is determined by the configurable parameter *mPDCCH-NumRepetition* defined in 36.331 and Rmax>1 to trigger Out-of-snych.  NOTE 2: L’max is derived from the configurable parameter *numberPRB-Pairs* defined in 36.331. L’max is 24, 16 and 8, if *numberPRB-Pairs* is 6, 4 and 2, respectively. | |

For a UE configured with *mpdcch-crs-connected-config*, threshold QE1\_out\_CatM1 is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to 10% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.2-4, provided

- Early-out-of-sync is triggered in the UE

Table 7.19.2-4 MPDCCH transmission parameters for early Out-of-sync for UE category M1 with CE mode A configured with *mpdcch-crs-connected-config*

|  |  |
| --- | --- |
| Attribute | Event E1 |
| DCI format | 6-1A |
| Starting OFDM symbols | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz |
| Maximum MPDCCH repetition level | Rmax/2 Note1 |
| Aggregation level (ECCE) | L’max-1 Note2 |
| MPDCCH Transmission type | Distributed |
| Power offset between CRS and DMRS antenna ports of MPDCCH | 0dB |
| NOTE 1: Rmax is determined by the configurable parameter *mPDCCH-NumRepetition* defined in 36.331 and Rmax>1 to trigger Out-of-snych.  NOTE 2: L’max is derived from the configurable parameter *numberPRB-Pairs* defined in 36.331. L’max is 24, 16 and 8, if *numberPRB-Pairs* is 6, 4 and 2, respectively. | |

#### 7.19.2.1 Minimum requirement when no DRX is used

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_CatM1 period becomes worse than the threshold Qout\_CatM1, Layer 1 of the UE shall send an out-of-sync indication for the PCell to the higher layers within TEvaluate\_Qout\_CatM1 evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_CatM1 period becomes better than the threshold Qin\_CatM1, Layer 1 of the UE shall send an in-sync indication for the PCell to the higher layers within TEvaluate\_Qin\_CatM1 evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the PCell shall be performed as specified in clause 4.2.1 in [3]. Two successive indications from Layer 1 shall be separated by at least max(10ms, rmax\*G).

The transmitter power of the UE shall be turned off within 40 ms after expiry of T310 timer as specified in clause 5.3.11 in TS 36.331 [2].

TEvaluate\_Qout\_CatM1 = 5\**rmax*\**G* ms and TEvaluate\_Qin\_CatM1 = 5\**rmax*\**G* ms, provided the below conditions are met, where *rmax*\**G* is MPDCCH monitoring cycle length and parameters *rmax* and *G* are as specified in [3]:

*rmax*\**G* ≥ 80 ms, and

*G*>1, and

UE is not receiving PDSCH,

otherwise TEvaluate\_Qout\_CatM1 = 400 ms and TEvaluate\_Qin\_CatM1 = 200 ms.

A UE configured with *rlm-ReportConfig* has to additionally meet the following requirements

- When the downlink radio link quality of the PCell estimated over the last Qout\_CatM1 evaluation period becomes worse than the threshold QE1\_out\_CatM1, Layer 1 of the UE shall trigger event E1 and send a report to the higher layers within Qout\_CatM1 evaluation period. A Layer 3 filter shall be applied to the E1 event indications as specified in TS 36.331 [2].

- When the downlink radio link quality of the PCell estimated over the last Qin\_CatM1 period becomes better than the threshold QE2\_in\_CatM1, Layer 1 of the UE shall trigger event E2 and send a report to the higher layers within Qin\_CatM1 evaluation period. A L3 filter shall be applied to the event E2 indications as specified in TS 36.331 [2]. The UE may also include the excess number of repetitions in the reported event report using the RRC parameter *excessRep-MPDCCH* as defined in TS 36.331 [2]. The reportable values of *excessRep-MPDCCH* are defined in Table 7.19.2.1-1.

Table 7.19.2.1-1: Reportable values of *excessRep-MPDCCH*

|  |  |
| --- | --- |
| Parameter: excessRep-MPDCCH-r14 | Value |
| ‘excessRep1’ | 2 Note1 |
| ‘excessRep2’ | 4 Note1 |
| NOTE 1: excessRep-MPDCCH-r14 is the factor by which UE recommends eNB to scale down Rmax (as per the formula Rmax / excessRep-MPDCCH-r14), where Rmax is determined by the configurable parameter *mPDCCH-NumRepetition* defined in 36.331. | |

#### 7.19.2.2 Minimum requirement when DRX is used

The requirements in this section apply regardless of the MPDCCH search space and parameter G [3] configuration.

When DRX is used for FD-FDD and TDD UE category M1 UEs, the Qout\_CatM1 evaluation period (TEvaluate\_Qout\_DRX\_CatM1) and the Qin\_CatM1 evaluation period (TEvaluate\_Qin\_DRX\_CatM1) specified in Table 7.19.2.2-1 will be used.

When eDRX\_CONN cycle is used for FD-FDD and TDD UE category M1 UEs, the Qout\_CatM1 evaluation period (TEvaluate\_Qout\_DRX\_CatM1) and the Qin\_CatM1 evaluation period (TEvaluate\_Qin\_DRX\_CatM1) specified in Table 7.19.2.2-2 will be used.

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_DRX\_CatM1 [s] period becomes worse than the threshold Qout\_CatM1, Layer 1 of the UE shall send out-of-sync indication for the PCell to the higher layers within TEvaluate\_Qout\_DRX\_CatM1 [s] evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_DRX\_CatM1 [s] period becomes better than the threshold Qin\_CatM1, Layer 1 of the UE shall send in-sync indications for the PCell to the higher layers within TEvaluate\_Qin\_DRX\_CatM1 [s] evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the PCell shall be performed as specified in clause 4.2.1 in [3]. When DRX is used, two successive indications from Layer 1 shall be separated by at least max(10ms, DRX\_cycle\_length). When eDRX\_CONN is used, two successive indications from Layer 1 shall be separated by at least max(10 ms, eDRX\_CONN cycle length).

Upon start of T310 timer as specified in clause 5.3.11 in TS 36.331 [2], the UE shall monitor the link for recovery using the evaluation period and Layer 1 indication interval corresponding to the non-DRX mode until the expiry or stop of T310 timer.

The transmitter power of the UE shall be turned off within 40 ms after expiry of T310 timer as specified in clause 5.3.11 in TS 36.331 [2].

Table 7.19.2.2-1: Qout\_CatM1 and Qin\_CatM1 Evaluation Period in DRX for FD-FDD and TDD UE category M1

|  |  |
| --- | --- |
| DRX cycle length (s) | TEvaluate\_Qout\_DRX\_CatM1 and TEvaluate\_Qin\_DRX\_CatM1 (s) (DRX cycles) |
| ≤ 0.01 | Non-DRX requirements in clause 7.19.2.1 are applicable. |
| 0.01 < DRX cycle ≤0.04 | Note (20) |
| 0.04 < DRX cycle ≤ 0. 64 | Note (10) |
| 0.64 < DRX cycle ≤ 2.56 | Note (5) |
| NOTE: Evaluation period length in time depends on the length of the DRX cycle in use | | |

Table 7.19.2.2-2: Qout\_CatM1 and Qin\_CatM1 evaluation period when eDRX\_CONN cycle is configured for FD-FDD and TDD UE category M1

|  |  |  |
| --- | --- | --- |
| eDRX\_CONN cycle length (s) | | TEvaluate\_Qout\_DRX\_CatM1 and TEvaluate\_Qin\_DRX\_CatM1 (s) (eDRX\_CONN cycles) |
| 2.56 < eDRX\_CONN cycle ≤ 10.24 | | Note (5) |
| NOTE: Evaluation period length in time depends on the length of the eDRX\_CONN cycle in use | | |

The requirements defined in clause 7.19.2.2 also apply for this section.

A UE configured with *rlm-ReportConfig* has to additionally meet the following requirements

- When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_DRX\_CatM1 [s] period becomes worse than the threshold QE1\_out\_CatM1, Layer 1 of the UE shall trigger event E1 and send a report to the higher layers within TEvaluate\_Qout\_DRX\_CatM1 [s] evaluation period. A Layer 3 filter shall be applied to the E1 event indications as specified in TS 36.331 [2].

- When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_DRX\_CatM1 [s] period becomes better than the threshold QE2\_in\_CatM1, Layer 1 of the UE shall trigger event E2 and send a report to the higher layers within TEvaluate\_Qin\_DRX\_CatM1 [s] evaluation period. A L3 filter shall be applied to the E2 event indications as specified in TS 36.331 [2]. The UE may also include the excess number of repetitions in the reported event report using the RRC parameter *excessRep-MPDCCH* as defined in TS 36.331 [2]. The reportable values of *excessRep-MPDCCH* are defined in Table 7.19.2.1-1.

#### 7.19.2.3 Minimum requirement at transitions

When the UE transitions between any two of DRX, eDRX\_CONN and non-DRX or when DRX or eDRX\_CONN cycle periodicity changes, for a duration of time equal to the evaluation period corresponding to the second mode after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation periods corresponding to the first mode and the second mode. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second mode. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the PCell.

### 7.19.3 Requirements for HD-FDD with CE mode A

The requirements defined in this subclause 7.19.3 for performing radio link monitoring are applicable for UE category M1 defined in Section 3.6.

#### 7.19.3.1 Minimum requirement when no DRX is used

The HD-FDD category M1 with CE mode A UE shall meet all applicable requirements specified in clause 7.19.2.1 under the following conditions

- at least 1 DL subframe per radio frame of PCell is available at the UE during Qin\_CatM1 and Qout\_CatM1 evaluation periods.

#### 7.19.3.2 Minimum requirement when DRX is used

The requirements in this section apply regardless of the MPDCCH search space and parameter G [3] configuration.

When DRX is used for HD-FDD category M1 with CE mode A UEs, the Qout\_CatM1 evaluation period (TEvaluate\_Qout\_DRX\_CatM1) and the Qin\_CatM1 evaluation period (TEvaluate\_Qin\_DRX\_CatM1) specified in Table 7.19.3.2-1 will be used.

When eDRX\_CONN cycle is used for HD-FDD category M1 with CE mode A UEs, the Qout\_CatM1 evaluation period (TEvaluate\_Qout\_DRX\_CatM1) and the Qin\_CatM1 evaluation period (TEvaluate\_Qin\_DRX\_CatM1) specified in Table 7.19.3.2-2 will be used.

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_DRX\_CatM1 [s] period becomes worse than the threshold Qout\_CatM1, Layer 1 of the UE shall send out-of-sync indication for the PCell to the higher layers within TEvaluate\_Qout\_DRX\_CatM1 [s] evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_DRX\_CatM1 [s] period becomes better than the threshold Qin\_CatM1, Layer 1 of the UE shall send in-sync indications for the PCell to the higher layers within TEvaluate\_Qin\_DRX\_CatM1 [s] evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the PCell shall be performed as specified in clause 4.2.1 in [3]. When DRX is used, two successive indications from Layer 1 shall be separated by at least max(10ms, DRX\_cycle\_length). When eDRX\_CONN is used, two successive indications from Layer 1 shall be separated by at least max(10 ms, eDRX\_CONN cycle length).

Upon start of T310 timer as specified in clause 5.3.11 in TS 36.331 [2], the UE shall monitor the link for recovery using the evaluation period and Layer 1 indication interval corresponding to the non-DRX mode until the expiry or stop of T310 timer.

The transmitter power of the UE shall be turned off within 40 ms after expiry of T310 timer as specified in clause 5.3.11 in TS 36.331 [2].

Table 7.19.3.2-1: Qout\_CatM1 and Qin\_CatM1 Evaluation Period in DRX for HD-FDD UE category M1 with CE mode A

|  |  |
| --- | --- |
| DRX cycle length (s) | TEvaluate\_Qout\_DRX\_CatM1 and TEvaluate\_Qin\_DRX\_CatM1 (s) (DRX cycles) |
| ≤ 0.01 | Non-DRX requirements in clause 7.19.3.1 are applicable. |
| 0.01 < DRX cycle ≤0.04 | Note (40) |
| 0.04 < DRX cycle ≤ 0. 16 | Note (20) |
| 0. 16 < DRX cycle ≤ 0.64 | Note (10) |
| 0.64 < DRX cycle ≤ 2.56 | Note (5) |
| Note: Evaluation period length in time depends on the length of the DRX cycle in use | | |

Table 7.19.3.2-2: Qout\_CatM1 and Qin\_CatM1 evaluation period when eDRX\_CONN cycle is configured for HD-FDD UE category M1 with CE mode A

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | TEvaluate\_Qout\_DRX\_CatM1 and TEvaluate\_Qin\_DRX\_CatM1 (s) (eDRX\_CONN cycles) |
| 2.56 < eDRX\_CONN cycle ≤ 10.24 | Note (5) |
| NOTE: Evaluation period length in time depends on the length of the eDRX\_CONN cycle in use | | |

The requirements defined in clause 7.19.3.2 also apply for this section.

A UE configured with *rlm-ReportConfig* has to additionally meet the following requirements

- When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_DRX\_CatM1 [s] period becomes worse than the threshold QE1\_out\_CatM1, Layer 1 of the UE shall trigger event E1 and send a report to the higher layers within TEvaluate\_Qout\_DRX\_CatM1 [s] evaluation period. A Layer 3 filter shall be applied to the E1 event indications as specified in TS 36.331 [2].

- When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_DRX\_CatM1 [s] period becomes better than the threshold QE2\_in\_CatM1, Layer 1 of the UE shall trigger event E2 and send a report to the higher layers within TEvaluate\_Qin\_DRX\_CatM1 [s] evaluation period. A L3 filter shall be applied to the E2 event indications as specified in TS 36.331 [2]. The UE may also include the excess number of repetitions in the reported event report using the RRC parameter *excessRep-MPDCCH* as defined in TS 36.331 [2]. The reportable values of *excessRep-MPDCCH* are defined in Table 7.19.2.1-1.

#### 7.19.3.3 Minimum requirement at transitions

The minimum requirements at transitions defined in clause 7.19.2.3 also apply for this section under the following conditions:

- at least 1 DL subframe per radio frame of PCell is available at the UE during Qin\_CatM1 and Qout\_CatM1 evaluation periods.

### 7.19.4 Requirements for FD-FDD and TDD with CE mode B

The requirements defined in this subclause 7.19.4 for performing radio link monitoring are applicable for UE category M1 defined in Section 3.6.

The UE shall estimate the downlink radio link quality and compare it to the thresholds Qout\_Cat M1 and Qin\_Cat M1 for the purpose of monitoring downlink radio link quality of the PCell.

The threshold Qout\_Cat M1 is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to 10% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.4-1.

The threshold Qin\_Cat M1 is defined as the level at which the downlink radio link quality can be significantly more reliably received than at Qout\_Cat M1 and shall correspond to 2% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.4-1.

Table 7.19.4-1 M-PDCCH transmission parameters for out-of-sync and in-sync for UE category M1 with CE mode B

|  |  |  |
| --- | --- | --- |
| Attribute | Out-of-sync | In-sync |
| DCI format | 6-1B | 6-1B |
| Starting OFDM symbols | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz |
| Maximum M-PDCCH repetition level | RmaxNote1 | Rmax/2Note1 |
| Aggregation level (ECCE) | L’max Note2 | L’max-2 Note2 |
| M-PDCCH Transmission type | Distributed | Distributed |
| NOTE 1: Rmax is determined by the configurable parameter *mPDCCH-NumRepetition* defined in 36.331 and Rmax>1.  NOTE 2: L’max and L’max-2 is derived from the configurable parameter *numberPRB-Pairs* defined in 36.331. L’max is 24, 16 and 8, if *numberPRB-Pairs* is 6, 4 and 2, respectively. L’max-2is the aggregation levels two levels below L’max, and L’max-2 is 8, 4 and 2, if *numberPRB-Pairs* is 6, 4 and 2, respectively. | | |

In addition, a UE configured with *rlm-ReportConfig* has to meet the following requirements

- Estimate the downlink radio link quality and compare it to the thresholds Q E1\_out\_CatM1 and Q E2\_in\_CatM1.

The threshold QE1\_out\_CatM1 is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to 10% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.4-2.

The threshold QE2\_in\_Cat M1 is defined as the level at which the downlink radio link quality can be significantly more reliably received than at Qout\_Cat M1 and shall correspond to 2% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.4-2.

Table 7.19.4-2 M-PDCCH transmission parameters for event E1 and event E2 for UE category M1 with CE mode B

|  |  |  |
| --- | --- | --- |
| Attribute | Event E1 | Event E2 |
| DCI format | 6-1B | 6-1B |
| Starting OFDM symbols | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz |
| Maximum M-PDCCH repetition level | Rmax/2 Note1 | Rmax/8 Note1 |
| Aggregation level (ECCE) | L’max-1Note2 | L’max-2Note2 |
| M-PDCCH Transmission type | Distributed | Distributed |
| NOTE 1: Rmax is determined by the configurable parameter *mPDCCH-NumRepetition* defined in 36.331 and Rmax ≥2 to trigger Event E1 and Rmax ≥ 8 to trigger Event E2.  NOTE 2: L’max-1 and L’max-2 is derived from the configurable parameter *numberPRB-Pairs* defined in 36.331. L’max-1 is 16, 8 and 4, if *numberPRB-Pairs* is 6, 4 and 2, respectively. L’max-2is the aggregation level one levels below L’max-1, and L’max-2 is 8, 4 and 2, if *numberPRB-Pairs* is 6, 4 and 2, respectively. | | |

For a UE configured with *mpdcch-crs-connected-config*, the threshold Qout\_Cat M1 is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to 10% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.4-3, provided:

- Out-of-sync indication is triggered in the UE.

Table 7.19.4-3 MPDCCH transmission parameters for Out-of-sync for UE category M1 with CE mode B configured with *mpdcch-crs-connected-config*

|  |  |
| --- | --- |
| Attribute | Out-of-sync |
| DCI format | 6-1B |
| Starting OFDM symbols | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz |
| Maximum MPDCCH repetition level | Rmax Note1 |
| Aggregation level (ECCE) | L’max Note2 |
| MPDCCH Transmission type | Distributed |
| Power offset between CRS and DMRS antenna ports of MPDCCH | 0dB |
| NOTE 1: Rmax is determined by the configurable parameter *mPDCCH-NumRepetition* defined in 36.331 and Rmax>1 to trigger Out-of-snych.  NOTE 2: L’max is derived from the configurable parameter *numberPRB-Pairs* defined in 36.331. L’max is 24, 16 and 8, if *numberPRB-Pairs* is 6, 4 and 2, respectively. | |

For a UE configured with *mpdcch-crs-connected-config*, the threshold QE1\_out\_CatM1 is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to 10% block error rate of a hypothetical MPDCCH transmission with transmission parameters specified in Table 7.19.4-4, provided

- Early-out-of-sync is triggered in the UE

Table 7.19.4-4 MPDCCH transmission parameters for early Out-of-sync for UE category M1 with CE mode B configured with *mpdcch-crs-connected-config*

|  |  |
| --- | --- |
| Attribute | Event E1 |
| DCI format | 6-1B |
| Starting OFDM symbols | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz |
| Maximum MPDCCH repetition level | Rmax/2 Note1 |
| Aggregation level (ECCE) | L’max-1 Note2 |
| MPDCCH Transmission type | Distributed |
| Power offset between CRS and DMRS antenna ports of MPDCCH | 0dB |
| NOTE 1: Rmax is determined by the configurable parameter *mPDCCH-NumRepetition* defined in 36.331 and Rmax>1 to trigger Out-of-snych.  NOTE 2: L’max is derived from the configurable parameter *numberPRB-Pairs* defined in 36.331. L’max is 24, 16 and 8, if *numberPRB-Pairs* is 6, 4 and 2, respectively. | |

#### 7.19.4.1 Minimum requirement when no DRX is used

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_CatM1 period becomes worse than the threshold Qout\_CatM1, Layer 1 of the UE shall send an out-of-sync indication for the PCell to the higher layers within TEvaluate\_Qout\_CatM1 evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_CatM1 period becomes better than the threshold Qin\_CatM1, Layer 1 of the UE shall send an in-sync indication for the PCell to the higher layers within TEvaluate\_Qin\_CatM1 evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the PCell shall be performed as specified in clause 4.2.1 in [3]. Two successive indications from Layer 1 shall be separated by at least max(10ms, rmax\*G).

The transmitter power of the UE shall be turned off within 40 ms after expiry of T310 timer as specified in clause 5.3.11 in TS 36.331 [2].

TEvaluate\_Qout\_CatM1 = 5\**rmax*\**G* ms and TEvaluate\_Qin\_CatM1 = 5\**rmax*\**G* ms, provided the below conditions are met, where *rmax*\**G* is MPDCCH monitoring cycle length and parameters *rmax* and *G* are as specified in [3]:

*rmax*\**G* ≥ 800 ms, and

*G*>1, and

UE is not receiving PDSCH,

otherwise TEvaluate\_Qout\_CatM1 = 4000 ms and TEvaluate\_Qin\_CatM1 = 2000 m

The requirements defined in clause 7.19.4.1 also apply for this section.

A UE configured with *rlm-ReportConfig* has to additionally meet the following requirements

- When the downlink radio link quality of the PCell estimated over the last Qout\_CatM1 evaluation period becomes worse than the threshold QE1\_out\_CatM1, Layer 1 of the UE shall trigger event E1 and send a report to the higher layers within Qout\_CatM1 evaluation period A Layer 3 filter shall be applied to the E1 event indications as specified in TS 36.331 [2].

- When the downlink radio link quality of the PCell estimated over the last Qin\_CatM1 evaluation period becomes better than the threshold QE2\_in\_CatM1, Layer 1 of the UE shall trigger event E2 and send a report to the higher layers within Qin\_CatM1 evaluation period. A L3 filter shall be applied to the E2 event indications as specified in TS 36.331 [2]. The UE may also include the excess number of repetitions in the reported event report using the RRC parameter *excessRep-MPDCCH* as defined in TS 36.331 [2]. The reportable values of *excessRep-MPDCCH* are defined in Table 7.19.4.1-1.

Table 7.19.4.1-1: Reportable values of *excessRep-MPDCCH*

|  |  |
| --- | --- |
| Parameter: excessRep-MPDCCH-r14 | Value |
| ‘excessRep1’ | 2 Note1 |
| ‘excessRep2’ | 4 Note1 |
| NOTE 1: excessRep-MPDCCH-r14 is the factor by which UE recommends eNB to scale down Rmax (as per the formula Rmax / excessRep-MPDCCH-r14), where Rmax is determined by the configurable parameter *mPDCCH-NumRepetition* defined in 36.331. | |

#### 7.19.4.2 Minimum requirement when DRX is used

The requirements in this section apply regardless of the MPDCCH search space and parameter G [3] configuration.

When DRX is used for FD-FDD and TDD UE category M1 UEs, the Qout\_CatM1 evaluation period (TEvaluate\_Qout\_DRX\_CatM1) and the Qin\_CatM1 evaluation period (TEvaluate\_Qin\_DRX\_CatM1) specified in Table 7.19.4.2-1 will be used.

When eDRX\_CONN cycle is used for FD-FDD and TDD UE category M1 UEs, the Qout\_CatM1 evaluation period (TEvaluate\_Qout\_DRX\_CatM1) and the Qin\_CatM1 evaluation period (TEvaluate\_Qin\_DRX\_CatM1) specified in Table 7.19.4.2-2 will be used.

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_DRX\_CatM1 [s] period becomes worse than the threshold Qout\_CatM1, Layer 1 of the UE shall send out-of-sync indication for the PCell to the higher layers within TEvaluate\_Qout\_DRX\_CatM1 [s] evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_DRX\_CatM1 [s] period becomes better than the threshold Qin\_CatM1, Layer 1 of the UE shall send in-sync indications for the PCell to the higher layers within TEvaluate\_Qin\_DRX\_CatM1 [s] evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the PCell shall be performed as specified in clause 4.2.1 in [3]. When DRX is used, two successive indications from Layer 1 shall be separated by at least max(10ms, DRX\_cycle\_length). When eDRX\_CONN is used, two successive indications from Layer 1 shall be separated by at least max(10 ms, eDRX\_CONN cycle length).

Upon start of T310 timer as specified in clause 5.3.11 in TS 36.331 [2], the UE shall monitor the link for recovery using the evaluation period and Layer 1 indication interval corresponding to the non-DRX mode until the expiry or stop of T310 timer.

The transmitter power of the UE shall be turned off within 40 ms after expiry of T310 timer as specified in clause 5.3.11 in TS 36.331 [2].

Table 7.19.4.2-1: Qout\_CatM1 and Qin\_CatM1 Evaluation Period in DRX for FD-FDD and TDD UE category M1

|  |  |
| --- | --- |
| DRX cycle length (s) | TEvaluate\_Qout\_DRX\_CatM1 and TEvaluate\_Qin\_DRX\_CatM1 (s) (DRX cycles) |
| ≤ 0.16 | Non-DRX requirements in clause 7.19.4.1 are applicable. |
| 0.160 < DRX cycle ≤ 0.320 | Note (20) |
| 0.320 < DRX cycle ≤ 0. 64 | Note (10) |
| 0.64 < DRX cycle ≤ 2.56 | Note (5) |
| NOTE: Evaluation period length in time depends on the length of the DRX cycle in use | | |

Table 7.19.4.2-2: Qout\_CatM1 and Qin\_CatM1 evaluation period when eDRX\_CONN cycle is configured for FD-FDD and TDD UE category M1

|  |  |  |
| --- | --- | --- |
| eDRX\_CONN cycle length (s) | | TEvaluate\_Qout\_DRX\_CatM1 and TEvaluate\_Qin\_DRX\_CatM1 (s) (eDRX\_CONN cycles) |
| 2.56 < eDRX\_CONN cycle ≤ 10.24 | | Note (5) |
| NOTE: Evaluation period length in time depends on the length of the eDRX\_CONN cycle in use | | |

The requirements defined in clause 7.19.4.2 also apply for this section.

A UE configured with *rlm-ReportConfig* has to additionally meet the following requirements

- When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_DRX\_CatM1 [s] period becomes worse than the threshold QE1\_out\_CatM1, Layer 1 of the UE shall trigger event E1 and send a report to the higher layers within TEvaluate\_Qout\_DRX\_CatM1 [s] evaluation period. A Layer 3 filter shall be applied to the E1 event indications as specified in TS 36.331 [2].

- When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_DRX\_CatM1 [s] period becomes better than the threshold QE2\_in\_CatM1, Layer 1 of the UE shall trigger event E2 and send a report to the higher layers within TEvaluate\_Qin\_DRX\_CatM1 [s] evaluation period. A L3 filter shall be applied to the E2 event indications as specified in TS 36.331 [2]. The UE may also include the excess number of repetitions in the reported event report using the RRC parameter *excessRep-MPDCCH* as defined in TS 36.331 [2]. The reportable values of *excessRep-MPDCCH* are defined in Table 7.19.4.1-1.

#### 7.19.4.3 Minimum requirement at transitions

When the UE transitions between any two of DRX, eDRX\_CONN and non-DRX or when DRX or eDRX\_CONN cycle periodicity changes, for a duration of time equal to the evaluation period corresponding to the second mode after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation periods corresponding to the first mode and the second mode. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second mode. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the PCell.

### 7.19.5 Requirements for HD-FDD with CE mode B

The requirements defined in this subclause 7.19.5 for performing radio link monitoring are applicable for UE category M1 defined in Section 3.6.

#### 7.19.5.1 Minimum requirement when no DRX is used

The HD-FDD category M1 with CE mode B UE shall meet all applicable requirements specified in clause 7.19.4.1 under the following conditions

- at least 1 DL subframe per radio frame of PCell is available at the UE during Qin\_CatM1 and Qout\_CatM1 evaluation periods.

#### 7.19.5.2 Minimum requirement when DRX is used

The requirements in this section apply regardless of the MPDCCH search space and parameter G [3] configuration.

When DRX is used for HD-FDD category M1 with CE mode B UEs, the Qout\_CatM1 evaluation period (TEvaluate\_Qout\_DRX\_CatM1) and the Qin\_CatM1 evaluation period (TEvaluate\_Qin\_DRX\_CatM1) specified in Table 7.19.5.2-1 will be used.

When eDRX\_CONN cycle is used for HD-FDD category M1 with CE mode B UEs, the Qout\_CatM1 evaluation period (TEvaluate\_Qout\_DRX\_CatM1) and the Qin\_CatM1 evaluation period (TEvaluate\_Qin\_DRX\_CatM1) specified in Table 7.19.5.2-2 will be used.

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_DRX\_CatM1 [s] period becomes worse than the threshold Qout\_CatM1, Layer 1 of the UE shall send out-of-sync indication for the PCell to the higher layers within TEvaluate\_Qout\_DRX\_CatM1 [s] evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_DRX\_CatM1 [s] period becomes better than the threshold Qin\_CatM1, Layer 1 of the UE shall send in-sync indications for the PCell to the higher layers within TEvaluate\_Qin\_DRX\_CatM1 [s] evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the PCell shall be performed as specified in clause 4.2.1 in [3]. When DRX is used, two successive indications from Layer 1 shall be separated by at least max(10ms, DRX\_cycle\_length). When eDRX\_CONN is used, two successive indications from Layer 1 shall be separated by at least max(10 ms, eDRX\_CONN cycle length).

Upon start of T310 timer as specified in clause 5.3.11 in TS 36.331 [2], the UE shall monitor the link for recovery using the evaluation period and Layer 1 indication interval corresponding to the non-DRX mode until the expiry or stop of T310 timer.

The transmitter power of the UE shall be turned off within 40 ms after expiry of T310 timer as specified in clause 5.3.11 in TS 36.331 [2].

Table 7.19.5.2-1: Qout\_CatM1 and Qin\_CatM1 Evaluation Period in DRX for HD-FDD UE category M1 with CE mode B

|  |  |
| --- | --- |
| DRX cycle length (s) | TEvaluate\_Qout\_DRX\_CatM1 and TEvaluate\_Qin\_DRX\_CatM1 (s) (DRX cycles) |
| ≤ 0.08 | Non-DRX requirements in clause 7.19.5.1 are applicable. |
| 0.08< DRX cycle ≤0.160 | Note (40) |
| 0.160 < DRX cycle ≤ 0.320 | Note (20) |
| 0.320 < DRX cycle ≤ 0.64 | Note (10) |
| 0.64 < DRX cycle ≤ 2.56 | Note (5) |
| NOTE: Evaluation period length in time depends on the length of the DRX cycle in use | | |

Table 7.19.5.2-2: Qout\_CatM1 and Qin\_CatM1 evaluation period when eDRX\_CONN cycle is configured for HD-FDD UE category M1 with CE mode B

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | TEvaluate\_Qout\_DRX\_CatM1 and TEvaluate\_Qin\_DRX\_CatM1 (s) (eDRX\_CONN cycles) |
| 2.56 < DRX cycle ≤ 10.24 | Note (5) |
| NOTE: Evaluation period length in time depends on the length of the eDRX\_CONN cycle in use | |

The requirements defined in clause 7.19.5.2 also apply for this section.

A UE configured with *rlm-ReportConfig* has to additionally meet the following requirements

- When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qout\_DRX\_CatM1 [s] period becomes worse than the threshold QE1\_out\_CatM1, Layer 1 of the UE shall trigger event E1 and send a report to the higher layers within TEvaluate\_Qout\_DRX\_CatM1 [s] evaluation period. A Layer 3 filter shall be applied to the E1 event indications as specified in TS 36.331 [2].

- When the downlink radio link quality of the PCell estimated over the last TEvaluate\_Qin\_DRX\_CatM1 [s] period becomes better than the threshold QE2\_in\_CatM1, Layer 1 of the UE shall trigger event E2 and send a report to the higher layers within TEvaluate\_Qin\_DRX\_CatM1 [s] evaluation period. A L3 filter shall be applied to the E2 event indications as specified in TS 36.331 [2]. The UE may also include the excess number of repetitions in the reported event report using the RRC parameter *excessRep-MPDCCH* as defined in TS 36.331 [2]. The reportable values of *excessRep-MPDCCH* are defined in Table 7.19.4.1-1.

#### 7.19.5.3 Minimum requirement at transitions

The minimum requirements at transitions defined in clause 7.19.4.3 also apply for this section under the following conditions:

- at least 1 DL subframe per radio frame of PCell is available at the UE during Qin\_CatM1 and Qout\_CatM1 evaluation periods.

## 7.20 UE transmit timing for NB-IoT

### 7.20.1 Introduction

The Category NB1 UE shall have capability to follow the frame timing change of the connected eNode B. The uplink frame transmission takes place  before the reception of the first detected path (in time) of the corresponding downlink frame from the reference NB-IoT cell.

UE shall use the serving NB-IoT cell as the reference cell for deriving the UE transmit timing. UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are defined in the following requirements.

### 7.20.2 Requirements

The UE initial transmission timing error shall be less than or equal to ±Te where the timing error limit value Te is specified in Table 7.20.2-1. This requirement applies when it is the first transmission in a DRX cycle or the first transmission in a repetition period (R>1) for NPUSCH and NPRACH, the first transmission after an uplink transmission gap in a repetition period (R>1) for NPUSCH and NPRACH transmission, or it is the transmission on PUR. The reference point for the UE initial transmit timing control requirement shall be the downlink timing of the serving NB-IoT cell minus . The downlink timing is defined as the time when the first detected path (in time) of the corresponding downlink frame is received from the serving NB-IoT cell. *N*TA\_Ref for NPRACH is defined as 0.  (in *Ts* units) for other channels is the difference between UE transmission timing and the Downlink timing immediately after when the last timing advance in clause 7.22 was applied. *N*TA\_Ref for other channels is not changed until next timing advance is received.

Table 7.20.2-1: Te Timing Error Limit

|  |  |
| --- | --- |
| Downlink Bandwidth (MHz) | Te\_ |
| 0.18 | 80\*TS |
| Note 1: TS is the basic timing unit defined in TS 36.211 | |

When it is not the first transmission in a DRX cycle or there is no DRX cycle, and when it is the transmission for NPUSCH the UE shall, when no repetitions are configured on the uplink or the repetition period is R=1, be capable of changing the transmission timing according to the received downlink frame of the serving NB-IoT cell except when the timing advance in clause 7.22 is applied such that the UE transmission timing error shall be less than or equal to ±Te, where the timing error limit value Te is specified in Table 7.20.2-1.

When no repetition period is configured, or the configured repetition period is R=1, all adjustments made to the UE uplink timing shall follow these rules:

1) The maximum amount of the magnitude of the timing change in one adjustment shall be 58.33\*TS seconds.

2) The minimum aggregate adjustment rate shall be 7\*TS per second.

3) The maximum aggregate adjustment rate shall be 58.33\*TS per 200ms.

When a repetition period is configured on the uplink for which R>1, the UE shall not adjust the uplink transmission timing autonomously during an ongoing repetition period other than at initial transmission as defined above.

## 7.21 UE timer accuracy for NB-IoT

### 7.21.1 Introduction

UE timers are used in different protocol entities to control the UE behaviour.

### 7.21.2 Requirements

For UE timers specified in TS 36.331 [2], UE shall comply with the timer accuracies according to Table 7.21.2-1.

The requirements are only related to the actual timing measurements internally in the UE. They do not include the following:

- Inaccuracy in the start and stop conditions of a timer (e.g. UE reaction time to detect that start and stop conditions of a timer is fulfilled), or

- Inaccuracies due to restrictions in observability of start and stop conditions of a UE timer (e.g. TTI alignment when UE sends messages at timer expiry).

Table 7.21.2-1

|  |  |
| --- | --- |
| Timer value [s] | Accuracy |
| timer value < 4 | ± 0.1s |
| timer value ≥ 4 | ± 2.5% |

## 7.22 Timing Advance for NB-IoT

### 7.22.1 Introduction

The timing advance is initiated from E-UTRAN with MAC message that implies and adjustment of the timing advance, see TS 36.321 [17] clause 5.2.

### 7.22.2 Requirements

#### 7.22.2.1 Timing Advance adjustment delay

UE shall adjust the timing of its uplink transmission timing at sub-frame *n*+12 for a timing advance command received in sub-frame *n*. In case repetitions are used on the downlink, sub-frame *n* refers to the last subframe in the repetition period in which the message containing the MAC control information was received. The UE shall not apply a TA command during an uplink repetition period.

#### 7.22.2.2 Timing Advance adjustment accuracy

The UE shall adjust the timing of its transmissions with a relative accuracy better than or equal to ±13.33\* TS seconds to the signalled timing advance value compared to the timing of preceding uplink transmission. The timing advance command is expressed in multiples of 16\* TS and is relative to the current uplink timing.

## 7.23 Radio Link Monitoring for Category NB1 UE

### 7.23.1 Introduction

The applicability of the requirements for performing radio link monitoring for Category NB1 UE in subclause 7.23 is defined in Section 3.1.

The UE shall monitor the downlink link quality based on the narrowband reference signal in order to detect the downlink radio link quality of the NB-IoT cell as specified in [3].

### 7.23.2 Requirements for Category NB1 UE

The requirements defined in this subclause 7.23.2 for performing radio link monitoring are applicable for Category NB1 UE defined in Section 3.1.

The UE shall meet all applicable requirements specified in clause 7.23.2 under the following condition:

- at least 1 DL subframe per radio frame of serving NB-IoT cell is available at the UE during Qout\_NB-IoT and Qin\_NB-IoT evaluation periods.

The UE shall estimate the downlink radio link quality and compare it to the thresholds Qout\_NB-IoT and Qin\_NB-IoT for the purpose of monitoring downlink radio link quality of the NB-IoT cell.

The threshold Qout\_NB-IoT is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to 10% block error rate of a hypothetical NPDCCH transmission with transmission parameters specified in Table 7.23.2-1.

The threshold Qin\_NB-IoT is defined as the level at which the downlink radio link quality can be significantly more reliably received than at Qout\_NB-IoT and shall correspond to 2% block error rate of a hypothetical NPDCCH transmission with transmission parameters specified in Table 7.23.2-1.

Table 7.23.2-1 NPDCCH transmission parameters for out-of-sync and in-sync for Category NB1 UE

|  |  |  |
| --- | --- | --- |
| Attribute | Out-of-sync | In-sync |
| DCI format | Format N1 | Format N1 |
| Number of information bits | 23 bits | 23 bits |
| System Bandwidth | 200kHz | 200kHz |
| Antenna configuration | 2x1 | 2x1 |
| Maximum NPDCCH Repetition level | RmaxNote1 | Rmax/4 Note1 |
| Aggregation level | 2 | 2 |
| DRX | OFF | OFF |
| NOTE 1: Rmax is a configurable parameter defined in TS 36.331[2]. | | |

#### 7.23.2.1 Minimum requirement when no DRX is used

When the downlink radio link quality of the NB-IoT cell estimated over the last TEvaluate\_Qout\_NB-IoT period becomes worse than the threshold Qout\_NB-IoT, Layer 1 of the UE shall send an out-of-sync indication for the NB-IoT cell to the higher layers within TEvaluate\_Qout\_NB-IoT evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the NB-IoT cell estimated over the last TEvaluate\_Qin\_NB-IoT period becomes better than the threshold Qin\_NB-IoT, Layer 1 of the UE shall send an in-sync indication for the NB-IoT cell to the higher layers within TEvaluate\_Qin\_NB-IoT evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the NB-IoT cell shall be performed as specified in clause 4.2.1 in [3]. Two successive indications from Layer 1 shall be separated by at least 10ms.

The transmitter power of the UE shall be turned off within 40ms after expiry of T310 timer as specified in clause 5.3.11 in TS 36.331 [2]. The following table 7.23.2.1-1 defines the TEvaluate\_Qout\_NB-IoT and TEvaluate\_Qin\_NB-IoT.

Table 7.23.2.1-1 Qout and Qin Evaluation Period in non-DRX for Category NB1 UE

|  |  |  |
| --- | --- | --- |
| Configured NPDCCH Rmax | TEvaluate\_Qout\_NB-IoT | TEvaluate\_Qin\_NB-IoT |
| Rmax ≤ 64 | 400ms | 200ms |
| Rmax> 64 | 4000ms | 2000ms |

#### 7.23.2.2 Minimum requirement when DRX is used

When DRX is used for Category NB1 UE UEs, the Qout\_NB-IoT evaluation period (TEvaluate\_Qout\_DRX\_NB-IoT) and the Qin\_NB-IoT evaluation period (TEvaluate\_Qin\_DRX\_NB-IoT) is specified in Table 7.23.2.2-1 will be used.

When the downlink radio link quality of the NB-IoT cell estimated over the last TEvaluate\_Qout\_DRX\_NB-IoT [s] period becomes worse than the threshold Qout\_NB-IoT, Layer 1 of the UE shall send out-of-sync indication for the NB-IoT cell to the higher layers within TEvaluate\_Qout\_DRX\_NB-IoT [s] evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the NB-IoT cell estimated over the last TEvaluate\_Qin\_DRX\_NB-IoT [s] period becomes better than the threshold Qin\_NB-IoT, Layer 1 of the UE shall send in-sync indications for the NB-IoT cell to the higher layers within TEvaluate\_Qin\_DRX\_NB-IoT [s] evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the NB-IoT cell shall be performed as specified in clause 4.2.1 in [3]. Two successive indications from Layer 1 shall be separated by at least max(10ms, DRX\_cycle\_length).

Upon start of T310 timer as specified in clause 5.3.11 in TS 36.331 [2], the UE shall monitor the link for recovery using the evaluation period and Layer 1 indication interval corresponding to the non-DRX mode until the expiry or stop of T310 timer.

The transmitter power of the UE shall be turned off within 40 ms after expiry of T310 timer as specified in clause 5.3.11 in TS 36.331 [2].

Table 7.23.2.2-1: Qout and Qin Evaluation Period in DRX for Category NB1 UE

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length (s) | TEvaluate\_Qout\_DRX\_NB-IoT and TEvaluate\_Qin\_DRX\_NB-IoT (s) | | |
| DRX cycles for Rmax ≤ 64 | DRX cycles for Rmax > 64 |
| 0.256 < DRX cycle ≤ 1.024 | Note 1 (20) | Note 1 (40) | |
| 1.024 < DRX cycle ≤ 3.072 | Note 1 (10) | Note 1 (20) | |
| 4.096 < DRX cycle ≤ 10.24 | Note 1 (5) | Note 1 (10) | |
| NOTE 1: Evaluation period length in time depends on the length of the DRX cycle in use | | | |

#### 7.23.2.3 Minimum requirement at transitions

When the UE transitions between DRX and non-DRX or when DRX cycle periodicity changes, for a duration of time equal to the evaluation period corresponding to the second mode after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation periods corresponding to the first mode and the second mode. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second mode. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the NB-IoT cell.

## 7.24 UE transmit timing for Category M1

### 7.24.1 Introduction

The Category M1 UE shall have the capability to follow the frame timing change of the connected eNode B. The uplink frame transmission takes place  before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell.

The UE shall use the serving cell as the reference cell for deriving the UE transmit timing. UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are defined in the following requirements.

### 7.24.2 Requirements

The UE initial transmission timing error shall be less than or equal to ±Te where the timing error limit value Te is specified in Table 7.24.2-1. This requirement applies when it is the first transmission in a DRX cycle, eDRX\_CONN cycle, or the first transmission in a repetition period (R>1) for PUCCH, PUSCH, and SRS, or the first transmission after an uplink transmission gap in a repetition period (R>1) for PUCCH or PUSCH, or it is the PRACH transmission, or it is the transmission on PUR. The reference point for the UE initial transmit timing control requirement shall be the downlink timing of the serving cell minus . The downlink timing is defined as the time when the first detected path (in time) of the corresponding downlink frame is received from the serving cell. *N*TA\_Ref for PRACH is defined as 0.  (in *Ts* units) for other channels is the difference between UE transmission timing and the Downlink timing immediately after when the last timing advance in clause 7.3 was applied. *N*TA\_Ref for other channels is not changed until the next timing advance is received.

Table 7.24.2-1: Te Timing Error Limit

|  |  |
| --- | --- |
| CE Mode | Te\_ |
| A | 24\*TS |
| B | 48\*Ts |
| NOTE 1: TS is the basic timing unit defined in TS 36.211.  NOTE 2: This requirement applies regardless of the downlink carrier bandwidth. | |

When it is not the first transmission in a DRX or eDRX\_CONN cycle or there is no DRX or no eDRX\_CONN cycle, and when it is the transmission for PUCCH, PUSCH and SRS transmission, the UE shall, when no repetitions are configured on the uplink or the repetition period is R=1, be capable of changing the transmission timing according to the received downlink frame of the serving cell except when the timing advance in clause 7.3 is applied such that the UE transmission timing error shall be less than or equal to ±Te where the timing error limit value Te is specified in Table 7.24.2-1.

When no repetition period is configured, or the configured repetition period is R=1, all adjustments made to the UE uplink timing shall follow these rules:

1) The maximum amount of the magnitude of the timing change in one adjustment shall be Tq seconds.

2) The minimum aggregate adjustment rate shall be 7\*TS per second.

3) The maximum aggregate adjustment rate shall be Tq per 200ms.

where the maximum autonomous time adjustment step Tq is specified in Table 7.24.2-2.

Table 7.24.2-2: Tq Maximum Autonomous Time Adjustment Step

|  |  |
| --- | --- |
| CE Mode | Tq\_ |
| A | 17.5\*TS |
| B | 17.5\*Ts |
| NOTE 1: TS is the basic timing unit defined in TS 36.211.  NOTE 2: This requirement applies regardless of the downlink carrier bandwidth. | |

When a repetition period is configured on the uplink for which R>1, the UE shall not adjust the uplink transmission timing autonomously during an ongoing repetition period other than at initial transmission as defined above.

## 7.25 Cell phase synchronization accuracy for MBMS services (FDD)

### 7.25.1 Definition

Cell phase synchronization accuracy is defined as the maximum absolute deviation in frame start timing between any pair of cells that have overlapping coverage areas in the same MBSFN area.

### 7.25.2 Minimum requirements

For eNodeB capable of supporting MBMS services, the cell phase synchronization accuracy measured at BS antenna connectors shall be better than the requirement specified in table 7.25.2-1.

Table 7.25.2-1: Cell phase synchronization requirement for MBMS services (FDD)

|  |  |
| --- | --- |
| CP length for MBSFN subframe | Requirement |
| 16.67 µs | ≤ 5 μs |
| 33.33 µs | ≤ 5 μs |
| 200 µs | ≤ 5 μs |
| 100 µs | ≤ 5 μs |
| 300 µs | ≤ [5] μs |

Note 1: When MBSFN subframe using is configured for a MBSFN area, the CP length for MBSFN subframes is 16.67µs. When MBSFN subframe using  is configured for a MBSFN area, the CP length for MBSFN subframes is 33.33µs.When MBSFN subframe using  is configured for a MBSFN area, the CP length for MBSFN subframes is 200µs. When MBSFN subframe using is configured for a MBSFN area, the CP length for MBSFN subframes is 100 µs. When MBSFN subframe using is configured for a MBSFN area, the CP length for MBSFN subframes is 300 µs.

## 7.26 UE transmit timing for Category M2

### 7.26.1 Introduction

The Category M1 UE shall have the capability to follow the frame timing change of the connected eNode B. The uplink frame transmission takes place  before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell.

The UE shall use the serving cell as the reference cell for deriving the UE transmit timing. UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are defined in the following requirements.

### 7.26.2 Requirements

The requirements defined in clause 7.24 also apply for this section with following change for the UE initial transmission timing error which shall be less than or equal to ±Te where the timing error limit value Te is specified in Table 7.26.2-1.

Table 7.26.2-1: Te Timing Error Limit

|  |  |  |
| --- | --- | --- |
| CE Mode | Downlink Bandwidth (MHz) | Te\_ |
| A | 1.4 | 24\*TS |
| A | 5 | 12\* TS |
| B | 1.4 | 48\*Ts |
| B | 5 | 40\* TS |
| NOTE 1: TS is the basic timing unit defined in TS 36.211.  NOTE 2: This requirement applies regardless of the downlink carrier bandwidth. | | |

## 7.27 UE timer accuracy for category M1

### 7.27.1 Introduction

UE timers are used in different protocol entities to control the UE behaviour.

### 7.27.2 Requirements

The requirements defined in clause 7.21.2 also apply for this section.

## 7.28 Timing Advance for Category M1

### 7.28.1 Introduction

The timing advance is initiated from E-UTRAN with MAC message that implies and adjustment of the timing advance, see TS 36.321 [17] clause 5.2.

### 7.28.2 Requirements

The requirements defined in clause 7.3.2 also apply for this section.

## 7.29 Interruptions requirements with FeMBMS

### 7.29.1 Introduction

The requirements in this section shall apply for the UE which is capable of receiving PMCH in MBSFN subframes using at least one of the following numerologies:

- subcarrier spacing of 7.5 kHz and the cyclic prefix length of 1024 Ts and

- subcarrier spacing of 1.25 kHz and the cyclic prefix length of 6144 Ts.

- subcarrier spacing of 2.5 kHz and the cyclic prefix length of 3072 Ts and

- subcarrier spacing of 370.37 Hz and the cyclic prefix length of 9216 Ts.

### 7.29.2 Requirements

When UE receives signals or channels in MBSFN subframes based on a numerology which is different than the numerology used in a preceding or succeeding downlink non-MBSFN subframe, the UE shall switch between the two numerologies without causing any interruption to the UE operations in the non-MBSFN subframes.

## 7.30 Numerology switching delay requirements with FeMBMS

### 7.30.1 Introduction

The requirements in this section shall apply for the UE which is capable of receiving PMCH in MBSFN subframes using at least one of the following numerologies:

- subcarrier spacing of 7.5 kHz and the cyclic prefix length of 1024 Ts and

- subcarrier spacing of 1.25 kHz and the cyclic prefix length of 6144 Ts.

- subcarrier spacing of 2.5 kHz and the cyclic prefix length of 3072 Ts and

- subcarrier spacing of 370.37 Hz and the cyclic prefix length of 9216 Ts.

### 7.30.2 Requirements

When UE receives MBSFN subframes with PMCH based on a numerology which is different than the numerology used in a preceding or succeeding downlink non-MBSFN subframe, the UE shall switch between the two numerologies without causing any delay to the UE operations in the non-MBSFN subframes.

## 7.31 NR PSCell Addition and Release Delay for E-UTRA - NR Dual Connectivity

### 7.31.1 Introduction

This section defines requirements for the delay within which the UE shall be able to configure an NR PSCell in EN-DC. The requirements are applicable to an E-UTRA-FDD – NR and E-UTRA-TDD – NR dual connectivity capable UE.

### 7.31.2 NR PSCell Addition Delay Requirement

The requirements in this section shall apply for the UE which is configured with PCell, and may also be configured with one or more SCells.

Upon receiving NR PSCell addition in subframe *n*, the UE shall be capable to transmit PRACH preamble towards NR PSCell no later than in subframe *n* + Tconfig PSCell:

Where:

Tconfig\_PSCell = TRRC\_delay + Tprocessing + Tsearch + T∆ + TPSCell\_ DU + 2 ms

TRRC\_delay is the RRC procedure delay as specified in [2].

Tprocessing is the SW processing time needed by UE, including RF warm up period. Tprocessing = 20 ms if NR PSCell is in FR1, Tprocessing = 40 ms if NR PSCell is in FR2.

Tsearch is the time for AGC settling and PSS/SSS detection.

- For NR PSCell in FR1: if the target cell is a known cell, Tsearch = 0 ms. If the target cell is an unknown cell and the target cell Es/Iot ≥ -2 dB, then Tsearch = 3\* Trs ms;

- For NR PSCell in FR2: if the target cell is a known cell, Tsearch = 0 ms. If the target cell is an unknown cell and the target cell Es/Iot ≥ -2 dB, then Tsearch = 24\* Trs ms.

T∆ is time for fine time tracking and acquiring full timing information of the target cell. T∆ = 1\*Trs ms for a known or unknown PSCell.

TPSCell\_ DU is the delay uncertainty in acquiring the first available PRACH occasion in the NR PSCell. TPSCell\_ DU is up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [39].

Trs is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in PSCell addition message, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this section is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

In FR1 and FR2, the NR PSCell is known if it has been meeting the following conditions:

During the last 5 seconds before the reception of the NR PSCell configuration command:

- the UE has sent a valid measurement report for the NR PSCell being configured and

- One of the SSBs measured from the NR PSCell being configured remains detectable according to the cell identification conditions specified in section 9.3 of TS 38.133 [50],

- One of the SSBs measured from NR PSCell being configured also remains detectable during the NR PSCell configuration delay according to the cell identification conditions specified in section 9.3 of TS 38.133 [50].

otherwise it is unknown.

The PCell interruption specified in section 7.32 is allowed only during the RRC reconfiguration procedure [2].

### 7.31.3 NR PSCell Release Delay Requirement

The requirements in this section shall apply for a UE which is configured with PCell and NR PSCell, and may also be configured with one or more SCells and/or NR SCells.

Upon receiving NR PSCell release in subframe *n*, the UE shall accomplish the release actions specified in [2] no later than in subframe *n+* TRRC\_delay:

Where

TRRC\_delay is the RRC procedure delay as specified in [2].

The PCell interruption specified in section 7.32 is allowed only during the RRC reconfiguration procedure [2].

## 7.31A Addition and Release Delay of NR PSCell Operating with CCA for E-UTRA - NR Dual Connectivity

### 7.31A.1 Introduction

This section defines requirements for the delay within which the UE shall be able to configure an NR PSCell operating with CCA in EN-DC. The requirements are applicable to an E-UTRA-FDD – NR and E-UTRA-TDD – NR dual connectivity capable UE.

In the requirements of clause 7.31A, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SS/PBCH block index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding period; otherwise the SMTC occasion is considered as available at the UE.

### 7.31A.2 NR PSCell Addition Delay Requirement

The requirements in this section shall apply for the UE which is configured with PCell, and may also be configured with one or more SCells.

Upon receiving NR PSCell addition in subframe *n*, the UE shall be capable to transmit PRACH preamble towards NR PSCell no later than in subframe *n* + Tconfig PSCell\_withCCA:

Where:

Tconfig\_PSCell\_withCCA = TRRC\_delay + Tprocessing + Tsearch\_withCCA + T∆\_withCCA + TPSCell\_ DU\_withCCA + 2 ms

TRRC\_delay is the RRC procedure delay as specified in [2].

Tprocessing is the software processing time needed by UE, including RF warm up period. Tprocessing = 20 ms.

Tsearch\_withCCA is the time for AGC settling and PSS/SSS detection.

- If the target cell is known, then Tsearch\_withCCA = 0 ms. If the target cell is an unknown cell and the target cell Es/Iot ≥ -2 dB, then Tsearch\_withCCA = (3 + L1)\* Trs ms where L1 is the number of SMTC occasions not available at the UE for AGC settling and PSS/SSS detection.

T∆\_withCCA is time for fine time tracking and acquiring full timing information of the target cell. T∆\_withCCA = (1+ L2)\*Trs ms for a known or for an unknown PSCell where L2 is the number of SMTC occasions not available at the UE for fine time tracking and acquiring full timing information.

TPSCell\_ DU\_withCCA is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell:

TPSCell\_ DU\_withCCA = (1+L3)×TSSB,RO + 10 ms; where:

- L3 is the consecutive number of SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failures. L3 = 0 for Type 2C UL channel access procedure as defined in TS 37.213 [33].

- TSSB,RO is the SSB to PRACH occasion association period as defined in the table 8.1-1 of TS 38.213 [3].

- The value of L3 is limited by *PREAMBLE\_TRANSMISSION\_COUNTER*, which is increased when PRACH occasion is unavailable for PRACH transmission due to UL CCA failure as specified in TS 38.321 [7]. The UE behaviour when *PREAMBLE\_TRANSMISSION\_COUNTER* reaches the *preambleTransMax* is specified in TS 38.321 [7].

Trs is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in PSCell addition message, otherwise Trs is the SMTC configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing. If UE is not provided SMTC configuration or measurement object on this frequency: the requirement in this clause is applied with Trs =5 ms assuming the SSB transmission periodicity is 5ms, and there is no requirement if the SSB transmission periodicity is not 5 ms.

NOTE 1: The PSCell addition delay including the potential extensions caused by L1, L2and L3 is limited by the T304 timer [2].

The NR PSCell operating with CCA is known if it has been meeting the following conditions:

During the last 5 seconds before the reception of the NR PSCell configuration command:

- the UE has sent a valid measurement report for the NR PSCell being configured and

- One of the SSBs measured from the NR PSCell being configured remains detectable according to the cell identification conditions in the SMTC occasions available at the UE, as specified in section 9.3A of TS 38.133 [50],

- One of the SSBs measured from NR PSCell being configured also remains detectable during the NR PSCell configuration delay according to the cell identification conditions in the SMTC occasions available at the UE, as specified in section 9.3A of TS 38.133 [50].

otherwise it is unknown. The PCell interruption specified in section 7.32 is allowed only during the RRC reconfiguration procedure [2].

### 7.31A.3 NR PSCell Release Delay Requirement

The requirements in this section shall apply for a UE which is:

- configured with PCell, and

- configured with NR PSCell operating with CCA, and

- may also be configured with one or more SCells, and

- may also be configured with one or more NR SCells operating with CCA.

Upon receiving NR PSCell release in subframe *n*, the UE shall accomplish the release actions specified in [2] no later than in subframe *n+* TRRC\_delay:

Where

TRRC\_delay is the RRC procedure delay as specified in [2].

The PCell interruption specified in section 7.32 is allowed only during the RRC reconfiguration procedure [2].

## 7.32 Interruptions with EN-DC

### 7.32.1 Introduction

This section contains the requirements related to the interruptions on PCell, and MCG SCell when

NR PSCell is added or released, or

transitions between active and non-active during NR PSCell DRX, or

transitions from NR PSCell non-DRX to DRX, or

SCell in either E-UTRA MCG or NR SCG is added or released, or

SCell(s) in either E-UTRA MCG or NR SCG is activated or deactivated, or

PUCCH SCell in NR SCG is activated or deactivated, or

measurements on SCC with deactivated SCell in either E-UTRA MCG or NR SCG, or

measurements on the deactivated PSCell in NR SCG, or

a downlink bandwidth part (BWP) and/or an uplink BWP is switched in NR PSCell or in any NR SCell, or

UE dynamic Tx switches between two uplink carriers, or

NR SRS carrier based switching is performed, or

NR SRS transmission with antenna port switching.

The requirements shall apply for EN-DC.

This section contains interruption requirements when the victim cell is PCell or SCell belonging to MCG. Requirements for interruptions where victim cell is the NR PSCell or an NR SCell belonging to SCG are specified in [50].

For a UE which does not support per-FR measurement gaps, interruptions to the PCell or active MCG SCells may be caused by NR PSCell or NR SCells on any frequency range. For UE which support per-FR gaps, interruptions to the PCell or active MCG SCells may be caused by NR PSCell or NR SCells on FR1 only.

### 7.32.2 Requirements

#### 7.32.2.1 Interruptions at PSCell addition/release

The UE is allowed an interruption of up to X1 subframes (synchronous EN-DC) or X1+1 subframes (asynchronous EN-DC) on PCell and activated SCells in MCG if configured during the RRC reconfiguration procedure in intraband EN-DC. This interruption is for both uplink and downlink of PCell. For PSCell addition X1 is equal to the duration of the SMTC of the PSCell being added + 1 ms. For PSCell release X1 is equal to 1ms. The interruption is based on assumption that the cell specific reference signals from both cells are available in the same slot.

The UE is allowed an interruption of up to 1 subframe (synchronous EN-DC) or 2 subframes (asynchronous EN-DC) on PCell and activated SCells in MCG if configured during the RRC reconfiguration procedure in interband EN-DC. This interruption is for both uplink and downlink of PCell.

#### 7.32.2.2 Interruptions at transitions between active and non-active during DRX

When PCell is in non-DRX and NR PSCell is in DRX, interruptions on PCell and the activated MCG SCells if configured due to transitions from active to non-active and from non-active to active during NR PSCell DRX are allowed with up to 1 % probability of missed ACK/NACK when the configured NR PSCell DRX cycle is less than 640ms, and 0.625% probability of missed ACK/NACK is allowed when the configured NR PSCell DRX cycle is 640ms or longer. Each interruption shall not exceed 2 subframes for asynchronised EN-DC or 1 subframe for synchronised EN-DC.

When both PCell and NR PSCell are in DRX, no interruption is allowed.

#### 7.32.2.3 Interruptions at transitions from non-DRX to DRX

Interruption on PCell and the activated SCell in MCG if configured due to NR PSCell transitions from non-DRX to DRX when PCell is in non-DRX shall not exceed 5 subframes for asynchronised EN-DC or 1 subframe for synchronised EN-DC.

#### 7.32.2.4 Interruptions at SCell addition/release

When one SCell belonging to MCG is added or released:

- the requirements in clause 7.8.2.7 shall apply.

When one NR SCell belonging to SCG is added or released:

- an interruption on Pcell or activated Scell in MCG shall not exceed X1 subframes for synchronous intraband EN-DC, X1+1 subframes for asynchronous intraband EN-DC, 1 subframe for synchronous interband EN-DC or 2 subframes for asynchronous interband EN-DC. For Scell addition X1 is equal to the duration of the SMTC of the Scell being added + 1 ms. If SSB configuration (*absoluteFrequencySSB*) but no SMTC configuration is provided for the Scell being added, the SSB transmission periodicity is assumed to be 5ms and TSMTC duration for the Scell being added is x ms, where x = the number of consecutive subframes containing all SSBs in one SSB burst transmitted by the Scell being added. If no SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration is provided for the Scell being added, TSMTC duration for the Scell being added is 0ms.

#### 7.32.2.5 Interruptions at SCell activation/deactivation

When one SCell belonging to MCG is activated or deactivated:

- the requirements in clause 7.8.2.8 shall apply.

When one NR SCell or NR SCell configured with PUCCH belonging to SCG is activated or deactivated

- an interruption on Pcell or activated Scell in MCG shall not exceed X1 subframes for synchronous intraband EN-DC, X1+1 subframes for asynchronous intraband EN-DC, 1 subframe for synchronous interband EN-DC or 2 subframes for asynchronous interband EN-DC. For Scell activation X1 is equal to the duration of the SMTC of the Scell being activated + 1 ms. If SSB configuration (*absoluteFrequencySSB*) but no SMTC configuration is provided for the Scell being activated, the SSB transmission periodicity is assumed to be 5ms and TSMTC duration for the Scell being activated is x ms, where x = the number of consecutive subframes containing all SSBs in one SSB burst transmitted by the Scell being activated. If no SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration is provided for the Scell being activated, TSMTC duration for the Scell being activated is 0ms.

- The interruption is based on assumption that the cell specific reference signals from both cells are available in the same slot. For Scell deactivation X1 is equal to 1ms.

When multiple NR SCells in SCG is activated or deactivated by a single MAC CE

- an interruption on PCell or activated SCell in MCG shall not exceed X1 subframes if the PCell or activated SCell is in the same band as any of the NR SCell being activated with synchronous EN-DC, X1+1 subframes if the PCell or activated SCell is in the same band as any of the NR SCell being activated with asynchronous EN-DC, 1 subframe if the PCell or activated SCell is not the same band as any of the NR SCell being activated with synchronous EN-DC, or 2 subframes if the PCell or activated SCell is not the same band as any of the NR SCell being activated with asynchronous EN-DC. For SCell activation X1 is equal to the longest duration of the SMTC of the NR SCells being activated in the same band as the interrupted cell + 1 ms. The interruption is based on assumption that the cell specific reference signals from both cells are available in the same slot. For SCell deactivation X1 is equal to 1ms.

#### 7.32.2.6 Interruptions during measurements on SCC

##### 7.32.2.6.1 Interruptions during measurements on deactivated NR SCC

PCell or activated SCell(s) interruptions due to measurements when an NR SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] is 640 ms or longer.

- For inter-band EN-DC, the UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption shall not exceed 1 subframe for synchronous inter-band EN-DC or 2 subframes for asynchronous inter-band EN-DC.

- For synchronous intra-band EN-DC, the UE is only allowed to cause an interruption no earlier than 1 subframe before an SMTC and no later than 1 subframe after the SMTC. The interruption shall not exceed the duration of the SMTC of the deactivated NR SCell + 2 subframes. The interruption is based on assumption that the cell specific reference signals from both cells are available in the same slot.

##### 7.32.2.6.2 Interruptions during measurements on deactivated E-UTRA SCC

PCell interruptions due to measurements when an SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] is 640 ms or longer. Each interruption shall not exceed:

- 1 subframes if the PCell is not in the same band as the deactivated SCell

- 5 subframes if the PCell is in the same band as the deactivated SCell

SCell interruptions due to measurements when an SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] is 640 ms or longer. Each interruption shall not exceed:

- 1 subframes if the SCell is not in the same band as the deactivated SCell

- 5 subframes if the SCell is in the same band as the deactivated Scell

##### 7.32.2.6.3 Interruptions during CQI measurements on dormant E-UTRA SCell

PCell and SCell interruptions due to CQI measurements when an SCell is dormant are allowed as defined in clause 7.8.2.17.

##### 7.32.2.6.4 Interruptions during RRM measurements on dormant E-UTRA SCC

PCell and SCell interruptions due to RRM measurements when an SCell is dormant are allowed as defined in

- clause 7.8.2.18 if PCell and/or activated SCell are in the same band as the dormant SCell

- clause 7.8.2.19 if PCell and/or activated SCell are not in the same band as the dormant SCell

#### 7.32.2.7 Interruptions at active BWP switching

The requirements in this clause shall apply for the UE configured with only NR PSCell or with NR PSCell and one or more NR SCells. The requirements in the section apply to the case that the BWP switch is performed on a single CC or multiple CCs.

When either of the DCI-based, timer-based or RRC-based downlink BWP switch and/or uplink BWP switch occur on multiple CCs simultaneously or over partially overlapping period, the interruption requirements described in this section apply for each BWP switch.

DCI-based or timer-based downlink BWP and/or uplink BWP switching due to change in any of the parameters listed in Table 8.2.1.2.7-2 of TS 38.133 [50] or SCS in NR PSCell or in any NR SCell may cause an interruption on PCell or on activated SCell(s) in the MCG. Interruptions are not allowed during BWP switch involving other parameter change.

Uplink BWP switching on a NR PSCell triggered by consistent uplink LBT failures on the NR PSCell may cause an interruption on PCell or on activated SCell(s) in the MCG.

The starting time of interruption due to DCI-based or timer-based downlink BWP and/or uplink BWP switching or due to uplink BWP switching on a NR PSCell triggered by consistent uplink LBT failures on the NR PSCell is only allowed within the BWP switching delay TBWPswitchDelay as defined in clause 8.6.2 of TS 38.133 [50] when BWP switch occurs on a single CC. The starting time of interruption caused by each BWP switch is only allowed within the BWP switch delay TMultipleBWPswitchDelay +Y as defined in clause 8.6.2A.1 of TS 38.133 [50] when DCI-based BWP switch occurs on multiple CCs. The starting time of interruption caused by each BWP switch is only allowed within the BWP switch delay TMultipleBWPswitchDelay as defined in clause 8.6.2B.1 of TS 38.133 [50] when timer-based BWP switch occurs on multiple CCs simultaneously or TMultipleBWPswitchDelayTotal as defined in clause 8.6.2B.2 of TS 38.133 [50] when timer-based BWP switch occurs on multiple CCs over partially overlapping time period.

RRC-based downlink BWP and/or uplink BWP switching due to change in any of the parameters listed in Table 8.2.1.2.7-2 of TS 38.133 [50] or SCS in NR PSCell or in any NR SCell may cause an interruption on PCell or on activated SCell(s) in the MCG. Interruptions are not allowed during BWP switch involving other parameter change.

The interruption due to RRC-based downlink BWP and/or uplink BWP switching is allowed anywhere within the BWP switching delay (TRRCprocessingDelay + TBWPswitchDelayRRC) defined in clause 8.6.3 of TS 38.133 [50] when BWP switch occurs on a single CC. The interruption is only allowed within the delay TRRCprocessingDelay + TBWPswitchDelayRRC + DRRC\*(N-1) as defined in clause 8.6.3A of TS 38.133 [50] when BWP switch occurs on multiple CCs.The interruption due to RRC-based downlink BWP and/or uplink BWP switching defined in this clause is applicable provided that:

- the RRC reconfiguration requires the UE to only switch its active BWP and

When BWP switch involves SCS changes,

the UE is allowed to cause interruption on PCell or on any activated SCell(s) regardless of the frequency range of the NR PCell or NR SCell on which the BWP switching occurs.

Otherwise,

the UE capable of per UE measurement gap [2] is allowed to cause interruption on PCell or on any activated SCell(s) regardless of the frequency range of the NR PSCell or NR SCell on which the BWP switching occurs;

the UE capable of per FR measurement gap [2] is allowed to cause interruption on PCell or on any activated SCell(s) provided that the NR PSCell or NR SCell on which the BWP switching occurs belongs to FR1.

The interruption on PCell or on any activated SCell(s) shall not exceed:

- 1 subframe in synchronous EN-DC,

- 2 subframes in asynchronous EN-DC.

#### 7.32.2.8 Interruptions at SCell activation and deactivation of dormant SCell

When one dormant SCell belonging to MCG is activated and deactivated, UE is allowed interruptions on PCell and any activated SCell(s) as defined in

- clause 7.8.2.14 if PCell and/or activated SCell are in the same band as the dormant SCell

- clause 7.8.2.15 if PCell and/or activated SCell are not in the same band as the dormant SCell

#### 7.32.2.9 Interruptions at SCell activation and deactivation of multiple dormant SCell

When any number of SCells in a dormant state between one and six is activated and deactivated using the same MAC control element as defined in TS 36.321 [17], UE is allowed interruptions on PCell and any activated SCell(s) as defined in clause 7.8.2.16.

#### 7.32.2.10 Interruptions at SCell hibernation

When any number of SCells in activated or deactivated state between one and six is hibernated using the same MAC control element as defined in TS 36.321 [17], UE is allowed interruptions on PCell and any activated SCell(s) as defined in clause 7.8.2.20.

#### 7.32.2.11 Interruptions at direct SCell activation and hibernation

When any number of SCells between one and M is directly activated or hibernated using the same RRC message as defined in TS 36.331 [2], UE is allowed interruptions on PCell and any activated SCell(s) as defined in clause 7.8.2.21.

When one or multiple NR SCell(s) belonging to SCG are directly activated

- an interruption on PCell or activated SCell in MCG shall not exceed X1 subframes for synchronous intraband EN-DC, X1+1 subframes for asynchronous intraband EN-DC, 1 subframe for synchronous interband EN-DC or 2 subframes for asynchronous interband EN-DC. For direct SCell activation X1 is equal to the duration of the SMTC of the SCell being activated + 1 ms. The interruption is based on assumption that the cell specific reference signals from both cells are available in the same slot.

#### 7.32.2.12 DL Interruptions at UE switching between two uplink carriers

The DL interruption requirements at dynamic switching between two uplink carriers specified in this sub-clause are applicable for an uplink band pair of an inter-band EN-DC configuration when the capability *uplinkTxSwitchingPeriod* is present, and is only applicable for uplink switching mechasim specified in sub-clause 6.1.0 of TS 38.38.214 [26], where E-UTRA UL carrier is capable of one transmit antenna connector and NR UL carrier is capable of two transmit antenna connectors, and the two uplink carriers are in different bands with different carrier frequencies.

When dynamic switching between two uplink carriers is conducted, UE is allowed to cause DL interruption of X OFDM symbols in E-UTRA downlink carrier(s) as indicated by *uplinkTxSwitching-DL-Interruption* [2]. The DL interruption starts from the first OFDM symbol which fully or partially overlaps with the UL switching period in NR carrier. The DL interruption lengths of X for EUTRA carrier(s) are defined in Table 7.32.2.12-1.

No DL interruption is allowed in the E-UTRA downlink carrier(s) which is not indicated by *uplinkTxSwitching-DL-Interruption*. No DL interruption is allowed for some inter-band EN-DC configurations as specified in clause 5.5B.4 of TS 38.101-3 [54].

Table 7.32.2.12-1: DL interruption length on EUTRA carrier(s) in the unit of OFDM symbols (X) at UE switching between two uplink carriers

|  |  |
| --- | --- |
| Uplink Tx switching period Note1 | |
| 35us | 140us |
| 2 | 3 |
| Note 1: Uplink Tx switching period depends on UE capability uplinkTxSwitchingPeriod. | |

#### 7.32.2.13 Interruptions at NR SRS carrier based switching

NR SRS, defined in TS 38.215 [58], can be configured on a carrier not configured for PUCCH/PUSCH transmission. When a UE needs to transmit periodic, semi-persistent or aperiodic NR SRS on a NR carrier of a serving cell not configured for PUCCH/PUSCH transmission, the UE can perform carrier based switching to one or more carriers not configured for PUCCH/PUSCH transmission from a carrier with PUCCH/PUSCH transmission or from a carrier not configured for PUCCH/PUSCH transmission prior to transmitting the NR SRS, provided that:

- switching is from a configured NR carrier to an active BWP of another activated NR carrier;

- the carrier of SCells not configured for PUCCH/PUSCH transmission to which NR SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic NR SRS transmission, or indicated by MAC-CE for semi-persistent NR SRS transmission, or configured via RRC for periodic NR SRS transmission;

- the serving cell, from which NR SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by *srs-SwitchFromServCellIndex* and *srs-SwitchFromCarrier* in TS38.331 [38];

- the NR SRS switching is not colliding with any other transmission with higher priority defined in TS 38.214 [51] ;

- the NR SRS switching is not colliding with any measurements in SCG;

- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 38.331 [38], and is compliant to the requirements for inter-band CA with uplink in one NR band and without simultaneous Rx/Tx specified in TS 38.101 [52], the NR SRS transmissions are not simultaneously scheduled with DL SSB/ CSI-RS for L3 or L1 measurements on other carriers.

The UE shall not perform NR SRS carrier based switching if the above conditions cannot be met.

The interruption on PCC and each of the activated SCCs during the NR SRS carrier switching to the NR SCC not configured for PUCCH/PUSCH transmission shall not exceed X1 subframes as defined in Table 7.32.2.13-1 including the first subframe where NR SRS transmission is configured on the NR SCC not configured for PUCCH/PUSCH transmission.

The interruption on PCC and each of the activated SCCs during the NR SRS carrier switching from the NR SCC not configured for PUCCH/PUSCH transmission shall not exceed X1 subframes as defined in Table 7.32.2.13-1 including the last subframe where NR SRS transmission is configured on the NR SCC not configured for PUCCH/PUSCH transmission.

Table 7.32.2.13-1: Interruption length X1 at NR SRS carrier based switching

|  |  |
| --- | --- |
| NR SRS carrier switching time (us)note1 | Interruption length X1 (subframes) |
|
| ≤500 | 2 |
| 900 | 3 |
| Note1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*. | |

#### 7.32.2.14 Interruptions at NR SCell dormancy

##### 7.32.2.14.1 Interruptions due to NR SCell dormancy switch

When one NR SCell in SGC is switched from dormancy to non-dormancy or from non-dormancy to dormancy [43] when UE is in DRX active time in SCG,

- the UE is allowed an interruption on any active serving cell in MCG as defined in clause 7.32.2.7, except that the interruption is allowed regardless of which parameters change between the dormant BWP and the non-dormant BWP.

- If the UE is not capable of per-FR gap, or if the dormancy switching involves SCS changing, the interruption is allowed to active serving cell in MCG regardless of the frequency range of the NR SCell on which the dormancy switching occurs. If the UE is capable of per-FR gap and the the dormancy switching does not involve SCS changing, UE is allowed to cause interruption to active serving cells in MCG provided that the NR SCell on which the dormancy switching occurs belongs to FR1.

- The starting time of interruption is only allowed within the dormancy switching delay as defined in clause 8.6.2 of TS 38.133 [50].

When more than one NR SCells in SGC are switched from dormancy to non-dormancy or from non-dormancy to dormancy [43] simultaneously when UE is in DRX active time in SCG, the interruption requirements described above apply for dormancy switch on each SCell in SCG.

##### 7.32.2.14.2 Interruptions due to CSI and RRM measurements during SCell dormancy

When one or more NR SCells in SCG are in dormancy, the UE is allowed to cause interruptions on active E-UTRA serving cells due to CSI and RRM measurements on the NR SCell(s) in dormancy.

The rate of ACK/NACK feedback loss on any active E-UTRA serving cell resulting from CSI and RRM measurements on NR SCells in dormancy shall not exceed 0.5% and 1.0%, respectively.

#### 7.32.2.15 Interruption during NR measurement with autonomous gaps

When a UE is identifying CGI of an NR cell with autonomous gaps as configured by PCell or NR PSCell, the UE is allowed on PCell or any activated SCell in MCG if configured

- up to K1 interruptions, each with up to X1 interrupted subframes, during MIB decoding time period TMIB specified in clause 9. 11 of TS 38.133 [50] if the CGI reading is configured by NR PSCell, or TMIB\_NR specified in clause 8.17. 18 and 8.17. 19 if the CGI reading is configured by LTE PCell,

- up to L1 interruptions, each with up to Y1 interrupted subframes, during SIB1 decoding time period TSIB1 specified in clause 9. 11 of TS 38.133 [50] if the CGI reading is configured by NR PSCell, or TSIB1\_NR specified in clause 8.17. 18 and 8.17. 19 if the CGI reading is configured by LTE PCell, for SSB and CORESET for RMSI scheduling multiplexing patterns 1,

- up to L2 interruptions, each with up to Y2 interrupted subframes, during SIB1 decoding time period TSIB1 specified in clause 9. 11 of TS 38.133 [50] if the CGI reading is configured by NR PSCell, or TSIB1\_NR specified in clause 8.17. 18 and 8.17. 19 if the CGI reading is configured by LTE PCell, for SSB and CORESET for RMSI scheduling multiplexing patterns 2 and 3,

where K1, L1, L2, X1, Y1 and Y2 are as defined in 8.2.1.2. 16 of TS 38.133 [50] assuming =0 for victim cell.

#### 7.32.2.16 Interruptions at SRS carrier based switching

A PUSCH-less SCC is a TDD SCC without PUCCH/PUSCH configured. When a UE needs to transmit periodic or aperiodic SRS [16] and/or non-contention based PRACH on a PUSCH-less SCC, the UE can perform carrier based switching to one or more PUSCH-less SCCs from a CC with PUSCH or from another PUSCH-less SCC prior to transmitting SRS and/or PRACH, provided that:

- switching is from a configured CC to another activated TDD CC;

- the PUSCH-less SCCs to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission or configured via RRC [2] for periodic SRS transmission or indicated by PDCCH for PRACH;

- the serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex [2];

- the SRS switching is not colliding with any other transmission with higher priority defined in [3];

- the SRS switching is not colliding with PDCCH in subframe 0 and 5 as specified in [3];

- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 36.331 [2], and is compliant to the requirements for inter-band CA with uplink in one E-UTRA band and without simultaneous Rx/Tx specified in TS 36.101 [5], the SRS or RACH transmission are not simultaneously scheduled with DL subframe #0 or DL subframe #5 on other CCs.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

The interruption on PCC and each of the activated SCCs during the switching to the PUSCH-less SCC shall not exceed 2 subframes including the first subframe where SRS transmission is configured on the PUSCH-less SCC.

The interruption on PCC and each of the activated SCCs during the switching from the PUSCH-less SCC shall not exceed 2 subframes including the last subframe where SRS transmission is configured on the PUSCH-less SCC.

#### 7.32.2.17 Interruptions at SCG activation/deactivation

The UE is allowed an interruption of up to X1 subframes (synchronous EN-DC) or X1+1 subframes (asynchronous EN-DC) on PCell and activated SCells in MCG if configured during the RRC reconfiguration procedure of SCG activation/deactivation in intraband EN-DC. This interruption is for both uplink and downlink of PCell and the activated SCells. For PSCell activation X1 is equal to the duration of the SMTC of the PSCell being activated + 1 ms. For PSCell deactivation X1 is equal to 1ms. The interruption is based on assumption that the cell specific reference signals from both cells are available in the same slot.

The UE is allowed an interruption of up to 1 subframe (synchronous EN-DC) or 2 subframes (asynchronous EN-DC)on PCell and activated SCells in MCG if configured during the RRC reconfiguration procedure of SCG deactivation in interband EN-DC. This interruption is for both uplink and downlink of PCell and activated SCells.

#### 7.32.2.18 Interruptions due to NR SRS antenna port switching

SRS transmission with antenna port switching can be configured on a NR SCell. For interruption caused by SRS antenna port switching, the victim cell is based on the entry number of the band indicated by *txSwitchImpactToRx* or *txSwitchWithAnotherBand.* An UL interruption is allowed on any of the serving cells as indicated in *txSwitchWithAnotherBand*, and a DL interruption is allowed on any of the serving cells as indicated by *txSwitchImpactToRx*. When a UE needs to transmit SRS with antenna port switching on a NR serving cell, the UE can perform SRS transmission with antenna port switching, provided that:

- the SRS is not colliding with any other transmission with higher priority defined in TS 38.214 [51].

- the SRS switching is not colliding with any NR measurements (i.e. SSB/CSI-RS based L1/L3 measurements) and the measurements for RLM/BFD/CBD if the carrier on which the NR measurements and the measurements for RLM/BFD/CBD is performed is indicated in *txSwitchImpactToRx* or is the same carrier on which SRS is transmitted.

The UE shall not perform SRS transmission with antenna port switching if the above conditions cannot be met.

No requirements apply when E-UTRA L3 measurement, RLM/BFD/CBD/L1-RSRP/L1-SINR L1 measurements are colliding with SRS antenna port switching if the serving cell on which the E-UTRA measurements are configured is a victim cell.

When only one SRS symbol is configured to transmit with antenna port switching in a slot, the interruption on PCC or each of the activated E-UTRA SCCs are synchronised with the NR carrier during UE transmit SRS with antenna port switching shall not exceed the symbols number as defined in Table 7.32.2.18-1.

Table 7.32.2.18-1: Interruption at NR SRS transmit with antenna port switching

|  |  |  |  |
| --- | --- | --- | --- |
|  | Aggressor NR CC SCS (kHz) | | |
| **15** | **30** | **60** |
| Interrupted symbol number on victim E-UTRA carrier | 3 | 2 | 2 |

When only one SRS symbol is configured to transmit with antenna port switching in a slot, and the PCC or other E-UTRA carriers are unsynchronised with the NR carrier, or more than one SRS symbols is configured to transmit with antenna port switching in a slot, the interruption on PCC and each of the activated E-UTRA SCCs during UE transmit SRS with antenna port switching shall not exceed 2 subframes.

#### 7.32.2.19 Interruptions at fast SCell activation/deactivation

When one NR SCell belonging to SCG is activated or deactivated

- an interruption on PCell or activated SCell in MCG shall not exceed X1 subframes for synchronous intraband EN-DC, X1+1 subframes for asynchronous intraband EN-DC, 1 subframe for synchronous interband EN-DC or 2 subframes for asynchronous interband EN-DC. For SCell activation X1 is equal to equal to the duration of the CSI-RS burst for SCell activation of the SCell being activated + 1 ms. The interruption is based on assumption that the cell specific reference signals from both cells are available in the same slot. For SCell deactivation X1 is equal to 1ms.

#### 7.32.2.20 Interruptions due to RRM measurements on deactivated NR SCG

If the UE is not configured with RLM or BFD on the deactivated NR PSCell, interruptions on E-UTRA PCell or activated E-UTRA SCell(s) due to measurements on the deactivated NR PSCell are allowed with up to 0.5% probability of missed ACK/NACK feedback when the configured *measCyclePSCell* is 640ms or longer.

- For inter-band EN-DC, the UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption shall not exceed 1 subframe for synchronous inter-band EN-DC or 2 subframes for asynchronous inter-band EN-DC.

- For synchronous intra-band EN-DC, the UE is only allowed to cause an interruption no earlier than 1 subframe before an SMTC and no later than 1 subframe after the SMTC. The interruption shall not exceed the duration of the SMTC of the deactivated NR PSCell + 2 subframes. The interruption is based on assumption that the cell specific reference signals from both cells are available in the same slot.

If the UE is configured with RLM or BFD on the deactivated NR PSCell, interruptions on E-UTRA PCell or activated E-UTRA SCell(s) due to measurements on the deactivated NR PSCell are allowed with up to 1.0% probability of missed ACK/NACK feedback.

## 7.33 Maximum Transmit/Receive Timing Difference in Carrier Aggregation forsTTI and 1ms-TTI with 3 subframe HARQ processing

### 7.33.1 Introduction

This section defines the requirements for the transmit and receive timing difference in carrier aggregation when *ShortTTI-r15* is configured or *ShortProcessingTime=TRUE*. Requirements in this section apply to a UE capable of any sTTI combination indicated in *sTTI-SupportedCombinations-r15* and/or frameStructureType-SPT when the UE is configured with one or more serving cell(s) where *ShortTTI-r15* is configured and/or *ShortProcessingTime=TRUE*.

### 7.33.2 Requirements

A UE configured with the inter-band carrier aggregation shall meet the maximum received timing difference requirement and the maximum transmit timing difference requirement in the subclause 7.9.2, provided that the conditions defined in the subclause B.7.1 are fulfilled.

For a UE not configured with sTAG, the UE is not expected to handle the combination of the received timing difference(s) between any pair of the serving cells and the timing advance in pTAG if the conditions defined in the subclause B.7.1 cannot be fulfilled under such combination.

For a UE configured with sTAG, the UE is not expected to handle the combination of the received timing difference(s) between any pair of the serving cells, the transmit timing difference between pTAG and sTAG, and the timing advances in pTAG and sTAG if the conditions defined in the subclause B.7.1 cannot be fulfilled under such combination.

## 7.34 Void

## 7.35 Interruptions with SFTD measurements

### 7.35.1 Introduction

This section contains the requirements for UE supporting E-UTRAN FDD – NR dual connectivity related to the interruptions on PCell and activated SCells in MCG if configured, when performing inter-RAT SFTD measurements on NR cells without measurement gaps when no NR PSCell is configured.The inter-RAT SFTD measurement can only be configured for E-UTRA - NR band combinations that are supported by the UE.

### 7.35.2 Requirements

The UE is allowed an interruption of up to 10 subframes on PCell and activated SCells if configured during Tmeasure\_SFTD1 as specified in 8.1.2.4.25due to intraband SFTD measurements on NR cells. This interruption is for both uplink and downlink of PCell and activated SCells if configured.

The UE is allowed an interruption on PCell and activated SCells if configured during Tmeasure\_SFTD1 as specified in 8.1.2.4.25 due to interband SFTD measurements on NR cells with maximum percentage of interrupted subframes on uplink and downlink as specified in Table 7.35.2-1.

Each interruption shall not exceed 1 subframe.

Table 7.35.2-1: Requirements on maximum percentage of interrupted subframes

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| SFTD configuration | SMTC periodicity | | | | | |
| 5 ms | 10 ms | 20 ms | 40 ms | 80 ms | 160 ms |
| With RSRP report | 8.4% | 6.3% | 8.4% | 6.3% | 5.3% | 4.7% |
| Without RSRP report | 11.4% | 8.6% | 7.8% | 6.8% | 6.3% | 6.0% |

## 7.36 Interruptions with NE-DC

### 7.36.1 Introduction

This clause contains the requirements related to the interruptions on PSCell and SCG SCells when

transitions between active and non-active during NR PCell DRX, or

transitions from NR PCell non-DRX to DRX, or

SCell in either NR MCG or E-UTRA SCG is added or released, or

SCell(s) in either NR MCG or E-UTRA SCG is activated or deactivated, or

measurements on SCC with deactivated SCell in either NR MCG or E-UTRA SCG, or

a downlink bandwidth part (BWP) and/or an uplink BWP is switched in NR PCell or in any NR SCell, or

NR SRS carrier based switching is performed, or

NR SRS transmission with antenna port switching.

The requirements shall apply for NE-DC.

This clause contains interruption requirements when the victim cell is PSCell or SCell belonging to SCG. Requirements for interruptions where victim cell is the NR PCell or an NR SCell belonging to MCG are specified in TS 38.133 [50].

For a UE which does not support per-FR measurement gaps, interruptions to the PSCell or active SCG SCells may be caused by NR PCell or NR SCells on any frequency range. For UE which support per-FR gaps, interruptions to the PSCell or active SCG SCells may be caused by NR PCell or NR SCells on FR1 only.

### 7.36.2 Requirements

#### 7.36.2.1 Interruptions at transitions between active and non-active during DRX

When PSCell is in non-DRX and NR PCell is in DRX, interruptions on PSCell and the activated SCG SCells if configured due to transitions from active to non-active and from non-active to active during NR PCell DRX are allowed with up to 1 % probability of missed ACK/NACK when the configured NR PCell DRX cycle is less than 640 ms, and 0.625 % probability of missed ACK/NACK is allowed when the configured NR PCell DRX cycle is 640 ms or longer. Each interruption shall not exceed 2 subframes for asynchronised NE-DC or 1 subframe for synchronised NE-DC.

When both PSCell and NR PCell are in DRX, no interruption is allowed.

#### 7.36.2.2 Interruptions at transitions from non-DRX to DRX

Interruption on PSCell and the activated SCell in SCG if configured due to NR PCell transitions from non-DRX to DRX when PSCell is in non-DRX shall not exceed 5 subframes for asynchronised NE-DC or 1 subframe for synchronised NE-DC.

#### 7.36.2.3 Interruptions at SCell addition/release

When one SCell belonging to SCG is added or released:

- the requirements in clause 7.8.2.7 shall apply.

When one NR SCell belonging to MCG is added or released:

- an interruption on PSCell or activated Scell in SCG shall not exceed X1 subframes for synchronous intraband NE-DC, X1+1 subframes for asynchronous intraband NE-DC, 1 subframe for synchronous interband NE-DC or 2 subframes for asynchronous interband NE-DC. For Scell addition X1 is equal to the duration of the SMTC of the Scell being added + 1 ms. If SSB configuration (*absoluteFrequencySSB*) but no SMTC configuration is provided for the Scell being added, the SSB transmission periodicity is assumed to be 5ms and TSMTC duration for the Scell being added is x ms, where x = the number of consecutive subframes containing all SSBs in one SSB burst transmitted by the Scell being added. If no SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration is provided for the Scell being added, TSMTC duration for the Scell being added is 0ms.

- The interruption is based on assumption that the cell specific reference signals from both cells are available in the same slot. For Scell release X1 is equal to 1 ms.

#### 7.36.2.4 Interruptions at SCell activation/deactivation

When one SCell belonging to SCG is activated or deactivated:

- the requirements in clause 7.8.2.8 shall apply.

When one NR SCell belonging to MCG is activated or deactivated

- an interruption on PSCell or activated Scell in SCG shall not exceed X1 subframes for synchronous intraband NE-DC, X1+1 subframes for asynchronous intraband NE-DC, 1 subframe for synchronous interband NE-DC or 2 subframes for asynchronous interband NE-DC. For Scell activation X1 is equal to the duration of the SMTC of the NR Scell being activated + 1 ms. If SSB configuration (*absoluteFrequencySSB*) but no SMTC configuration is provided for the Scell being activated, the SSB transmission periodicity is assumed to be 5ms and TSMTC duration for the Scell being activated is x ms, where x = the number of consecutive subframes containing all SSBs in one SSB burst transmitted by the Scell being activated. If no SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration is provided for the Scell being activated, TSMTC duration for the Scell being activated is 0ms.

- The interruption is based on assumption that the cell specific reference signals from both cells are available in the same slot. For Scell deactivation X1 is equal to 1 ms.

When multiple NR SCells in MCG is activated or deactivated by a single MAC CE

- an interruption on PSCell or activated SCell in SCG shall not exceed X1 subframes if the PSSCell or activated SCell is in the same band as any of the NR SCell being activated with synchronous NE-DC, X1+1 subframes if the PSCell or activated SCell is in the same band as any of the NR SCell being activated with asynchronous NE-DC, 1 subframe if the PSCell or activated SCell is not the same band as any of the NR SCell being activated with synchronous NE-DC, or 2 subframes if the PSCell or activated SCell is not the same band as any of the NR SCell being activated with asynchronous NE-DC. For SCell activation X1 is equal to the longest duration of the SMTC of the NR SCells being activated in the same band as the interrupted cell + 1 ms. The interruption is based on assumption that the cell specific reference signals from both cells are available in the same slot. For SCell deactivation X1 is equal to 1ms.

#### 7.36.2.5 Interruptions during measurements on SCC

##### 7.36.2.5.1 Interruptions during measurements on deactivated NR SCC

Interruption on PSCell or other activated SCell(s) during measurement on the deactivated NR SCC shall meet requirements in clause 7.32.2.6.1, where the term PCell and EN-DC in clause 8.2.2.2.3 shall be deemed to be replaced with PSCell and NE-DC, respectively.

##### 7.36.2.5.2 Interruptions during measurements on deactivated E-UTRA SCC

PSCell interruptions due to measurements when an SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] is 640 ms or longer. Each interruption shall not exceed:

- 1 subframes if the PSCell is not in the same band as the deactivated SCell

- 5 subframes if the PSCell is in the same band as the deactivated SCell

SCell interruptions due to measurements when an SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] is 640 ms or longer. Each interruption shall not exceed:

- 1 subframes if the SCell is not in the same band as the deactivated SCell

- 5 subframes if the SCell is in the same band as the deactivated Scell

##### 7.36.2.5.3 Interruptions during CQI measurements on dormant E-UTRA SCell

PSCell interruptions due to CQI measurements when an SCell is dormant are allowed as defined in clause 7.8.2.17.

##### 7.36.2.5.4 Interruptions during RRM measurements on dormant E-UTRA SCC

PSCell and SCell interruptions due to RRM measurements when an SCell is dormant are allowed as defined in

- clause 7.8.2.18 if PSCell and/or activated SCell are in the same band as the dormant SCell

- clause 7.8.2.19 if PSCell and/or activated SCell are not in the same band as the dormant SCell

#### 7.36.2.6 Interruptions at active BWP switching

The requirements in this clause shall apply for the UE configured with LTE PSCell only or with LTE PSCell and one or more LTE SCells. The requirements in this section apply to the case that the BWP switch is performed on a single CC or multiple CCs.

When either of the DCI-based, timer-based or RRC-based downlink BWP switch and/or uplink BWP switch occur on multiple CCs simultaneously or over partially overlapping period, the interruption requirements described in this section apply for each BWP switch.

DCI-based or timer-based downlink BWP and/or uplink BWP switching due to change in any of the parameters listed in Table 8.2.2.2.5-2 in TS 38.133 [50] or SCS on NR PCell or on any NR SCell may cause an interruption on PSCell or on activated SCell(s) in the SCG. Interruptions are not allowed during BWP switch involving other parameter change.

Uplink BWP switching on a NR PCell triggered by consistent uplink LBT failures on the NR PCell may cause an interruption on PCell or on activated SCell(s) in the MCG.

The starting time of interruption due to DCI-based or timer-based downlink BWP and/or uplink BWP switching or due to uplink BWP switching on a NR PCell triggered by consistent uplink LBT failures on the NR PCell is only allowed within the BWP switching delay TBWPswitchDelay as defined in clause 8.6.2 of TS 38.133 [50] when BWP switch occurs on a single CC. The starting time of interruption caused by each BWP switch is only allowed within the BWP switch delay TMultipleBWPswitchDelay +Y as defined in clause 8.6.2A.1 of TS 38.133 [50] when DCI-based BWP switch occurs on multiple CCs. The starting time of interruption caused by each BWP switch is only allowed within the BWP switch delay TMultipleBWPswitchDelay as defined in clause 8.6.2B.1 of TS 38.133 [50] when timer-based BWP switch occurs on multiple CCs simultaneously or TMultipleBWPswitchDelayTotal as defined in clause 8.6.2B.2 of TS 38.133 [50] when timer-based BWP switch occurs on multiple CCs over partially overlapping time period.

RRC-based downlink BWP and/or uplink BWP switching due to change in any of the parameters listed in Table 8.2.1.2.7-2 of TS 38.133 [50] or SCS in NR PSCell or in any NR SCell may cause an interruption on PCell or on activated SCell(s) in the MCG. Interruptions are not allowed during BWP switch involving other parameter change.

The interruption due to RRC-based downlink BWP and/or uplink BWP switching is allowed anywhere within the BWP switching delay (TRRCprocessingDelay + TBWPswitchDelayRRC) defined in clause 8.6.3 of TS 38.133 [50] when BWP switch occurs on a single CC. The interruption is only allowed within the delay TRRCprocessingDelay + TBWPswitchDelayRRC + DRRC\*(N-1) as defined in clause 8.6.3A of TS 38.133 [50] when BWP switch occurs on multiple CCs. The interruption due to RRC-based downlink BWP and/or uplink BWP switching defined in this clause is applicable provided that:

- the RRC reconfiguration requires the UE to only switch its active BWP and

Table 7.36.2.6-1: Void

When BWP switch involves SCS changes,

the UE is allowed to cause interruption on PCell or on any activated SCell(s) regardless of the frequency range of the NR PCell or NR SCell on which the BWP switching occurs.

Otherwise,

the UE capable of per UE measurement gap [2] is allowed to cause interruption on PSCell or on any activated SCell(s) regardless of the frequency range of the NR PCell or NR SCell on which the BWP switching occurs;

the UE capable of per FR measurement gap [2] is allowed to cause interruption on PSCell or on any activated SCell(s) provided that the NR PCell or NR SCell on which the BWP switching occurs belongs to FR1.

The interruption on PSCell or on any activated SCell(s) shall not exceed:

- 1 subframe in synchronous NE-DC,

- 2 subframes in asynchronous NE-DC.

#### 7.36.2.7 Interruptions at SCell activation and deactivation of dormant SCell

When one dormant SCell belonging to SCG is activated and deactivated, UE is allowed interruptions on PSCell and any activated SCell(s) as defined in

- clause 7.8.2.14 if PSCell and/or activated SCell are in the same band as the dormant SCell

- clause 7.8.2.15 if PSCell and/or activated SCell are not in the same band as the dormant SCell

#### 7.36.2.8 Interruptions at SCell activation and deactivation of multiple dormant SCell

When any number of SCells in a dormant state between one and six is activated and deactivated using the same MAC control element as defined in TS 36.321 [17], UE is allowed interruptions on PSCell and any activated SCell(s) as defined in clause 7.8.2.16.

#### 7.36.2.9 Interruptions at SCell hibernation

When any number of SCells in activated or deactivated state between one and six is hibernated using the same MAC control element as defined in TS 36.321 [17], UE is allowed interruptions on PSCell and any activated SCell(s) as defined in clause 7.8.2.20.

#### 7.36.2.10 Interruptions at direct SCell activation and hibernation

When any number of SCells between one and M is directly activated or hibernated using the same RRC message as defined in  TS 36.331 [2], UE is allowed interruptions on PSCell and any activated SCell(s) as defined in clause 7.8.2.21.

When one or multiple NR SCell(s) belonging to MCG are directly activated

- an interruption on PSCell or activated SCell in SCG shall not exceed X1 subframes for synchronous intraband NE-DC, X1+1 subframes for asynchronous intraband NE-DC, 1 subframe for synchronous interband NE-DC or 2 subframes for asynchronous interband NE-DC. For direct SCell activation X1 is equal to the duration of the SMTC of the NR SCell being activated + 1 ms. The interruption is based on assumption that the cell specific reference signals from both cells are available in the same slot.

#### 7.36.2.11 Interruptions at NR SRS carrier based switching

NR SRS , defined in TS 38.215 [58], can be configured on a carrier not configured for PUCCH/PUSCH transmission. When a UE needs to transmit periodic, semi-persistent or aperiodic NR SRS on a NR carrier of a serving cell not configured for PUCCH/PUSCH transmission, the UE can perform carrier based switching to one or more carriers not configured for PUCCH/PUSCH transmission from a carrier with PUCCH/PUSCH transmission or from a carrier not configured for PUCCH/PUSCH transmission prior to transmitting the NR SRS, provided that:

- switching is from a configured NR carrier to an active BWP of another activated NR carrier;

- the carrier of SCells not configured for PUCCH/PUSCH transmission to which NR SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic NR SRS transmission, or indicated by MAC-CE for semi-persistent NR SRS transmission, or configured via RRC for periodic NR SRS transmission;

- the serving cell, from which NR SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by *srs-SwitchFromServCellIndex* and *srs-SwitchFromCarrier* in TS38.331 [38];

- the NR SRS switching is not colliding with any other transmission with higher priority defined in TS 38.214 [51] ;

- the NR SRS switching is not colliding with any measurements in MCG.

- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 38.331 [38], and is compliant to the requirements for inter-band CA with uplink in one NR band and without simultaneous Rx/Tx specified in TS 38.101 [52], the NR SRS transmissions are not simultaneously scheduled with DL SSB/ CSI-RS for L3 or L1 measurements on other carriers.

The UE shall not perform NR SRS carrier based switching if the above conditions cannot be met.

The interruption on PSCC and each of the activated SCCs during the NR SRS carrier switching to the NR SCC not configured for PUCCH/PUSCH transmission shall not exceed X2 subframes including the first subframe where NR SRS transmission is configured on the NR SCC not configured for PUCCH/PUSCH transmission.

The interruption on PSCC and each of the activated SCCs during the NR SRS carrier switching from the NR SCC not configured for PUCCH/PUSCH transmission shall not exceed X2 subframes including the last subframe where NR SRS transmission is configured on the NR SCC not configured for PUCCH/PUSCH transmission.

Table 7.36.2.11-1: Interruption length X2 at NR SRS carrier based switching

|  |  |
| --- | --- |
| NR SRS carrier switching time (us)note1 | Interruption length X2 (subframes) |
|
| ≤500 | 2 |
| 900 | 3 |
| Note1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*. | |

#### 7.36.2.12 Interruptions at NR SCell dormancy

##### 7.36.2.12.1 Interruptions due to NR SCell dormancy switch

When one NR SCell in MGC is switched from dormancy to non-dormancy or from non-dormancy to dormancy [43] when UE is in DRX active time in MCG,

- the UE is allowed an interruption on any active serving cell in SCG as defined in clause 7.36.2.6, except that the interruption is allowed regardless of which parameters change between the dormant BWP and the non-dormant BWP.

- If the UE is not capable of per-FR gap, or if the dormancy switching involves SCS changing, the interruption is allowed to active serving cell in SCG regardless of the frequency range of the NR SCell on which the dormancy switching occurs. If the UE is capable of per-FR gap and the the dormancy switching does not involve SCS changing, UE is allowed to cause interruption to active serving cells in SCG provided that the NR SCell on which the dormancy switching occurs belongs to FR1.

- The starting time of interruption is only allowed within the dormancy switching delay as defined in clause 8.6.2 of TS 38.133 [50].

When more than one NR SCells in MGC are switched from dormancy to non-dormancy or from non-dormancy to dormancy [43] simultaneously when UE is in DRX active time in MCG, the interruption requirements described above apply for dormancy switch on each SCell in MCG.

##### 7.36.2.12.2 Interruptions due to CSI and RRM measurements during SCell dormancy

When one or more NR SCells in MCG are in dormancy, the UE is allowed to cause interruptions on active E-UTRA serving cells due to CSI and RRM measurements on the NR SCell(s) in dormancy.

The rate of ACK/NACK feedback loss on any active E-UTRA serving cell resulting from CSI and RRM measurements on NR SCells in dormancy shall not exceed 0.5% and 1.0%, respectively.

#### 7.36.2.13 Interruption during E-UTRA measurement with autonomous gaps

When UE is configured by NR PCell to identify CGI of an E-UTRA FDD or E-UTRA TDD cell, UE may cause interruptions on PSCell, and SCell(s) in SCG if configured.

During the time period of as specified in clause 9.4.7 of TS 38.133 [50], over which the UE identifies the new CGI of the E-UTRA cell, the UE shall transmit at least 60 ACK/NACKs on FDD PSCell and each of activated FDD SCell(s), and at least NACK/NACK ACK/NACKs on TDD PSCell and each of activated TDD SCell(s) where NACK/NACK is specified in Table 7.36.2.13-1, provided that

- there is continuous DL data allocation,

- no DRX and no eDRX\_CONN cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each subframe,

- no MBSFN subframes are configured in the PCell or each of activated SCell(s).

Table 7.36.2.13-1: Number of ACK/NACKs transmitted by the UE during the time for identification of CGI of an E-UTRA cell

|  |  |
| --- | --- |
| UL/DL configuration | Minimum number of transmitted ACK/NACKs |
| 0 (Note 1) | 18 |
| 1 | 35 |
| 2 | 43 |
| 3 | 36 |
| 4 | 39 |
| 5 | 42 |
| 6 | 30 |
| Note 1: When a UE is configured with EIMTA-*MainConfigServCell* via RRC signalling [2] only this requirement shall apply. | |

#### 7.36.2.14 Interruption during NR measurement with autonomous gaps

When UE is configured by NR PCell to identify CGI of an NR cell, UE may cause interruptions on PSCell, and SCell(s) in SCG if configured.

- up to K1 interruptions, each with up to X1 interrupted subframes, during MIB decoding time period TMIB specified in clause 9. 11 of TS 38.133 [50],

- up to L1 interruptions, each with up to Y1 interrupted subframes, during SIB1 decoding time period TSIB1 specified in clause 9. 11 of TS 38.133 [50], for SSB and CORESET for RMSI scheduling multiplexing patterns 1,

- up to L2 interruptions, each with up to Y2 interrupted subframes, during SIB1 decoding time period TSIB1 specified in clause 9. 11 of TS 38.133 [50], for SSB and CORESET for RMSI scheduling multiplexing patterns 2 and 3,

where K1, L1, L2, X1, Y1 and Y2 are as defined in 8.2.1.2. 16 of TS 38.133 [50] assuming =0 for victim cell.

#### 7.36.2.15 Interruptions at SRS carrier based switching

A PUSCH-less SCC is a TDD SCC without PUCCH/PUSCH configured. When a UE needs to transmit periodic or aperiodic SRS [16] and/or non-contention based PRACH on a PUSCH-less SCC, the UE can perform carrier based switching to one or more PUSCH-less SCCs from a CC with PUSCH or from another PUSCH-less SCC prior to transmitting SRS and/or PRACH, provided that:

- switching is from a configured CC to another activated TDD CC;

- the PUSCH-less SCCs to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission or configured via RRC [2] for periodic SRS transmission or indicated by PDCCH for PRACH;

- the serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex [2];

- the SRS switching is not colliding with any other transmission with higher priority defined in [3];

- the SRS switching is not colliding with PDCCH in subframe 0 and 5 as specified in [3];

- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 36.331 [2], and is compliant to the requirements for inter-band CA with uplink in one E-UTRA band and without simultaneous Rx/Tx specified in TS 36.101 [5], the SRS or RACH transmission are not simultaneously scheduled with DL subframe #0 or DL subframe #5 on other CCs.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

The interruption on PSCC and each of the activated SCCs during the switching to the PUSCH-less SCC shall not exceed 2 subframes including the first subframe where SRS transmission is configured on the PUSCH-less SCC.

The interruption on PSCC and each of the activated SCCs during the switching from the PUSCH-less SCC shall not exceed 2 subframes including the last subframe where SRS transmission is configured on the PUSCH-less SCC.

#### 7.36.2.16 Interruptions due to NR SRS antenna port switching

SRS transmission with antenna port switching can be configured on a NR Cell. For interruption caused by SRS antenna port switching, the victim cell is based on the entry number of the band indicated by *txSwitchImpactToRx* or *txSwitchWithAnotherBand.* An UL interruption is allowed on any of the serving cells as indicated in *txSwitchWithAnotherBand*, and a DL interruption is allowed on any of the serving cells as indicated by *txSwitchImpactToRx*. When a UE needs to transmit SRS with antenna port switching on a NR serving cell, the UE can perform SRS transmission with antenna port switching, provided that:

- the SRS is not colliding with any other transmission with higher priority defined in TS 38.214 [51].

- the SRS switching is not colliding with any NR measurements (i.e. SSB/CSI-RS based L1/L3 measurements) and the measurements for RLM/BFD/CBD if the carrier on which the NR measurements and the measurements for RLM/BFD/CBD is performed is indicated in *txSwitchImpactToRx* or is the same carrier on which SRS is transmitted.

The UE shall not perform SRS transmission with antenna port switching if the above conditions cannot be met.

No requirements apply when E-UTRA L3 measurement, RLM/BFD/CBD/L1-RSRP/L1-SINR L1 measurements are colliding with SRS antenna port switching if the serving cell on which the E-UTRA measurements are configured is a victim cell.

When SRS transmission with antenna port switching is performed in a slot, the UE is allowed interruptions on any active serving cell reception if the cell frequency belongs to the IE *txSwitchImpactToRx* indication, or interruptions on any active serving cell transmission if the cell frequency belongs to the IE *txSwitchWithAnotherBand* indication overlapped with the SRS transmission, regardless of per-FR MG capability.

When only one SRS symbol is configured to transmit with antenna port switching in a slot, the interruption on each of the activated E-UTRA SCCs are synchronised with the NR carrier during UE transmit SRS with antenna port switching shall not exceed the symbols number as defined in Table 7.36.2.16-1.

**Table 7.36.2.16-1: Interruption at NR SRS transmit with antenna port switching**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Aggressor NR CC SCS (kHz) | | |
| **15** | **30** | **60** |
| Interrupted symbol number on victim E-UTRA carrier | 3 | 2 | 2 |

When only one SRS symbol is configured to transmit with antenna port switching in a slot, and the E-UTRA carriers are unsynchronised with the NR carrier, or more than one SRS symbols is configured to transmit with antenna port switching in a slot, the interruption on each of the activated E-UTRA SCCs during UE transmit SRS with antenna port switching shall not exceed 2 subframes.

## 7.37 Interruptions during NR measurement with autonomous gaps

### 7.37.1 Introduction

This section contains the requirements for the interruptions on PCell and activated SCells if configured, when performing inter-RAT NR measurement with autonomous gaps cells.

### 7.37.2 Requirements

When a UE is identifying CGI of an NR cell with autonomous gaps as configured by PCell, the UE is allowed on PCell or any activated SCell if configured

- up to K1 interruptions, each with up to X1 interrupted subframes, during MIB decoding time period TMIB\_NR specified in clause 8.1.2.4. 27.2 and 8.1.2.4. 28.2,

- up to L1 interruptions, each with up to Y1 interrupted subframes, during SIB1 decoding time period TSIB1\_NR specified in clause 8.1.2.4. 27.2 and 8.1.2.4. 28.2, for SSB and CORESET for RMSI scheduling multiplexing patterns 1,

- up to L2 interruptions, each with up to Y2 interrupted subframes, during SIB1 decoding time period TSIB1\_NR specified in clause 8.1.2.4. 27.2 and 8.1.2.4. 28.2, for SSB and CORESET for RMSI scheduling multiplexing patterns 2 and 3,

where K1, L1, L2, X1, Y1 and Y2 are as defined in 8.2.1.2. 16 of TS 38.133 [50] assuming =0 for victim cell.

## 7.38 SCG Activation and Deactivation Delay

### 7.38.1 Introduction

This clause defines requirements for the delay within which the UE shall be able to activate one SCG and deactivate on SCG in EN-DC. The requirements are applicable to an E-UTRA-FDD – NR and E-UTRA-TDD – NR dual connectivity capable UE.

### 7.38.2 SCG Activation Delay Requirement

The requirements in this clause shall apply for the UE configured with one deactivated SCG in EN-DC, and when PScell in one SCG is being activated.

The delay within which the UE shall be able to activate the deactivated SCG depends upon the specified conditions.

Upon receiving SCG activation command in slot *n*, the UE shall be capable to transmit PRACH preamble or PUCCH towards PSCell no later than in slot ,

where:

Tactivation\_time = TRRC\_delay + Tprocessing + Tsearch + T∆ + TIU + 2 ms

TRRC\_delay is the RRC procedure delay as specified in TS 38.331 [2].

Tprocessing is the SW processing time needed by UE, including RF warm up period. When PSCell is activated from deactivated state, if any PSCell parameter is modified, Tprocessing = [20ms]. Otherwise, Tprocessing = [5 or 10ms].

Tsearch is the time for AGC settling and PSS/SSS detection.

For RACH based PSCell activation, if the target cell is a known NR FR1 or FR2 PScell, Tsearch = 0 ms. If the target cell is an unknown FR1 PScell and Es/Iot ≥ -2 dB, Tsearch = 3\* Trs ms. If the target cell is an unknown FR2 PScell and Es/Iot ≥ -2 dB, then Tsearch = 24\* Trs ms.

For RACH-less based PSCell activation, if RLM and BFD are configured and no failure is detected, Tsearch = 0 ms if the target cell is a known FR2 PScell. There are no requirements if PSCell is unknown.

T∆ is time for fine time tracking and acquiring full timing information of the target PSCell. T∆ = 1\*Trs ms.

TIU: When RACH based PSCell activation is configured, it is the delay uncertainty in acquiring the first available PRACH occasion in the PSCell. TIU is up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in Table 8.1-1 of TS 38.213 [3].

When RACH-less based PSCell activation is configured, it is the uncertainty in acquiring the first PUSCH transmission occasion [or SR on PUCCH].

Trs is the SMTC periodicity of the PScell if the UE has been provided with an SMTC configuration for the target cell in PSCell addition message, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5.

In FR1 and FR2, the PSCell is known if it has been meeting the following conditions:

- During the last 5 seconds before the reception of the SCG activation command:

- the UE has sent a valid measurement report for the PSCell being activated and

- One of the SSBs measured from the PSCell being activated remains detectable according to the cell identification conditions specified in clause 9.3.

- One of the SSBs measured from PSCell being activated also remains detectable during the PSCell activation delay Tconfig\_PSCell according to the cell identification conditions specified in clause 9.3.

otherwise it is unknown.

The PCell interruption specified in clause 8.2 is allowed only during the RRC reconfiguration procedure [2].

### 7.38.3 SCG Deactivation Delay Requirement

The requirements in this clause shall apply for a UE which is configured with at least PCell and PSCell.

Upon receiving SCG deactivation command in subframe n, the UE shall accomplish the deactivation actions specified in TS 38.331 [2] no later than in slot :

where

TRRC\_delay is the RRC procedure delay as specified in TS 38.331 [2].

The PCell interruption specified in clause 8.2 is allowed only during the RRC reconfiguration procedure [2].

FFS: MAC CE based SCG deactivation delay requirements.

# 8 UE Measurements Procedures in RRC\_CONNECTED State

## 8.1 General Measurement Requirements

### 8.1.1 Introduction

This clause contains requirements on the UE regarding measurement reporting in RRC\_CONNECTED state. The requirements are split in E-UTRA intra frequency, E-UTRA inter frequency, Inter-RAT UTRA FDD, UTRA TDD and GSM measurements. These measurements may be used by the E-UTRAN, e.g. for handover decisions. The measurement quantities are defined in [4], the measurement model is defined in [22] and measurement accuracies are specified in clause 9. Control of measurement reporting is specified in TS 36.331 [2].

When the UE is provided with IDC solution, the UE shall also perform RRM measurements and meet the corresponding requirements in clause 8.

In the requirements of Section 8.1 for the UE capable of CA and the UE configured with up to six SCells, the applicable exceptions for side conditions are specified in Annex B, Sections B.4.2 and B.4.3, respectively.

In the requirements of Section 8.1 for the UE capable of DC and the UE configured with one PSCell, the applicable exceptions for side conditions are specified in Annex B, Sections B.4.2 and B.4.3, respectively.

The requirements in Section 9 are applicable for a UE performing measurements according to Section 8.1.

### 8.1.2 Requirements

#### 8.1.2.1 UE measurement capability

If the UE requires measurement gaps to identify and measure inter-frequency and/or inter-RAT cells and the UE does not support perServingCellMeasurementGap-r14 or is not configured with per serving cell measurement gaps, in order for the requirements in the following subsections to apply the E-UTRAN must provide a single measurement gap pattern with constant gap duration for concurrent monitoring of all frequency layers and RATs. If the UE requires measurement gaps to identify and measure inter-frequency and/or inter-RAT cells and the UE supports perServingCellMeasurementGap-r14 and is configured with per serving cell measurement gaps, in order for the requirements in the following subsections to apply the E-UTRAN must provide gap pattern(s) on at least each serving component carrier (per-CC) where the UE has indicated in the *perCC-ListGapIndication* IE that gaps are required. No gap pattern is required to be provided on the serving component carrier where UE has indicated in the the *perCC-ListGapIndication* IE that gaps are not required. The requirements apply if the gap on each serving cell is at least that which the UE has indicated with gapIndication in the *perCC-ListGapIndication* IE, and if the gapOffset, MGRP and MGL are the same for each serving component carrier. During the measurement gaps the UE:

During the measurement gaps the UE:

- shall not transmit any data

- is not expected to tune its receiver on any of the E-UTRAN carrier frequencies of PCell and any SCell.

- is not expected to tune its receiver on any of the E-UTRAN carrier frequencies of PCell, PSCell, and SCell.

If the UE supporting dual connectivity is configured with PSCell, during the total interruption time as shown in Figure 8.1.2.1-1, the UE shall not transmit and receive any data in SCG.

In addition, for UE supporting E-UTRA-NR dual connectivity, if MG timing advance of 0.5ms is applied, the UE:

- shall not transmit any data

- is not expected to tune its receiver on any of the E-UTRAN carrier frequencies of PCell and any SCell.

- is not expected to tune its receiver on any of the E-UTRAN carrier frequencies of PCell, PSCell, and SCell.

in subframes fully or partially overlapping with the measurement gaps on E-UTRAN serving cells. The total interruption time on E-UTRAN serving cells is (MGL+1) subframes.

When MG timing advance of 0.5 ms is not applied, in the uplink subframe occurring immediately after the measurement gap,

- if the following conditions are met then it is up to UE implementation whether or not the UE can transmit data:

- all the serving cells belong to E-UTRAN TDD;

- the measurement objects do not include any NR carrier frequency;

- if the subframe occurring immediately before the measurement gap is an uplink subframe.

- Otherwise the UE shall not transmit any data.

When MG timing advance of 0.5 ms is applied, in the uplink subframe occurring immediately after the subframe partially overlapped with measurement gap,

- it is up to UE implementation whether or not the UE can transmit data

In determining the above UE behaviour in the uplink subframe occurring immediately after the measurement gap or after the subframe partially overlapped with measurement gap,the UE shall treat a special subframe as an uplink subframe if the special subframe occurs immediately before the measurement gap.

Inter-frequency and inter-RAT measurement requirements within this clause rely on the UE being configured with one measurement gap pattern unless the UE has signaled that it is capable according to the capability interFreqNeedForGaps or interRATNeedForGaps of conducting such measurements without gaps and without interruption. UEs shall only support those measurement gap patterns listed in Table 8.1.2.1-1 and table 8.1.2.1.-2 that are relevant to its measurement capabilities. UEs supporting network controlled small gap and which have signaled that they are capable of measurements without gap but requiring NCSG, can be configured with a network controlled small gap pattern in table 8.1.2.1.3-1 on all component carrier(s) to perform inter-frequency and inter-RAT measurement.

ProSe capable UE is allowed to perform ProSe transmissions during the measurement gaps that are not used for measurements if the requirements specified in section 8 for inter-frequency and inter-RAT measurements are fulfilled.

In E-UTRA-NR dual connectivity mode, NR - E-UTRAdual connectivity mode and E-UTRA standalone mode, all gap patterns #0~11 in Table 8.1.2.1-1 can be configured for measurements of NR carriers only, and gap pattern#0, 1, 2, 3, 4, 6, 7, 8, 10 can be configured for measurements of E-UTRA carriers with the applicability as specified in Table 8.1.2.1-1.

Table 8.1.2.1-1: Gap Pattern Configurations supported by the UE

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Gap Pattern Id | MeasurementGap Length (MGL, ms) | Measurement Gap Repetition Period  (MGRP, ms) | Minimum available time for inter-frequency and inter-RAT measurements during 480ms period  (Tinter1, ms) | Measurement Purpose |
| 0 | 6 | 40 | 60 | Inter-Frequency E-UTRAN FDD and TDD, UTRAN FDD, GERAN, LCR TDD, HRPD, CDMA2000 1x, inter-RAT NR |
| 1 | 6 | 80 | 30 | Inter-Frequency E-UTRAN FDD and TDD, UTRAN FDD, GERAN, LCR TDD, HRPD, CDMA2000 1x, inter-RAT NR |
| 2 | 3 | 40 | 24NOTE 1,2 | Inter-Frequency E-UTRAN FDD and TDD for cells with time difference as specified below.  inter-RAT NR |
| 3 | 3 | 80 | 12NOTE 1,2 | Inter-Frequency E-UTRAN FDD and TDD for cells with time difference according as specified below.  inter-RAT NR |
| 4 | 6 | 20 | 120 Note 1 | inter-RAT NR, Inter-Frequency E-UTRAN FDD and TDD Note 6 |
| 5 | 6 | 160 | Note 3 | inter-RAT NR |
| 6 | 4 | 20 | 72 Note 1, 5, 7 | inter-RAT NR, Inter-Frequency E-UTRAN FDD and TDD Note 6 |
| 7 | 4 | 40 | 36 Note 1, 5, 8 | inter-RAT NR, Inter-Frequency E-UTRAN FDD and TDD Note 6 |
| 8 | 4 | 80 | 18Note 1, 5, 9 | inter-RAT NR, Inter-Frequency E-UTRAN FDD and TDD Note 6 |
| 9 | 4 | 160 | Note 3 | inter-RAT NR |
| 10 | 3 | 20 | 48 Note 1, 5 | inter-RAT NR, Inter-Frequency E-UTRAN FDD and TDD Note 6 |
| 11 | 3 | 160 | Note 3 | inter-RAT NR |
| 24 | 10 | 80 | 54Note 1 | Inter-Frequency E-UTRAN FDD and TDD Note 11 |
| 25 | 20 | 160 | Note 3 | Note 11 |
| NOTE 1: When determing UE requirements using Tinter1 for GP2, 3, 4, 6, 7, 8, 10, Tinter1 = 60 for GP2, GP4, GP6, GP7, GP10 and Tinter1 = 30 for GP3, GP8 and GP24 shall be used.  NOTE 2: Void.  NOTE 3: This gap pattern can be used only for measurement of NR carriers, and Tinter is not applicable.  NOTE 4: Void  NOTE 5: Void.  NOTE 6: This gap pattern is supported by UEs which are configured to perform both E-UTRA inter-frequency measurement and inter-RAT NR measurement or supported by UEs configured to perform inter-RAT NR measurement only.  NOTE 7: When this gap pattern is used, the Tinter for E-UTRA interfrequency measurements is 48ms corresponding to the first 3ms of the 4ms gap  NOTE 8: When this gap pattern is used, the Tinter for E-UTRA interfrequency measurements is 24ms corresponding to the first 3ms of the 4ms gap  NOTE 9: When this gap pattern is used, the Tinter for E-UTRA interfrequency measurements is 12ms corresponding to the first 3ms of the 4ms gap  NOTE 10: For UE only supporting *measGapPatterns-NRonly-r16* for the corresponding gap patterns among GP2-11, the corresponding gap patterns are only applicable to measurement of inter-RAT NR.  NOTE 11: Measurement gap patterns #24 and #25 can be requested by NR PCell [38] only when the UE is configured at least with any of RSTD, UE Rx-Tx, or PRS-RSRP measurements requiring such gaps and can only be used during the corresponding positioning measurement period | | | | |

Table 8.1.2.1-2: Gap Pattern Configurations for UE supporting low density burst gap pattens

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Gap Pattern Id | MeasurementGap Length (MGL, ms) | Measurement Gap Repetition Period  (MGRP, ms) | Number of gaps per burst | Burst repetition period Tburst | Measurement Purpose |
| nonUniform1 | 6 | 40 | 13 | 1.28s | Inter-Frequency E-UTRAN FDD and TDD |
| nonUniform2 | 6 | 40 | 13 | 2.56s | Inter-Frequency E-UTRAN FDD and TDD |
| nonUniform3 | 6 | 40 | 13 | 5.12s | Inter-Frequency E-UTRAN FDD and TDD |
| nonUniform4 | 6 | 40 | 13 | 10.24s | Inter-Frequency E-UTRAN FDD and TDD |
| NOTE 1: When determing UE requirements nonUniform1, nonUniform2, nonUniform3 or nonUniform4, 60ms shall be assumed as the minimum available time for inter-frequency and inter-RAT measurements during each burst..  NOTE 2: The Gap patterns nonUniform1, nonUniform2, nonUniform3 and nonUniform4 cannot be be combined with IncMon reduced performance group | | | | | |

NOTE 1: When inter-frequency RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, only Gap Pattern 0 can be used. For defining the inter-frequency and inter-RAT requirements Tinter1=30ms shall be assumed.

NOTE 2: A measurement gap starts at the end of the latest subframe occurring immediately before the measurement gap among MCG serving cells subframes. If the measurement objects include at least one NR carrier frequency, the measurement gap starts at time TMG ms if configured advanced to the end of the latest DL E-UTRA subframe occurring immediately before the configured measurement gap among MCG serving cells.

NOTE 2a: In EN-DC mode, the measurement gap starts at time TMG ms if configured advanced to the end of the latest E-UTRA DL subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.

NOTE 2b: In NE-DC mode,

- if per-UE measurement gap is configured with MG timing advance of TMG ms, the measurement gap starts at time TMG ms advanced to the end of the latest NR DL subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.

- if per-FR measurement gap for FR1 is configured with MG timing advance of TMG ms and UE has NR serving cell in FR1, the measurement gap for FR1 starts at time TMG ms advanced to the end of the latest NR DL subframe occurring immediately before the configured measurement gap among MCG serving cells subframes in FR1.

- if per-FR measurement gap for FR1 is configured with MG timing advance of TMG ms and UE doesn’t have NR serving cell in FR1, the measurement gap for FR1 starts at time TMG ms advanced to the end of the latest DL E-UTRA subframe occurring immediately before the configured measurement gap among SCG serving cells subframes.

TMG is the MG timing advance value provided in mgta according to TS 36.331 [2].

NOTE 3: MGL is the time from start of tuning to end of retuning, which is aligned between MCG and SCG.

NOTE 4: For GP0 and GP1 The total interruption time on SCG is 6 subframes for synchronous dual connectivity, and the total interruption time on SCG is 7 subframes for asyncrhonous dual connectivity. As shown in Figure 8.1.2.1-1, MCG subframes from *i+*1 to *i+*6 are included in total interruption time together with SCG subframes from *j+*1 to *j+*6 for synchronous dual connectivity and *j+*1 to *j+*7for asyncrhonous dual connectivity.

NOTE 5: For GP0 and GP1 and asynchronous dual connectivity as shown in Figure 8.1.2.1-1 (b), subframe *j* is regarded as the subframe occurring immediately before the measurement gap for SCG, similarly, subframe *j*+8 is regarded as the subframe occurring immediately after the measurement gap for SCG.

NOTE 6: For GP2 and GP3 the total interruption time on SCG is 3 subframes for synchronous dual connectivity, and the total interruption time on SCG is 4 subframes for asyncrhonous dual connectivity. The total interrupt is applied in same spirit as shown in Figure 8.1.2.1-1. I.e. For MCG subframes from *i+*1 to *i+*3 are included in total interruption time together with SCG subframes from *j+*1 to *j+*3 for synchronous dual connectivity and *j+*1 to *j+*4for asyncrhonous dual connectivity.

NOTE 7: For GP2 and GP3 and asynchronous dual connectivity as shown in Figure 8.1.2.1-1 (b) with measurement gap length 3, subframe *j* is regarded as the subframe occurring immediately before the measurement gap for SCG, similarly, subframe *j*+5 is regarded as the subframe occurring immediately after the measurement gap for SCG.

NOTE 8: nonUniform1 – nonUniform4 gap patterns are shown in figure 8.1.2.1-2. A burst repetition period Tburst is consisted of T1 and T2. During T1, UE performs measurement during the gap. During T2, UE suspends measurement gap. Both UE and eNB can assume there is no gap during T2. T1 equals to number of gaps per burst in Table 8.1.2.1-2. Tburst is configured by the higher layers.For nonUniform1 – nonUniform4 the total interruption time on SCG is same as for GP0 and GP1 for both synchronous and asynchronous dual connectivity as shown in Figure 8.1.2.1-1. For asynchronous dual connectivity as shown in Figure 8.1.2.1-1 (b), subframe *j* is regarded as the subframe occurring immediately before the measurement gap for SCG, similarly, subframe *j*+8 is regarded as the subframe occurring immediately after the measurement gap for SCG.

NOTE 9: When UE is in NE-DC, the total interruption time on SCG is MGL subframes for synchronous NE-DC, and the total interruption time on SCG is (MGL+1) subframes for asyncrhonous NE-DC. Subframe occurring immediately before the measurement gap for SCG is the latest subframe in SCG which is before and fully non-overlapped with the measurement gap, similarly, subframe occurring immediately after the measurement gap for SCG is the earliest subframe in SCG which is after and fully non-overlapped with the measurement gap.



Figure 8.1.2.1-1: Measurement GAP and total interruption time on MCG and SCG



Figure 8.1.2.1-2: Non-uniform gap pattern

A UE that is capable of identifying and measuring inter-frequency and/or inter-RAT cells without gaps shall follow requirements as if Gap Pattern Id #0 had been used and the minimum available time Tinter1 of 60 ms shall be assumed for the corresponding requirements.

A UE configured with gap pattern Id 2, 3 or 10, shall be able to detect a target cell if the sub frame #0 or #5 of the target cell begins no earlier than 500uS from the start of the measurement gap and if the sub frame #0 or #5 of the target cell ends no later than 500uS before the end of the measurement gap in case of FDD, and no later than [750]us before the end of measurement gap in case of TDD.

A UE configured with gap pattern Id 6, 7 or 8 shall be able to detect a target cell if the sub frame #0 or #5 of the target cell begins no earlier than 500uS from the start of the measurement gap and if the sub frame #0 or #5 of the target cell ends no later than 1500uS before the end of the measurement gap in case of FDD, and no later than 1750us before the end of measurement gap in case of TDD.

If the UE supporting E-UTRA carrier aggregation when configured with up to six SCCs is performing measurements on cells on PCC, inter-frequency measurements, or inter-RAT measurements, and interruption occurs on PCell or any activated SCell or both due to measurements performed on cells on an SCC with a deactivated SCell according to section 8.3, then the UE shall meet the requirements specified for each measurement in Section 8 and Section 9.

If the UE supporting E-UTRA dual connectivity when configured with a PSCell is performing measurements on cells on PCC, inter-frequency measurements, or inter-RAT measurements, then the UE shall meet the requirements specified for each measurement in Section 8 and Section 9.

A UE which indicate support for Increased UE carrier monitoring E-UTRA according to the capabilities in [2, 31] and which is capable of identifying and measuring inter-frequency and/or inter-RAT cells without gaps, shall be able to monitor maximum number of layers as defined in 8.1.2.1.1.1a, and apply the *MeasScaleFactor* [2] defining the relaxation to the requirements for the configured carriers according to section 8.1.2.1.1a.

A UE configured via LPP [24] to perform RSTD measurements requiring measurement gaps and provided with the OTDOA assistance data, which is comprising at least one PRS configuration with >6 consecutive downlink positioning subframes defined in TS 36.211 [16] in at least one cell, can be configured for performing the RSTD measurements with the following measurement gap patterns and shall not be used outside the corresponding RSTD measurement period:

- measurement gap pattern with Id 0 specified in Table 8.1.2.1-1, or

- an applicable measurement gap pattern specified in Table 8.1.2.1-3, provided the following conditions are met:

- the UE is Cat M1 or Cat M2 UE, and

- the applicability conditions are met for the UE.

Table 8.1.2.1-3: Additional Measurement Gap Pattern Configurations supported by the UE

|  |  |  |  |
| --- | --- | --- | --- |
| Gap Pattern Id | Measurement Gap Length  (MGL, ms) | Measurement Gap Repetition Period  (MGRP, ms) | Applicability |
| rstd0 | 10 | 80 | NOTE 1, 2 |
| rstd1 | 10 | 160 |
| rstd2 | 10 | 320 |
| rstd3 | 10 | 640 |
| rstd4 | 10 | 1280 |
| rstd5 | 14 | 160 | NOTE 1, 2 |
| rstd6 | 14 | 320 |
| rstd7 | 14 | 640 |
| rstd8 | 14 | 1280 |
| rstd9 | 24 | 320 | NOTE 1, 2 |
| rstd10 | 24 | 640 |
| rstd11 | 24 | 1280 |
| rstd12 | 32 | 320 | NOTE 1, 2 |
| rstd13 | 32 | 640 |
| rstd14 | 32 | 1280 |
| rstd15 | 54 | 640 | NOTE 2 |
| rstd16 | 54 | 1280 |
| rstd17 | 64 | 640 | NOTE 2 |
| rstd18 | 64 | 1280 |
| rstd19 | 80 | 640 | NOTE 3 |
| rstd20 | 80 | 1280 |
| NOTE 1: For FDD, (MGL-2) shall not be larger than the required minimum number of available measurement subframes specified in Section 9 in the corresponding RSTD measurement accuracy requirements.  NOTE 2: For TDD, the number of DL subframes within the available measurement time of the measurement gap shall not be larger than the required minimum number of available measurement subframes specified in Section 9 in the corresponding RSTD measurement accuracy requirements.  NOTE 3: At least one cell in the OTDOA assistance data is configured with multiple PRS configurations | | | |

If the UE is configured with any of the measurement gap patterns specified in Table 8.1.2.1-3 for performing RSTD measurements, using of any other measurement gap pattern configured to the UE is suspended during the RSTD measurement period.

##### 8.1.2.1.1 Monitoring of multiple layers using gaps

When monitoring of multiple inter-frequency E-UTRAN and inter-RAT (UTRAN, GSM, NR) using gaps (or without using gaps provided the UE supports such capability) is configured, the UE shall be capable of performing one measurement of the configured measurement type (RSRP, RSRQ, RSTD, UTRAN TDD P-CCPCH RSCP, UTRAN FDD CPICH measurements, GSM carrier RSSI, NR SS-RSRP, NR SS-RSRQ, NR SS-SINR, etc.) of detected cells on all the layers

The effective total number of frequencies excluding the frequencies of the PCell, SCells, and PSCell being monitored is Nfreq, which is defined as:

Nfreq = Nfreq, E-UTRA + Nfreq, UTRA + Mgsm + Nfreq, cdma2000 + Nfreq, HRPD + Nfreq, NR

where

Nfreq, E-UTRA is the number of E-UTRA carriers being monitored (FDD and TDD)

Nfreq, UTRA is the number of UTRA carriers being monitored (FDD and TDD)

MGSM is an integer which is a function of the number of GSM carriers on which measurements are being performed. MGSM is equal to 0 if no GSM carrier is being monitored. For a MGRP of 40 ms, MGSM is equal to 1 if cells on up to 32 GSM carriers are being measured. For a MGRP of 80 ms, MGSM is equal to ceil(Ncarriers,GSM /20) where Ncarriers,GSM is the number of GSM carriers on which cells are being measured.

Nfreq, cdma2000 is the number of cdma2000 1x carriers being monitored.

Nfreq, HRPD is the number of HRPD carriers being monitored.

Nfreq, NR is the number of NR inter-RAT carriers being monitored.

8.1.2.1.1.1 Maximum allowed layers for multiple monitoring

The UE shall be capable of monitoring at least per RAT group:

- Depending on UE capability, 3 FDD E-UTRA inter-frequency carriers, and

- Depending on UE capability, 1 FDD E-UTRA inter-frequency carrier for RSTD measurements, and

- Depending on UE capability, 3 TDD E-UTRA inter-frequency carriers, and

- Depending on UE capability, 1 TDD E-UTRA inter-frequency carrier for RSTD measurements, and

- Depending on UE capability, 3 FDD UTRA carriers, and

- Depending on UE capability, 3 TDD UTRA carriers, and

- Depending on UE capability, 32 GSM carriers (one GSM layer corresponds to 32 carriers), and

- Depending on UE capability, 5 cdma2000 1x carriers, and

- Depending on UE capability, 5 HRPD carriers, and

- Depending on UE capability, 8 NR inter-RAT carriers

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 7 effective carrier frequency layers comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD, UTRA FDD, UTRA TDD, GSM (one GSM layer corresponds to 32 carriers), cdma2000 1x, and HRPD layers.

In addition to the requirements defined above, the UE which supports NR inter-RAT measurements or EN-DC but is not configured with NR PSCell shall be capable of monitoring a total of at least 9 effective carrier frequency layers comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD, UTRA FDD, UTRA TDD, GSM (one GSM layer corresponds to 32 carriers), cdma2000 1x, HRPD and NR layers.

8.1.2.1.1.1a Maximum allowed layers for multiple monitoring (Increased UE carrier monitoring)

UE which indicate support for Increased UE carrier monitoring E-UTRA according to the capabilities in [2,31] shall be capable of monitoring at least

- Depending on UE capability, 8 FDD E-UTRA inter-frequency carriers, and

- Depending on UE capability, 8 TDD E-UTRA inter-frequency carriers

UE which indicate support for increased UE carrier monitoring UTRA according to the capabilities in [2,31] shall be capable of monitoring at least

- Depending on UE capability, 6 FDD UTRA carriers, and

- Depending on UE capability, 7 TDD UTRA carriers, and

In addition to the requirements defined above, the UE which indicate support for Increased UE carrier monitoring E-UTRA or increased UE carrier monitoring UTRA according to the capabilities in [2,31] shall be capable of monitoring a total of at least 12 carrier frequency layers comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD, UTRA FDD, UTRA TDD, GSM (one GSM layer corresponds to 32 carriers), cdma2000 1x and HRPD layers

The minimum performance requirements for a UE which does not indicate support for Increased UE carrier monitoring E-UTRA [2,31] are calculated assuming all E-UTRA carriers which the UE is required to monitor, are having normal performance, i.e. Nfreq, E-UTRA,reduced =0. The minimum performance requirements for a UE which does not indicate support for Increased UE carrier monitoring UTRA [2,31] are calculated assuming all UTRA carriers which the UE is required to monitor, are having normal performance, i.e. Nfreq, UTRA,reduced =0. Capabilities for number of carriers to monitor for UE which do not support increased carrier monitoring E-UTRA or increased carrier monitoring UTRA are specified in section 8.1.2.1.1.1. A UE which do not indicate support for Increased UE carrier monitoring E-UTRA or UTRAN [2,31] does not have any reduced performance carrier requirements and Kn=1.

In addition to the requirements defined above, the UE which indicates support for Increased UE carrier monitoring E-UTRA or increased UE carrier monitoring UTRA according to the capabilities in [2,31], and also supports NR inter-RAT measurement or EN-DC but is not configured with NR PSCell, shall be capable of monitoring a total of at least 14 carrier frequency layers comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD, UTRA FDD, UTRA TDD, GSM (one GSM layer corresponds to 32 carriers), cdma2000 1x, HRPD and NR layers.

The minimum performance requirements for a UE configured with inter-RAT NR layers are calculated assuming all E-UTRA carriers which the UE is required to monitor are having normal performance.

##### 8.1.2.1.1a Monitoring of multiple layers using gaps (Increased UE carrier monitoring)

For UE which support increased carrier monitoring E-UTRA or increased carrier monitoring UTRA, the measurement performance for different carriers may be configured by higher layers to be either normal or reduced performance. A measurement scaling factor, *MeasScaleFactor [2],* defining the relaxation to be applied to the requirements for carriers measured with reduced measurement performance is signalled by higher layers and has the possible settings shown in table 8.1.2.1.1-1.

Table 8.1.2.1.1-1: Measurement Scaling factor Configurations supported by the UE

|  |  |  |  |
| --- | --- | --- | --- |
|  | *MeasScaleFactor* information element settting | Kn | Kr |
| sf-EUTRA-cf1 | 8 | 8/7 | 8 |
| sf-EUTRA-cf2 | 16 | 16/15 | 16 |

If no reduced performance group carrier is configured, the UE shall consider all carriers to have normal performance

If no *MeasScaleFactor* is configured, a UE indicating support for increased carrier monitoring E-UTRA or increased carrier monitoring UTRA shall monitor at least the number of carriers specified in section 8.1.2.1.1.1 and is not required to monitor the increased number of carriers specified in section 8.1.2.1.1.1a.

The following definitions are used in the performance requirements:

Nfreq =Nfreq,n + Nfreq,r

Where:

Nfreq,n = Nfreq, E-UTRA,normal + Nfreq, UTRA, normal + Mgsm + Nfreq, cdma2000 + Nfreq, HRPD : Total number of interfrequency carriers to be monitored with normal measurement performance

Nfreq,r = Nfreq, E-UTRA,reduced + Nfreq, UTRA, reduced : Total number of interfrequency carriers to be monitored with reduced measurement performance

Where :

Nfreq, E-UTRA,normal : Number of interfrequency carriers to be monitored with normal performance

Nfreq, E-UTRA,normal,FDD : Number of interfrequency FDD carriers to be monitored with normal performance

Nfreq, E-UTRA,normal,TDD : Number of interfrequency TDD carriers to be monitored with normal performance

Nfreq, E-UTRA,reduced : Number of interfrequency carriers to be monitored with reduced performance

Nfreq, UTRA,normal : Number of UTRA carriers (FDD and TDD) to be monitored with normal performance

Nfreq, E-UTRA,normal,FDD : Number of interfrequency FDD carriers to be monitored with normal performance

Nfreq, E-UTRA,normal,TDD : Number of interfrequency TDD carriers to be monitored with normal performance

Nfreq, UTRA,reduced : Number of UTRA carriers (FDD and TDD) to be monitored with reduced performance

For interfrequency carriers, if Nfreq, E-UTRA,reduced is not equal to zero then Kn and Kr are as shown in table 8.1.2.1.1-1. Otherwise Kn=1 and all interfrequency layers have normal performance.

For UTRAN carriers, if Nfreq, UTRA,reduced is not equal to zero then Kn and Kr are as shown in table 8.1.2.1.1-1. Otherwise Kn=1 and all UTRA frequency layers have normal performance.

The minimum performance requirements for a UE which indicates support for Increased UE carrier monitoring E-UTRA [2, 31] are calculated as defined in sections 8.1.2.3.1 and 8.1.2.3.2 provided that Nfreq, E-UTRA,normal ≤3 for a UE capable of either FDD E-UTRA carrier monitoring or TDD E-UTRA carrier monitoring or Nfreq, E-UTRA,normal ≤6 for a UE capable of both FDD and TDD E-UTRA carrier monitoring provided Nfreq, E-UTRA,normal,FDD ≤3 E-UTRA carriers and Nfreq, E-UTRA,normal,TDD ≤3 TDD E-UTRA carriers or if Nfreq,n= Nfreq. The minimum performance requirements for a UE which indicates support for Increased UE carrier monitoring UTRA [2, 31] are calculated as defined in sections 8.1.2.4.1, 8.1.2.4.3, 8.1.2.4.7 and 8.1.2.4.13 provided that Nfreq, UTRA,normal ≤3 for UE capable of either FDD UTRA carrier monitoring or TDD UTRA carrier monitoring or Nfreq, UTRA,normal ≤6 for a UE capable of both FDD and TDD UTRA carrier monitoring provided Nfreq, UTRA,normal,FDD ≤3 FDD UTRA carriers and Nfreq, UTRA,normal,TDD ≤3 TDD UTRA carriers or if Nfreq,n= Nfreq. Capabilities for number of carriers to monitor for a UE which supports Increased carrier monitoring E-UTRA or Increased carrier monitoring UTRA are specified in section 8.1.2.1.1.1a. Minimum performance requirements as defined in sections 8.1.2.3.1 and 8.1.2.3.2 are not applicable if Nfreq,r >0 and NR interRAT, NR intrafrequency measurements with gaps or NR interfrequency measurements are configured.

##### 8.1.2.1.1b Monitoring of multiple layers using gaps (EN-DC)

The requirements in this section are applicable for EN-DC capable UE, which is configured with NR PSCell.

When monitoring of multiple inter-frequency E-UTRAN and inter-RAT (UTRAN, GSM, NR) carriers as configured by PCell, and inter-frequency NR carriers as configured by NR PSCell using gaps (or without using gaps provided the UE supports such capability) is configured, the UE shall be capable of performing one measurement of the configured measurement type (RSRP, RSRQ, RS-SINR, UTRAN TDD P-CCPCH RSCP, UTRAN FDD CPICH measurements, GSM carrier RSSI, NR SS-RSRP, NR SS-RSRQ, NR SS-SINR, NR CSI-RSRP, NR CSI-RSRQ, NR CSI-SINR, etc.) of detected cells on all the layers.

The effective total number of frequencies excluding the frequencies of the PCell, SCells, NR PSCell and NR SCells being monitored is Nfreq, NSA, which is defined as:

Nfreq, NSA = Nfreq, NSA, E-UTRA + Nfreq, NSA, NR + Nfreq, NSA, UTRA + MNSA, gsm

where

Nfreq, NSA, E-UTRA is the number of E-UTRA (FDD and TDD) inter-frequency carriers being monitored as configured by PCell

Nfreq, NSA, NR ≤ Nfreq, NSA, NR, inter-RAT + Nfreq, NSA, NR, inter-freq

where

Nfreq, NSA, NR, inter-RAT is the number of NR inter-RAT carriers excluding NR serving carrier(s) being monitored as configured by Pcell,

Nfreq, NSA, NR, inter-freq is the number of NR inter-frequency carriers being monitored as configured by NR PSCell [50] or via LPP [24],

Nfreq, NSA, UTRA is the number of UTRA inter-RAT carriers being monitored as configured by E-UTRA PCell (FDD and TDD),

MNSA, GSM is an integer which is a function of the number of GSM inter-RAT carriers as configured by E-UTRA PCell on which measurements are being performed. MNSA, GSM is equal to 0 if no GSM carrier is being monitored. For a MGRP of 40 ms, MNSA, GSM is equal to 1 if cells on up to 32 GSM carriers are being measured. For a MGRP of 80 ms, MNSA, GSM is equal to ceil(Ncarriers,GSM /20) where Ncarriers,GSM is the number of GSM carriers on which cells are being measured.

8.1.2.1.1b.1 Maximum allowed layers for multiple monitoring for UE in NSA operation

The UE configured with NR PSCell shall be capable of monitoring at least per RAT group:

- Depending on UE capability, 6 FDD E-UTRA inter-frequency carriers configured by PCell, and

- Depending on UE capability, 6 TDD E-UTRA inter-frequency carriers configured by PCell, and

- Depending on UE capability, 7 NR SSB inter-RAT carriers excluding NR serving carrier(s) configured by PCell, and

- Depending on UE capability, 7 NR SSB inter-frequency carriers configured by PSCell [50], and

- Depending on UE capability, 8 NR inter-frequency carriers including SSB and CSI-RS in total configured by NR PSCell [50] , and

- Depending on UE capability, 3 FDD UTRA carriers, and

- Depending on UE capability, 3 TDD UTRA carriers, and

- Depending on UE capability, 32 GSM carriers (one GSM layer corresponds to 32 carriers), and

- Depending on UE capability, 1 FDD E-UTRA inter-frequency carrier for RSTD measurements configured via LPP [24], and

- Depending on UE capability, 1 TDD E-UTRA inter-frequency carrier for RSTD measurements configured via LPP [24].

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 13 effective carrier frequency layers comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD, UTRA FDD, UTRA TDD, GSM (one GSM layer corresponds to 32 carriers) and NR layers.

The UE shall be capable of monitoring a total of at least 7 + NCSI effective NR carrier frequency layers excluding NR serving carrier(s), comprising of any above defined combination of NR inter-RAT carriers excluding NR serving carrier(s) configured by PCell and NR inter-frequency carriers configured by NR PSCell. NCSI equals 1 if UE supports CSI-RS based L3 measurement, and NCSI =0 otherwise.

When PCell and NR PSCell configure the same NR carrier frequency layer to be monitored by the UE in synchronous intra-band EN-DC, this layer shall be counted only once to the total number of effective carrier frequency layers provided that the SFN-s and slot boundries are aligned, unless the configured NR carrier frequency layers to be monitored have

- different RSSI measurement resources or

- different deriveSSB-IndexFromCell indications or

- different SMTC configurations.

NOTE 1: The EN-DC capable UE configured with NR PSCell shall fulfil the requirements defined in only one of Section 8.2.1.1b.1 and Section 9.1.3.2 of TS 38.133 [50].

##### 8.1.2.1.1c Monitoring of multiple layers using gaps (NE-DC)

The requirements in this section are applicable for UE capable of and configured with the NE-DC operation mode.

When monitoring of multiple inter-frequency E-UTRAN carriers as configured by PSCell, inter-RAT E-UTRAN carriers as configured by NR PCell, inter-RAT UTRA FDD carriers as configured by NR PCell, and inter-frequency NR carriers as configured by NR PCell using gaps (or without using gaps provided the UE supports such capability) is configured, the UE shall be capable of performing one measurement of the configured measurement type (NR SS-RSRP, NR SS-RSRQ, NR SS-SINR, SFTD, RSRP, RSRQ, RS-SINR, UTRAN FDD CPICH measurements, NR CSI-RSRP, NR CSI-RSRQ, and NR CSI-SINR measurements, etc.) of detected cells on all the layers.

For UE configured with the NE-DC operation, the effective total number of frequencies excluding the frequencies of the NR PCell, NR SCells, PSCell, and SCells being monitored is Nfreq, NE-DC, which is defined as:

Nfreq, NE-DC = Nfreq, NE-DC, NR + Nfreq, NE-DC, E-UTRA + Nfreq, NE-DC, UTRA,

where

Nfreq, NE-DC, NR is the number of NR inter-frequency carriers being monitored as configured by NR PCell.

Nfreq, NE-DC, UTRA is the number of UTRA FDD inter-RAT carriers being monitored as configured by NR PCell,

Nfreq, NE-DC, E-UTRA ≤ Nfreq, NE-DC, E-UTRA, inter-RAT + Nfreq, NE-DC, E-UTRA, inter-freq

where

Nfreq, NE-DC, E-UTRA, inter-RAT is the number of E-UTRA inter-RAT carriers (FDD and TDD) excluding E-UTRA serving carrier(s) being monitored as configured by NR PCell [50] or via LPP [59],

Nfreq, NE-DC, E-UTRA, inter-freq is the number of E-UTRA inter-frequency carriers (FDD and TDD) being monitored as configured by PSCell.

8.1.2.1.1c.1 NE-DC: Maximum allowed layers for multiple monitoring

If a UE is configured with NE-DC operation, the UE shall be capable of monitoring at least per RAT group:

- Depending on UE capability, 7 NR SSB inter-frequency carriers configured by NR PCell [50], and

- Depending on UE capability, 8 NR inter-frequency carriers including SSB and CSI-RS in total configured by NR PCell [50], and

- Depending on UE capability, 6 E-UTRA TDD inter-RAT carriers excluding E-UTRA serving carriers configured by NR PCell [50], and

- Depending on UE capability, 6 E-UTRA FDD inter-RAT carriers excluding E-UTRA serving carriers configured by NR PCell [50], and

- Depending on UE capability, 6 E-UTRA TDD inter-frequency carriers configured by PSCell, and

- Depending on UE capability, 6 E-UTRA FDD inter-frequency carriers configured by PSCell, and

- Depending on UE capability, 1 E-UTRA FDD inter-RAT carrier for RSTD measurements configured via LPP [59], and

- Depending on UE capability, 1 E-UTRA TDD inter-RAT carrier for RSTD measurements configured via LPP [59].

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 13 effective carrier frequency layers comprising of any above defined combination of NR, E-UTRA FDD, and E-UTRA TDD layers. The UE shall be capable of monitoring a total of at least 6 effective E-UTRA carrier frequency layers, excluding E-UTRA serving carrier(s), comprising of any above defined combination of E-UTRA inter-RAT carriers excluding E-UTRA serving carrier(s) configured by NR PCell and E-UTRA inter-frequency carriers configured by PSCell.

##### 8.1.2.1.1d Monitoring of multiple layers using gaps (RedCap)

When monitoring of multiple inter-frequency E-UTRAN and inter-RAT (NR) using gaps (or without using gaps provided the UE supports such capability) is configured, the UE shall be capable of performing one measurement of the configured measurement type (RSRP, RSRQ, RSTD, NR SS-RSRP, NR SS-RSRQ, NR SS-SINR, etc.) of detected cells on all the layers.

The effective total number of frequencies excluding the frequencies of the PCell being monitored is Nfreq\_RedCap, which is defined as:

Nfreq\_RedCap = Nfreq\_RedCap, E-UTRA + Nfreq\_RedCap, NR

where

Nfreq\_RedCap, E-UTRA is the number of E-UTRA carriers being monitored (FDD and TDD),

Nfreq\_RedCap, NR is the number of NR inter-RAT carriers being monitored.

8.1.2.1.1d.1 Maximum allowed layers for multiple monitoring

The RedCap UE shall be capable of monitoring at least per RAT group:

- Depending on UE capability, 6 FDD E-UTRA inter-frequency carriers, and

- Depending on UE capability, 6 TDD E-UTRA inter-frequency carriers, and

- Depending on UE capability, 6 NR SSB inter-RAT carriers configured by PCell, and

- Depending on UE capability, 7 NR inter-RAT carriers including SSB and CSI-RS in total configured by PCell

In addition to the requirements defined above, the RedCap UE shall be capable of monitoring a total of at least 10 effective carrier frequency layers comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD and NR layers.

##### 8.1.2.1.2 Network controlled small gap

A UE may reconfigure the receiver bandwidth, carrier frequency or turn on/off one of the RF chains when performing measurements on PCell, activated SCell/PSCell, deactivated SCell and/or unused RF chain. This may cause interruptions on PCell or activated SCell(s) or both that are specified in Section 7.8.

If the UE requires network controlled small gap (NCSG) to prevent the interruption and UE is not configured with asynchrouns DC,

- When UE is not configured with measurement gap, the E-UTRAN can explicitly provide a single NCSG pattern with constant repetition period per UE.

- When UE is configured with Gap Pattern ID #0 on some of, but not all, serving carriers including PCC and SCC(s), a single NCSG pattern with NCSG Pattern ID #0 in Table 8.1.2.1.2-1 can be implicitly configured on the serving carrier(s), where measurement gap is not configured.

- When UE is configured with Gap Pattern ID #1 on some of, but not all, serving carriers including PCC and SCC(s), a single NCSG pattern with NCSG Pattern ID #1 in Table 8.1.2.1.2-1 can be implicitly configured on the serving carrier(s), where measurement gap is not configured.

- When UE measurement gap is configured on all serving carriers including PCC and SCC(s), NCSG should not be configured.

Note: As shown in Figure 8.1.2.1.2-1, subframes of serving carrier 1 from i+1 to i+6 are used as measurement gap. The NCSG can be implicitly configured on other serving carrier subframes from j+1 to j+6, where no measurement gap is configured.



Figure 8.1.2.1.2-1: Measurement GAP and NCSG

If the UE requires NCSG to prevent the interruption and the UE supporting asynchronous DC is configured with PSCell which is asynchnous with PCell,

- When there is no measurement gap configured among MCG and SCG cell subframes, the E-UTRAN can explicitly provide a single NCSG pattern with constant repetition period per serving carrier.

- When Gap Pattern ID #0 is configured for UE on MCG (or SCG) and no measurement gap is configured on SCG (or MCG), a single NCSG pattern with NCSG Pattern ID #2 can be implicitly configured on SCG (or MCG).

- When Gap Pattern ID #1 is configured for UE on MCG (or SCG) and no measurement gap is configured on SCG (or MCG), a single NCSG pattern with NCSG Pattern ID #3 can be implicitly configured on SCG (or MCG).

Note: As shown in Figure 8.1.2.1.2-2, one serving carrier subframes from i+1 to i+6 are used as measurement gap. The NCSG can be implicitly configured on other serving carrier subframes from j+1 to j+7, where no measurement gap is configured.



Figure 8.1.2.1.2-2: Measurement GAP and NCSG for dual connectivity

UEs shall only support those NCSG patterns listed in Table 8.1.2.1.2-1 that are relevant to its measurement capabilities.

Table 8.1.2.1.2-1: NCSG Configurations supported by the UE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NCSG Pattern Id | Visible interruption length before measurement (VIL1, ms) | Measurement Length during which there is no gap (ML, ms) | Visible interruption length after measurement (VIL2, ms) | Visible interruption Repetition Period  (VIRP, ms) | Purpose |
| 0 | 1 | 4 | DL: 1  UL: 2 | 40 | Interruption control according to requirements in sections 7.8.2.5, 7.8.2.6, 7.8.2.9, 7.8.2.12, 7.10.2.1, 7.10.2.2, 7.10.2.3 |
| 1 | 1 | 4 | DL: 1  UL: 2 | 80 | Interruption control according to requirements in sections 7.8.2.5, 7.8.2.6, 7.8.2.9, 7.8.2.12, 7.10.2.1, 7.10.2.2, 7.10.2.3 |
| 2 | 2 | 3 | 2 | 40 | Interruption control according to requirements in sections 7.8.2.5, 7.8.2.6, 7.8.2.9, 7.8.2.12, 7.10.2.1, 7.10.2.2, 7.10.2.3 |
| 3 | 2 | 3 | 2 | 80 | Interruption control according to requirements in sections 7.8.2.5, 7.8.2.6, 7.8.2.9, 7.8.2.12, 7.10.2.1, 7.10.2.2, 7.10.2.3 |

During the VIL1 and VIL2, the UE is not expected to transmit and receive any data. During ML, the UE is expected to transmit and receive data on the corresponding serving carrier(s).

A UE that is capable of identifying and measuring inter-frequency and/or inter-RAT cells without gaps, but needs interruption, and is configured with the network controlled small gap for such measurement (NCSG Pattern Id #0-3) shall follow requirements as if Gap Pattern Id #0 or Gap Pattern Id #1 had been used and shall not make any autonomous interruption outside the visual interruption of the configured network controlled small gap for the measurement, and the minimum available time Tinter1 of 60 ms and 30 ms shall be assumed for the corresponding requirement for visible interruption repetition period (VIRP) of 40 ms and 80 ms, respectively.

#### 8.1.2.2 E-UTRAN intra frequency measurements

The UE shall be able to identify new intra-frequency cells and perform RSRP, RSRQ, and RS-SINR measurements of identified intra-frequency cells without an explicit intra-frequency neighbour cell list containing physical layer cell identities. During the RRC\_CONNECTED state the UE shall continuously measure identified intra frequency cells and additionally search for and identify new intra frequency cells.

##### 8.1.2.2.1 E-UTRAN FDD intra frequency measurements

8.1.2.2.1.1 E-UTRAN intra frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify a new detectable FDD intra frequency cell within



where

Tbasic\_identify\_E-UTRA\_FDD, intra is 800 ms

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.2.1 and 9.1.2.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.5.1 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Section 9.1.17.2.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band.

TIntra : This is the minimum time that is available for intra frequency measurements, during the measurement period with an arbitrarily chosen timing. Time is assumed to be available for performing intra frequency measurements whenever the receiver is guaranteed to be active on the intra frequency carrier.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period Intra. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is 200 ms. When no measurement gaps are activated, the UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements for 8 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of 200 ms. When measurement gaps are activated, including nonUniform1 – nonUniform4 gaps, the UE shall be capable of performing measurements for at least Ymeasurement intra cells , where Ymeasurement intra is defined in the following equation. If the UE has identified more than Ymeasurement intra cells, the UE shall perform measurements of at least 8 identified intra- frequency cells but the reporting rate of RSRP, RSRQ, and RS-SINR measurements of cells from UE physical layer to higher layers may be decreased.

cells

where

Xbasic measurement FDD = 8 (cells),

TMeasurement\_Period, Intra = 200 ms is the measurement period for intra frequency RSRP, RSRQ, and RS-SINR measurements.

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.2.1 and 9.1.2.2, the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.5.1, and RS-SINR measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.17.2.1.

8.1.2.2.1.1.1 Measurement Reporting Requirements

8.1.2.2.1.1.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

8.1.2.2.1.1.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.2.1.1.1.3.

8.1.2.2.1.1.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify intra defined in Clause 8.1.2.2.1.1.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra defined in clause 8.1.2.2.1.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period, Intra provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.2.1.2 E-UTRAN intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra as shown in table 8.1.2.2.1.2-1. When eDRX\_CONN is in use the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra as shown in table 8.1.2.2.1.2-1A. When *highSpeedEnhancedMeasFlag* is configured the UE shall be able to identify a new detectable FDD intra-frequency cell within Tidentify\_intra as shown in table 8.1.2.2.1.2-1B. When *highSpeedEnhMeasFlag2-r16* is configured the UE shall be able to identify a new detectable FDD intra-frequency cell within Tidentify\_intra as shown in table 8.1.2.2.1.2-1C.

Table 8.1.2.2.1.2-1: Requirement to identify a newly detectable FDD intrafrequency cell

|  |  |
| --- | --- |
| DRX cycle length (s) | Tidentify\_intra (s) (DRX cycles) |
| ≤0.04 | 0.8 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2 (40) |
| 0.128 | 3.2 (25) |
| 0.128<DRX-cycle≤2.56 | Note2(20) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

Table 8.1.2.2.1.2-1A: Requirement to identify a newly detectable FDD intra-frequency cell when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_intra (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note(20) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

Table 8.1.2.2.1.2-1B: Requirement to identify a newly detectable FDD intrafrequency cell for UE configured with *highSpeedEnhancedMeasFlag*

|  |  |
| --- | --- |
| DRX cycle length (s) | Tidentify\_intra (s) (DRX cycles) |
| ≤0.04 | 0.8 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2(15) |
| 0.08<DRX-cycle≤1.28 | Note2(10) |
| 1.28<DRX-cycle≤2.56 | Note2(20) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

Table 8.1.2.2.1.2-1C: Requirement to identify a newly detectable FDD intrafrequency cell for UE configured with *highSpeedEnhMeasFlag2-r16*

|  |  |
| --- | --- |
| DRX cycle length (s) | Tidentify\_intra (s) (DRX cycles) |
| ≤0.04 | 0.8 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2(15) |
| 0.08<DRX-cycle<1.28 | Note2(10) |
| DRX=1.28 | Note2(8) |
| 1.28<DRX-cycle≤2.56 | Note2(20) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.2.1 and 9.1.2.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.5.1 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Section 9.1.17.2.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band.

When DRX is used in the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra as shown in table 8.1.2.2.1.2-2. When eDRX\_CONN is used in the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra as shown in table 8.1.2.2.1.2-3. When *highSpeedEnhancedMeasFlag* or *highSpeedEnhMeasFlag2-r16* is configured in the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra as shown in table 8.1.2.2.1.2-4. The UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements for 8 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra.

Table 8.1.2.2.1.2-2: Requirement to measure FDD intrafrequency cells

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_intra (s) (DRX cycles) |
| ≤0.04 | 0.2 (Note1) |
| 0.04<DRX-cycle≤2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

Table 8.1.2.2.1.2-3: Requirement to measure FDD intra-frequency cells when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_intra (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

Table 8.1.2.2.1.2-4: Requirement to measure FDD intrafrequency cells for UE configured with *highSpeedEnhancedMeasFlag* or *highSpeedEnhMeasFlag2-r16*

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_intra (s) (DRX cycles) |
| ≤0.04 | 0.2 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2 (4) |
| 0.08<DRX-cycle≤1.28 | Note2 (3) |
| 1.28<DRX-cycle≤2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.2.1 and 9.1.2.2, the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.5.1, and RS-SINR measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.17.2.1.

8.1.2.2.1.2.1 Measurement Reporting Requirements

8.1.2.2.1.2.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

8.1.2.2.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.2.1.2.1.3.

8.1.2.2.1.2.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra defined in Clause 8.1.2.2.1.2.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra defined in clause 8.1.2.2.1.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.1.2.2.2 E-UTRAN TDD intra frequency measurements

8.1.2.2.2.1 E-UTRAN intra frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify a new detectable TDD intra frequency cell within



where

Tbasic\_identify\_E-UTRA\_TDD, intra is 800 ms

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.2.1 and 9.1.2.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.5.1 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Section 9.1.17.2.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band.

TIntra : This is the minimum time that is available for intra frequency measurements, during the measurement period with an arbitrarily chosen timing. Time is assumed to be available for performing intra frequency measurements whenever the receiver is guaranteed to be active on the intra frequency carrier.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period Intra. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is 200 ms. When no measurement gaps are activated, the UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements for 8 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of 200 ms. When measurement gaps are activated the UE shall be capable of performing measurements for at least Ymeasurement intra cells , where Ymeasurement intra is defined in the following equation. If the UE has identified more than Ymeasurement intra cells, the UE shall perform measurements of at least 8 identified intra-frequency cells but the reporting rate of RSRP, RSRQ, and RS-SINR measurements of cells from UE physical layer to higher layers may be decreased.

cells

where

Xbasic measurement TDD = 8 (cells),

TMeasurement\_Period Intra = 200 ms is the measurement period for intra frequency RSRP, RSRQ, and RS-SINR measurements.

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.2.1 and 9.1.2.2, the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.5.1, and RS-SINR measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.17.2.1.

8.1.2.2.2.1.1 Measurement Reporting Requirements

8.1.2.2.2.1.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

8.1.2.2.2.1.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.2.2.1.1.3.

8.1.2.2.2.1.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify intra defined in Clause 8.1.2.2.2.1.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra defined in clause 8.1.2.2.2.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period Intra provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.2.2.2 E-UTRAN intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable TDD intra frequency cell within Tidentify\_intra as shown in table 8.1.2.2.2.2-1. When eDRX\_CONN is in use, the UE shall be able to identify a new detectable TDD intra frequency cell within Tidentify\_intra as shown in table 8.1.2.2.2.2-1A. When *highSpeedEnhancedMeasFlag* is configured the UE shall be able to identify a new detectable TDD intra-frequency cell within Tidentify\_intra as shown in table 8.1.2.2.2.2-1B. When *highSpeedEnhMeasFlag2-r16* is configured the UE shall be able to identify a new detectable TDD intra-frequency cell within Tidentify\_intra as shown in table 8.1.2.2.2.2-1C.

Table 8.1.2.2.2.2-1: Requirement to identify a newly detectable TDD intrafrequency cell

|  |  |
| --- | --- |
| DRX cycle length (s) | Tidentify\_intra (s) (DRX cycles) |
| ≤0.04 | 0.8 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2 (40) |
| 0.128 | 3.2 (25) |
| 0.128<DRX-cycle≤2.56 | Note2(20) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

Table 8.1.2.2.2.2-1A: Requirement to identify a newly detectable TDD intra-frequency cell when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_intra (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note(20) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

Table 8.1.2.2.2.2-1B: Requirement to identify a newly detectable TDD intrafrequency cell for UE configured with *highSpeedEnhancedMeasFlag*

|  |  |
| --- | --- |
| DRX cycle length (s) | Tidentify\_intra (s) (DRX cycles) |
| ≤0.04 | 0.8 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2(15) |
| 0.08<DRX-cycle≤1.28 | Note2(10) |
| 1.28<DRX-cycle≤2.56 | Note2(20) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

Table 8.1.2.2.2.2-1C: Requirement to identify a newly detectable TDD intrafrequency cell for UE configured with *highSpeedEnhMeasFlag2-r16*

|  |  |
| --- | --- |
| DRX cycle length (s) | Tidentify\_intra (s) (DRX cycles) |
| ≤0.04 | 0.8 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2(15) |
| 0.08<DRX-cycle<1.28 | Note2(10) |
| DRX=1.28 | Note2(8) |
| 1.28<DRX-cycle≤2.56 | Note2(20) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

A cell shall be considered detectable when

- RSRP related side conditions given in Clause 9.1.2.1 and 9.1.2.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.5.1 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Clause 9.1.17.2.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band.

When DRX is in use in the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra as shown in table 8.1.2.2.2.2-2. When eDRX\_CONN is in use in the RRC\_CONNECTED state, the measurement period for intra frequency measurements is Tmeasure\_intra as shown in table 8.1.2.2.2.2-3. When *highSpeedEnhancedMeasFlag* or *highSpeedEnhMeasFlag2-r16* is configured in the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra as shown in table 8.1.2.2.2.2-4. The UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements for 8 identified intra-frequency cells and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra.

Table 8.1.2.2.2.2-2: Requirement to measure TDD intra frequency cells

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_intra (s) (DRX cycles) |
| ≤0.04 | 0.2 (Note1) |
| 0.04<DRX-cycle≤2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

Table 8.1.2.2.2.2-3: Requirement to measure TDD intra-frequency cells when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_intra (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5) |
| Note: Time depends upon the eDRX\_CONN cycle in use. | |

Table 8.1.2.2.2.2-4: Requirement to measure TDD intrafrequency cells for UE configured with *highSpeedEnhancedMeasFlag* or *highSpeedEnhMeasFlag2-r16*

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_intra (s) (DRX cycles) |
| ≤0.04 | 0.2 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2 (4) |
| 0.08<DRX-cycle≤1.28 | Note2 (3) |
| 1.28<DRX-cycle≤2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.2.1 and 9.1.2.2, the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.5.1, and the RS-SINR measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.17.2.1.

8.1.2.2.2.2.1 Measurement Reporting Requirements

8.1.2.2.2.2.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

8.1.2.2.2.2.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.2.2.2.1.3.

8.1.2.2.2.2.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.2.1, 9.1.2.2, 9.1.5.1, and 9.1.17.2.1, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra defined in Clause 8.1.2.2.2.2.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra defined in clause 8.1.2.2.2.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.1.2.2.3 E-UTRAN FDD intra frequency measurements with autonomous gaps

8.1.2.2.3.1 Identification of a new CGI of E-UTRA cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose ‘reportCGI’. The UE may make autonomous gaps in downlink reception and uplink transmission for receiving MIB and SIB1 message according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI, intra = 150 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of an E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.2 for a corresponding Band

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI,.intra is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the UE shall transmit at least 60 ACK/NACKs on PCell or each of activated SCell(s), provided that:

- there is continuous DL data allocation,

- no DRX and no eDRX\_CONN cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each subframe,

- no MBSFN subframes are configured in the PCell or each of activated SCell(s).

Note : ACK requirements for CGI reading were derived assuming *ShortTTI-r15* is not configured. When *ShortTTI-r15* is configured is used, a greater number of transmitted ACK/NACK is expected.

For the UE capable of SRS carrier based switching when configured to perform SRS carrier based switching for SRS transmission and/or RACH transmission via one or more SCells without PUSCH (NOTE: The requirement on the number of ACK/NACKs transmitted during SRS carrier based switching does not need to be tested):

- the requirements defined in this section shall be met provided during :

- the SRS carrier based switching does not cause any interruption on the PCell or on any activated SCell during and

- DL subframe #0 and DL subframe #5 per radio frame of the target E-UTRA are available at the UE.

- otherwise the time to acquire the new CGI of the E-UTRA cell may be extended or the UE may not be able to transmit the required number of ACK/NACKs on PCell or each of the activated SCell(s).

8.1.2.2.3.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

##### 8.1.2.2.4 E-UTRAN TDD intra frequency measurements with autonomous gaps

8.1.2.2.4.1 Identification of a new CGI of E-UTRA cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose ‘reportCGI’. The UE may make autonomous gaps in downlink reception and uplink transmission for receiving MIB and SIB1 messages according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI, intra = 150 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of an E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable when the following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.2 for a corresponding Band

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI, intra is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the UE shall be able to transmit at least the number of ACK/NACKs stated in Table 8.1.2.2.4.1-1 on PCell or each of activated SCell(s), provided that:

- there is continuous DL data allocation,

- no DRX and no eDRX\_CONN cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each subframe,

- no MBSFN subframes are configured in the PCell or each of activated SCell(s).

Table 8.1.2.2.4.1-1: Requirement on minimum number of ACK/NACKs to transmit during Tbasic\_identify\_CGI, intra.

|  |  |
| --- | --- |
| UL/DL configuration | Minimum number of transmitted ACK/NACKs |
| 0 (Note 1) | 18 |
| 1 | 35 |
| 2 | 43 |
| 3 | 36 |
| 4 | 39 |
| 5 | 42 |
| 6 | 30 |
| Note 1: When a UE is configured with EIMTA-*MainConfigServCell* via RRC signalling [2] only this requirement shall apply. | |

Note : ACK requirements for CGI reading were derived assuming *ShortTTI-r15* is not configured. When *ShortTTI-r15* is configured is used, a greater number of transmitted ACK/NACK is expected.

For the UE capable of SRS carrier based switching when configured to perform SRS carrier based switching for SRS transmission and/or RACH transmission via one or more SCells without PUSCH (NOTE: The requirement on the number of ACK/NACKs transmitted during SRS carrier based switching does not need to be tested):

- the requirements defined in this section shall be met provided during :

- the SRS carrier based switching does not cause any interruption on the PCell or on any activated SCell during and

- DL subframe #0 and DL subframe #5 per radio frame of the target E-UTRA are available at the UE.

- otherwise the time to acquire the new CGI of the E-UTRA cell may be extended or the UE may not be able to transmit at least the number of ACK/NACKs as specified in Table 8.1.2.2.4.1-1 on PCell or each of the activated SCell(s).

8.1.2.2.4.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

##### 8.1.2.2.5 E-UTRAN FDD intra-frequency measurements on carrier with FeMBMS/Unicast mixed cells

Requirements in this section apply for UE configured to perform intra-frequency measurements on a carrier with one or more FeMBMS/Unicast mixed cells and which are capable of unicast reception from FeMBMS/Unicast mixed cell and capable of receiving at least one of *SystemInformationBlockType15* or *fembms-MixedCarrier-r14* indication and are provided with the information that one or more FeMBMS/Unicast mixed cells are present on the intra-frequency to be measured.

The UE shall meet the requirements in Section 8.1.2.2.1, when performing intra-frequency measurements on a carrier with at least one FeMBMS/Unicast mixed cell. The minimum number of cells that the UE shall be able to measure on includes also FeMBMS/Unicast mixed cells.

#### 8.1.2.3 E-UTRAN inter frequency measurements

The UE shall be able to identify new inter-frequency cells and perform RSRP, RSRQ, and RS-SINR measurements of identified inter-frequency cells if carrier frequency information is provided by the PCell, even if no explicit neighbour list with physical layer cell identities is provided.

The requirements in this section shall also appy, when the UE is configured to perform SRS carrier based switching and using measurement gaps.

##### 8.1.2.3.1 E-UTRAN FDD – FDD inter frequency measurements

8.1.2.3.1.1 E-UTRAN FDD – FDD inter frequency measurements when no DRX is used

When measurement gaps other than nonUniform1 – nonUniform4 are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new FDD inter-frequency within TIdentify\_Inter according to the following expression:

(normal performance) and

(reduced performance)

Where:

TBasic\_Identify\_Inter = 480 ms. It is the time period used in the inter frequency equation where the maximum allowed time for the UE to identify a new FDD inter-frequency cell is defined.

Nfreq,n Nfreq,r Kn and Kr are defined in clause 8.1.2.1.1 and Tinter1 is defined in clause 8.1.2.1

When measurement gaps nonUniform1 – nonUniform4 are scheduled, the UE shall be able to identify a new FDD inter-frequency within TIdentify\_Inter according to the following expressions:



If the UE requires measurement gaps to identify and measure inter-frequency and/or inter-RAT cells and the UE supports perServingCellMeasurementGap-r14 and is configured with per per-CC, or the UE supports parallel measurements, the UE shall be able to identify a new FDD inter-frequency within TIdentify\_Inter\_perCC according to the following expression:

(normal performance) and

(reduced performance)

where:

TBasic\_Identify\_Inter = 480 ms. It is the time period used in the inter frequency equation where the maximum allowed time for the UE to identify a new FDD inter-frequency cell is defined.

If the UE supports perServingCellMeasurementGap-r14 and is configured with per-CC gap, or the UE supports parallel measurements, Nfreq,n = Nfreq,n,effective shall be used in section 8.1.2.3.1 when deriving the UE requirements. Nfreq,n,effective Nfreq,r,effective are defined as effective number of layers to be monitored by the UE for normal performance group and reduced performance group. They are reported by the UE. Nfreq,n,effective should be equal or less than Nfreq,n defined in clause 8.1.2.1.1. and Nfreq,r,effective should be equal or less than Nfreq,r defined in clause 8.1.2.1.1Kn and Kr are defined in clause 8.1.2.1.1 and Tinter1 is defined in clause 8.1.2.1For UE other than category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Sections 9.1.3.1 and 9.1.3.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.1 and 9.1.6.2 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Sections 9.1.17.3.1 and 9.1.17.3.2 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

For category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Sections 9.1.3.3 and 9.1.3.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.5 and 9.1.6.6 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

When measurement gaps are scheduled for FDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively, with measurement period given by table 8.1.2.3.1.1-1.

Table 8.1.2.3.1.1-1: Measurement period and measurement bandwidth

|  |  |  |  |
| --- | --- | --- | --- |
| Configuration | Physical Layer Measurement period: TMeasurement\_Period \_Inter\_FDD [ms] (normal performance) | Physical Layer Measurement period: TMeasurement\_Period \_Inter\_FDD [ms] (reduced performance) | Measurement bandwidth [RB] |
| 0 | 480 x Kn x Nfreq,n | 480 x Kr x Nfreq,r | 6 |
| 1 (Note 1) | 240 x Kn x Nfreq,n | 240 x Kr x Nfreq,r | 50 |
| 2 (Note 2) | Tburst x Nfreq | N/A | 6 |
| 3 (Note 3) | ½∙Tburst x Nfreq | N/A | 50 |
| Note 1: This configuration is optional  Note 2: This configuration is for when nonUniform1 – nonUniform4 are configured  Note 3: This configuration is optional and when nonUniform1 – nonUniform4 are configured | | | |

The UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements of at least 4 inter-frequency cells per FDD inter-frequency for up to 3 FDD inter-frequencies or 8 FDD interfrequencies if the UE supports Increased UE carrier monitoring E-UTRA and the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period defined in Table 8.1.2.3.1.1-1.

For category 1bis UE, when measurement gaps are scheduled for FDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.3.3, 9.1.3.4, 9.1.6.5 and 9.1.6.6, respectively, with measurement period given by table 8.1.2.3.1.1-2.

Table 8.1.2.3.1.1-2: Measurement period and measurement bandwidth (category 1bis UE)

|  |  |  |  |
| --- | --- | --- | --- |
| Configuration | Physical Layer Measurement period: TMeasurement\_Period \_Inter\_FDD [ms] (normal performance) | Physical Layer Measurement period: TMeasurement\_Period \_Inter\_FDD [ms] (reduced performance) | Measurement bandwidth [RB] |
| 0 | 960 x Kn x Nfreq,n | 960 x Kr x Nfreq,r | 6 |
| 1 (Note) | 480 x Kn x Nfreq,n | 480 x Kr x Nfreq,r | 50 |
| Note: This configuration is optional | | | |

The category 1bis UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency for up to 3 FDD inter-frequencies or 8 FDD interfrequencies if the UE supports Increased UE carrier monitoring E-UTRA and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period defined in Table 8.1.2.3.1.1-2.

8.1.2.3.1.1.1 Measurement Reporting Requirements

8.1.2.3.1.1.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

8.1.2.3.1.1.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.3.1.1.1.3.

8.1.2.3.1.1.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH . The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify -inter or T identify –inter-perCC when per-CC based measurement gap configured defined in clause 8.1.2.3.1.1.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter or T identify –inter-perCC when per-CC based measurement gap configured defined in clause 8.1.2.3.1.1 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_Inter\_FDD defined in clause 8.1.2.3.1.1 provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.3.1.2 E-UTRAN FDD – FDD inter frequency measurements when DRX is used

When DRX or eDRX\_CONN is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable E-UTRAN FDD inter frequency cell within Tidentify\_inter or T identify –inter-perCC when per-CC based measurement gap configured. When DRX is in use, Tidentify\_inter is as defined in Table 8.1.2.3.1.2-1, and when eDRX\_CONN is in use, Tidentify\_inter is as defined in Table 8.1.2.3.1.2-1A for GP0 and GP1. If UE is configured with nonUniform1 – nonUniform4 Tidentify\_inter is as defined in Table 8.1.2.3.1.2-1B.

Table 8.1.2.3.1.2-1: Requirement to identify a newly detectable FDD interfrequency cell

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX cycle length (s) | Tidentify\_inter (s) (DRX cycles), normal performance | | Tidentify\_inter (s) (DRX cycles), reduced performance | |
| Gap period = 40 ms, 20ms | Gap period = 80 ms | Gap period = 40 ms | Gap period = 80 ms |
| ≤0.16 | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable |
| 0.256 | 5.12\*Kn\*Nfreq,n  (20\*Kn\*Nfreq,n) | 7.68\*Kn \*Nfreq,n (30\*Kn \*Nfreq,n) | 5.12\*Kr\*Nfreq,r  (20\*Kr\*Nfreq,r) | 7.68\*Kr \*Nfreq,r (30\*Kr \*Nfreq,r) |
| 0.32 | 6.4\*Kn \*Nfreq,n (20\*Kn \*Nfreq,n) | 7.68\*Kn \*Nfreq,nl (24\*Kn \*Nfreq,n) | 6.4\*Kr \*Nfreq,r (20\*Kr \*Nfreq,r) | 7.68\*Kr \*Nfreq,r (24\*Kr \*Nfreq,r) |
| 0.32< DRX-cycle≤2.56 | Note (20\*Kn \*Nfreq,n) | Note (20\*Kn \*Nfreq,n) | Note (20\*Kr \*Nfreq,r) | Note (20\*Kr \*Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | | | |

Table 8.1.2.3.1.2-1A: Requirement to identify a newly detectable FDD inter-frequency cell when eDRX\_CONN cycle is used

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_inter (s) (eDRX\_CONN cycles), normal performance | | Tidentify\_inter (s) (eDRX\_CONN cycles), reduced performance | |
| **Gap period = 40 ms, 20ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| 2.56< eDRX\_CONN cycle≤10.24 | Note (20\*Kn \*Nfreq,n) | Note (20\*Kn \*Nfreq,n) | Note (20\*Kr \*Nfreq,r) | Note (20\*Kr \*Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | | | |

Table 8.1.2.3.1.2-1B: Requirement to identify a newly detectable FDD inter-frequency cell when non-uniform gap pattern nonUniform1 – nonUniform4 is used

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX\_CONN cycle length (s) | Tidentify\_inter  (DRX\_cycles) | | | |
| Tburst = 1280 ms | Tburst = 2560 ms | Tburst = 5120 ms | Tburst = 10240 ms |
| ≤0.16 | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable |
| 0.16< DRX-cycle<2.56 | Note (20\* Nfreq \*ceil(Tburst/480) ) | Note (20\* Nfreq \*ceil(Tburst/480) ) | Note (20\* Nfreq \*ceil(Tburst/480) ) | Note (20\* Nfreq \*ceil(Tburst/480) ) |
| Note: Time depends upon the DRX cycle in use | | | | |

For UE other than category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Clause 9.1.3.1 and 9.1.3.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.1 and 9.1.6.2 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Sections 9.1.17.3.1 and 9.1.17.3.2 are fulfilled for a corresponding Band,

- SCH\_RP|dBm SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

For category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Clause 9.1.3.3 and 9.1.3.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.5 and 9.1.6.6 are fulfilled for a corresponding Band,

- SCH\_RP|dBm SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements of at least 4 inter-frequency cells per FDD inter-frequency and the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period Tmeasure\_inter, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is used, Tmeasure\_inter is as defined in Table 8.1.2.3.1.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter is as defined in Table 8.1.2.3.1.2-3 for GP0 and GP1. If UE is configured with nonUniform1 – nonUniform4 Tidentify\_inter is as defined in Table 8.1.2.3.1.2-4.

Table 8.1.2.3.1.2-2: Requirement to measure FDD interfrequency cells

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | Tmeasure\_inter (s) (DRX cycles) (normal performance) | Tmeasure\_inter (s) (DRX cycles) (reduced performance) |
| ≤0.08 | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable |
| 0.08<DRX-cycle≤2.56 | Note (5\*Kn\*Nfreq,n) | Note (5\*Kr\*Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | |

Table 8.1.2.3.1.2-3: Requirement to measure FDD inter-frequency cells when eDRX\_CONN cycle is used

|  |  |  |
| --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_inter (s) (eDRX\_CONN cycles) (normal performance) | Tmeasure\_inter (s) (eDRX\_CONN cycles) (reduced performance) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\*Kn\*Nfreq,n) | Note (5\*Kr\*Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

Table 8.1.2.3.1.2-4: Requirement to measure FDD inter-frequency cells when non-uniform gap pattern nonUniform1 – nonUniform4 is used

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX\_CONN cycle length (s) | Tmeasure\_inter  (DRX cycles) | | | |
| Tburst = 1280 ms | Tburst = 2560 ms | Tburst = 5120 ms | Tburst = 10240 ms |
| DRX-cycle ≤2.56 | Note (5\* Nfreq \*ceil(Tburst/480)) | Note (5\* Nfreq \*ceil(Tburst/480)) | Note (5\* Nfreq \*ceil(Tburst/480)) | Note (5\* Nfreq \*ceil(Tburst/480)) |
| Note: Time depends on the DRX cycles in use | | | | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.3.1 and 9.1.3.2, the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.6.1 and 9.1.6.2, and the RS-SINR measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.17.3.1 and 9.1.17.3.2.

For category 1bis UE, when DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period Tmeasure\_inter, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is used, Tmeasure\_inter is as defined in Table 8.1.2.3.1.2-5, and when eDRX\_CONN is in use, Tmeasure\_inter is as defined in Table 8.1.2.3.1.2-6.

Table 8.1.2.3.1.2-5: Requirement to measure FDD interfrequency cells (category 1bis UE)

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | Tmeasure\_inter (s) (DRX cycles) (normal performance) | Tmeasure\_inter (s) (DRX cycles) (reduced performance) |
| ≤0.08 | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable |
| 0.08<DRX-cycle≤2.56 | Note (10\*Kn\*Nfreq,n) | Note (10\*Kr\*Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | |

Table 8.1.2.3.1.2-6: Requirement to measure FDD inter-frequency cells when eDRX\_CONN cycle is used (category 1bis UE)

|  |  |  |
| --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_inter (s) (eDRX\_CONN cycles) (normal performance) | Tmeasure\_inter (s) (eDRX\_CONN cycles) (reduced performance) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (10\*Kn\*Nfreq,n) | Note (5\*Kr\*Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.3.3 and 9.1.3.4 and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.6.5 and 9.1.6.6.

8.1.2.3.1.2.1 Measurement Reporting Requirements

8.1.2.3.1.2.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

8.1.2.3.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.3.1.2.1.3.

8.1.2.3.1.2.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_inter defined in clause 8.1.2.3.1.2.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter defined in clause 8.1.2.3.1.2 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasure\_inter defined in clause 8.1.2.3.1.2 provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.1.2.3.2 E-UTRAN TDD – TDD inter frequency measurements

8.1.2.3.2.1 E-UTRAN TDD – TDD inter frequency measurements when no DRX is used

When measurement gaps other than nonUniform1 – nonUniform4 are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new TDD inter-frequency within TIdentify\_Inter according to the following expression:

- When configuration 0 or configuration 1 in Table 8.1.2.3.2.1-1 is applied, ,

- When configuration 2 or configuration 3 in Table 8.1.2.3.2.1-1 is applied, ,.

TBasic\_Identify\_Inter = 480 ms. It is the time period used in the inter frequency equation where the maximum allowed time for the UE to identify a new TDD inter-frequency cell is defined.

Nfreq is defined in clause 8.1.2.1.1 and Tinter1 is defined in clause 8.1.2.1

When measurement gaps nonUniform1 – nonUniform4 are scheduled, the UE shall be able to identify a new FDD inter-frequency within TIdentify\_Inter according to the following expression:

- When configuration 0 or configuration 1 in Table 8.1.2.3.2.1-1 is applied,



- When configuration 2 or configuration 3 in Table 8.1.2.3.2.1-1 is applied,



If the UE requires measurement gaps to identify and measure inter-frequency and/or inter-RAT cells and the UE supports perServingCellMeasurementGap-r14 and is configured per-CC, or the UE supports parallel measurements, the UE shall be able to identify a new TDD inter-frequency within TIdentify\_Inter\_perCC according to the following expression:

- When configuration 0 or configuration 1 in Table 8.1.2.3.2.1-1 is applied,

(normal performance) and

(reduced performance)

- When configuration 2 or configuration 3 in Table 8.1.2.3.2.1-1 is applied,

(normal performance) and

(reduced performance)

where:

TBasic\_Identify\_Inter = 480 ms. It is the time period used in the inter frequency equation where the maximum allowed time for the UE to identify a new TDD inter-frequency cell is defined.

If the UE supports perServingCellMeasurementGap-r14 and is configured with per-CC gap, or the UE supports parallel measurements, Nfreq,n = Nfreq,n,effective shall be used in section 8.1.2.3.2 when deriving the UE requirements. Nfreq,n,effective Nfreq,r,effective are defined as effective number of layers to be monitored by the UE for normal performance group and reduced performance group. They are reported by the UE. Nfreq,n,effective should be equal or less than Nfreq,n defined in clause 8.1.2.1.1. and Nfreq,r,effective should be equal or less than Nfreq,r defined in clause 8.1.2.1.1. Kn and Kr are defined in clause 8.1.2.1.1 and Tinter1 is defined in clause 8.1.2.1.

For UE other than category 1bis UE , a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Clause 9.1.3.1 and 9.1.3.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.1 and 9.1.6.2 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Sections 9.1.17.3.1 and 9.1.17.3.2 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

For category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Clause 9.1.3.3 and 9.1.3.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.5 and 9.1.6.6 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

When measurement gaps are scheduled for TDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively, with measurement period (TMeasurement\_Period\_TDD\_Inter) given by table 8.1.2.3.2.1-1:

Table 8.1.2.3.2.1-1: TMeasurement\_Period\_TDD\_Inter for different configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Configuration | | Measurement bandwidth [RB] | Number of UL/DL sub-frames per half frame (5 ms) | | DwPTS | | TMeasurement\_Period\_TDD\_Inter [ms] (normal performance) | TMeasurement\_Period\_TDD\_Inter [ms] (reduced performance) |
|  |  | DL | UL | Normal CP | Extended CP |  |  |
| 0 | | 6 | 2 | 2 |  |  | 480 x Kn x Nfreq,n | 480 x Kr x Nfreq,r |
| 1 (Note 1) | | 50 | 2 | 2 |  |  | 240 x Kn x Nfreq,n | 240 x Kr x Nfreq,r |
| 2 | | 6 | 1 | 3 |  |  | 720 x Kn x Nfreq,n | 720 x Kr x Nfreq,r |
| 3 (Note 1) | | 50 | 1 | 3 |  |  | 480 x Kn x Nfreq,n | 480 x Kr x Nfreq,r |
| 4 | | 6 | 2 | 2 |  |  | Tburst x Nfreq | Tburst x Nfreq |
| 5 (Note 3) | | 50 | 2 | 2 |  |  | ½ x Tburst x Nfreq | ½ x Tburst x Nfreq |
| 6 | | 6 | 1 | 3 |  |  | 3/2∙Tburst x Nfreq | 3/2 x Tburst x Nfreq |
| 7 (Note 3) | | 50 | 1 | 3 |  |  | Tburst x Nfreq | Tburst x Nfreq |
| Note 1: This configuration is optional  Note 2: *T*s is defined in TS 36.211 [16]  Note 3: This configuration is optional and when nonUniform1 – nonUniform4 are configured | | | | | | | | |

The UE shall be capable of performing RSRP, RSRQ, RS-SINR measurements of at least 4 inter-frequency cells per TDD inter-frequency and the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period TMeasurement\_Period\_TDD\_Inter.

For category 1bis UE, when measurement gaps are scheduled for TDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.3.3, 9.1.3.4, 9.1.6.5 and 9.1.6.6, respectively, with measurement period (TMeasurement\_Period\_TDD\_Inter) given by table 8.1.2.3.2.1-2:

Table 8.1.2.3.2.1-2: TMeasurement\_Period\_TDD\_Inter for different configurations (category 1bis UE)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Configuration | | Measurement bandwidth [RB] | Number of UL/DL sub-frames per half frame (5 ms) | | DwPTS | | TMeasurement\_Period\_TDD\_Inter [ms] (normal performance) | TMeasurement\_Period\_TDD\_Inter [ms] (reduced performance) |
|  |  | DL | UL | Normal CP | Extended CP |  |  |
| 0 | | 6 | 2 | 2 |  |  | 960 x Kn x Nfreq,n | 960 x Kr x Nfreq,r |
| 1 (Note 1) | | 50 | 2 | 2 |  |  | 480 x Kn x Nfreq,n | 480 x Kr x Nfreq,r |
| 2 | | 6 | 1 | 3 |  |  | 1440 x Kn x Nfreq,n | 1440 x Kr x Nfreq,r |
| 3 (Note 1) | | 50 | 1 | 3 |  |  | 960 x Kn x Nfreq,n | 960 x Kr x Nfreq,r |
| Note 1: This configuration is optional  Note 2: *T*s is defined in TS 36.211 [16] | | | | | | | |  |

The category 1bis UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per TDD inter-frequency and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period TMeasurement\_Period\_TDD\_Inter given by table 8.1.2.3.2.1-2.

8.1.2.3.2.1.1 Measurement Reporting Requirements

8.1.2.3.2.1.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

8.1.2.3.2.1.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.3.2.1.1.3.

8.1.2.3.2.1.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than TIdentify\_Inter or T identify –inter-perCC when per-CC based measurement gap configured defined in clause 8.1.2.3.2.1.When L3 filtering is used or IDC autonomous denial or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period TIdentify\_Inter or T identify –inter-perCC when per-CC based measurement gap configured defined in clause 8.1.2.3.2.1 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_TDD\_Inter defined in clause 8.1.2.3.2.1 provided the timing to that cell has not changed more than ± 50 Ts while measurementgap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.3.2.2 E-UTRAN TDD – TDD inter frequency measurements when DRX is used

When DRX or eDRX\_CONN is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable E-UTRAN TDD inter frequency cell within Tidentify\_inter or T identify –inter-perCC when per-CC based measurement gap configured. When DRX is in use, Tidentify\_inter is as defined in Table 8.1.2.3.2.2-1, and when eDRX\_CONN is in use Tidentify\_inter is as defined in Table 8.1.2.3.2.2-1A for GP0 and GP1. If UE is configured with nonUniform1 – nonUniform4 Tidentify\_inter is as defined in Table 8.1.2.3.2.2-1B.

Table 8.1.2.3.2.2-1: Requirement to identify a newly detectable TDD interfrequency cell

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX cycle length (s) | Tidentify\_inter (s) (DRX cycles) (normal performance) | | Tidentify\_inter (s) (DRX cycles) (reduced performance) | |
| Gap period = 40 ms, 20ms | Gap period = 80 ms | Gap period = 40 ms | Gap period = 80 ms |
| ≤0.16 | Non DRX Requirements in clause 8.1.2.3.2.1 are applicable | Non DRX Requirements in clause 8.1.2.3.2.1 are applicable | Non DRX Requirements in clause 8.1.2.3.2.1 are applicable | Non DRX Requirements in clause 8.1.2.3.2.1 are applicable |
| 0.256 | 5.12\*Kn\*Nfreq,n (20\*Kn \*Nfreq,n) | 7.68\*Kn \*Nfreq,n (30\*Kn \*Nfreq,n) | 5.12\*Kr\*Nfreq,r (20\*Kr \*Nfreq,r) | 7.68\*Kr \*Nfreq,r (30\*Kr \*Nfreq,r) |
| 0.32 | 6.4\*Kn \*Nfreq,n (20\*Kn \*Nfreq,n) | 7.68\*Kn \*Nfreq,n (24\*Kn \*Nfreq,n) | 6.4\*Kr \*Nfreq,r (20\*Kr \*Nfreq,r) | 7.68\*Kr \*Nfreq,r (24\*Kr \*Nfreq,r) |
| 0.32<DRX-cycle≤2.56 | Note (20\*Kn \*Nfreq,n) | Note (20\*Kn \*Nfreq,n) | Note (20\*Kr \*Nfreq,r) | Note (20\*Kr \*Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | | | |

Table 8.1.2.3.2.2-1A: Requirement to identify a newly detectable TDD inter-frequency cell when eDRX\_CONN cycle is used

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_inter (s) (eDRX\_CONN cycles) (normal performance) | | Tidentify\_inter (s) (eDRX\_CONN cycles) (reduced performance) | |
| Gap period = 40 ms, 20ms | Gap period = 80 ms | Gap period = 40 ms | Gap period = 80 ms |
| 2.56<eDRX\_CONN cycle ≤10.24 | Note (20\*Kn \*Nfreq,n) | Note (20\*Kn \*Nfreq,n) | Note (20\*Kr \*Nfreq,r) | Note (20\*Kr \*Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | | | |

Table 8.1.2.3.2.2-1B: Requirement to identify a newly detectable TDD inter-frequency cell when non-uniform gap pattern nonUniform1 – nonUniform4 is used

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX\_CONN cycle length (s) | Tidentify\_inter  (DRX cycles) | | | |
| Tburst = 1280 ms | Tburst = 2560 ms | Tburst = 5120 ms | Tburst = 10240 ms |
| ≤0.16 | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable | Non DRX Requirements in clause 8.1.2.3.1.1 are applicable |
| 0.16< DRX-cycle<2.56 | Note (20\* Nfreq \*ceil(Tburst/480) ) | Note (20\* Nfreq \*ceil(Tburst/480) ) | Note (20\* Nfreq \*ceil(Tburst/480) ) | Note (20\* Nfreq \*ceil(Tburst/480) ) |
| Note: Time depends upon the DRX cycle in use | | | | |

For UE other than category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Clause 9.1.3.1 and 9.1.3.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.1 and 9.1.6.2 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Sections 9.1.17.3.1 and 9.1.17.3.2 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

For category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Clause 9.1.3.3 and 9.1.3.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.5 and 9.1.6.6 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements of at least 4 inter-frequency cells per TDD inter-frequency for up to 3 TDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period Tmeasure\_inter, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is in use, Tmeasure\_inter is as defined in Table 8.1.2.3.2.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter  is as defined in Table 8.1.2.3.2.2-3 for GP0 and GP1. If UE is configured with nonUniform1 – nonUniform4 Tidentify\_inter is as defined in Table 8.1.2.3.2.2-4.

Table 8.1.2.3.2.2-2: Requirement to measure TDD interfrequency cells

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | Tmeasure\_inter (s) (DRX cycles) (normal requirement) | Tmeasure\_inter (s) (DRX cycles) (reduced requirement) |
| ≤0.08 | Non DRX Requirements in clause 8.1.2.3.2.1 are applicable | Non DRX Requirements in clause 8.1.2.3.2.1 are applicable |
| 0.128 | When configuration 2 non DRX Requirements in clause 8.1.2.3.2.1 are applicable,  Otherwise  Note (5\*Kn\*Nfreq,n) | When configuration 2 non DRX Requirements in clause 8.1.2.3.2.1 are applicable,  Otherwise  Note (5\*Kr\*Nfreq,r) |
| 0.128<DRX-cycle≤2.56 | Note (5\*Kn\*Nfreq,n) | Note (5\*Kr\*Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | |

Table 8.1.2.3.2.2-3: Requirement to measure TDD inter-frequency cells when eDRX\_CONN cycle is used

|  |  |  |
| --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_inter (s) (eDRX\_CONN cycles) (normal requirement) | Tmeasure\_inter (s) (eDRX\_CONN cycles) (reduced requirement) |
| 2.56<eDRX\_CONN cycle ≤10.24 | Note (5\*Kn\*Nfreq,n) | Note (5\*Kr\*Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

Table 8.1.2.3.2.2-4: Requirement to measure TDD inter-frequency cells when non-uniform gap pattern nonUniform1 – nonUniform4 is used

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX\_CONN cycle length (s) | Tmeasure\_inter  (DRX cycles) | | | |
| Tburst = 1280 ms | Tburst = 2560 ms | Tburst = 5120 ms | Tburst = 10240 ms |
| DRX-cycle ≤2.56 | Note (5\* Nfreq \*ceil(Tburst/480)) | Note (5\* Nfreq \*ceil(Tburst/480)) | Note (5\* Nfreq \*ceil(Tburst/480)) | Note (5\* Nfreq \*ceil(Tburst/480)) |
| Note: Time depends upon the DRX cycle in use | | | | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.3.1 and 9.1.3.2, the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.6.1 and 9.1.6.2, and the RS-SINR measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.17.3.1 and 9.1.17.3.2.

For category 1bis UE, when DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per TDD inter-frequency for up to 3 TDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period Tmeasure\_inter, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is in use, Tmeasure\_inter is as defined in Table 8.1.2.3.2.2-5, and when eDRX\_CONN is in use, Tmeasure\_inter  is as defined in Table 8.1.2.3.2.2-6.

Table 8.1.2.3.2.2-5: Requirement to measure TDD interfrequency cells (category 1bis UE)

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | Tmeasure\_inter (s) (DRX cycles) (normal requirement) | Tmeasure\_inter (s) (DRX cycles) (reduced requirement) |
| ≤0.08 | Non DRX Requirements in clause 8.1.2.3.2.1 are applicable | Non DRX Requirements in clause 8.1.2.3.2.1 are applicable |
| 0.128 | When configuration 2 non DRX Requirements in clause 8.1.2.3.2.1 are applicable,  Otherwise  Note (10\*Kn\*Nfreq,n) | When configuration 2 non DRX Requirements in clause 8.1.2.3.2.1 are applicable,  Otherwise  Note (10\*Kr\*Nfreq,r) |
| 0.128<DRX-cycle≤2.56 | Note (10\*Kn\*Nfreq,n) | Note (10\*Kr\*Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | |

Table 8.1.2.3.2.2-6: Requirement to measure TDD inter-frequency cells when eDRX\_CONN cycle is used (category 1bis UE)

|  |  |  |
| --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_inter (s) (eDRX\_CONN cycles) (normal requirement) | Tmeasure\_inter (s) (eDRX\_CONN cycles) (reduced requirement) |
| 2.56<eDRX\_CONN cycle ≤10.24 | Note (10\*Kn\*Nfreq,n) | Note (5\*Kr\*Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.3.3 and 9.1.3.4 and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.6.5 and 9.1.6.6.

8.1.2.3.2.2.1 Measurement Reporting Requirements

8.1.2.3.2.2.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

8.1.2.3.2.2.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.3.2.2.1.3.

8.1.2.3.2.2.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clause 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than TIdentify\_Inter defined in Clause 8.1.2.3.2.2.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period TIdentify\_Inter in clause 8.1.2.3.2.2 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasure\_inter in clause 8.1.2.3.2.2 provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.1.2.3.3 E-UTRAN TDD – FDD inter frequency measurements

8.1.2.3.3.1 E-UTRAN TDD – FDD inter frequency measurements when no DRX is used

The requirements in this clause shall apply to UE supporting FDD and TDD.

The requirements in clause 8.1.2.3.1.1 also apply for this section.

8.1.2.3.3.2 E-UTRAN TDD – FDD inter frequency measurements when DRX is used

The requirements in this clause shall apply to UE supporting FDD and TDD.

When DRX or eDRX\_CONN cycle is used, the requirements in clause 8.1.2.3.1.2 shall also apply for this section.

##### 8.1.2.3.4 E-UTRAN FDD – TDD inter frequency measurements

8.1.2.3.4.1 E-UTRAN FDD – TDD inter frequency measurements when no DRX is used

The requirements in this clause shall apply to UE supporting FDD and TDD.

The requirements in clause 8.1.2.3.2.1 also apply for this section.

8.1.2.3.4.2 E-UTRAN FDD – TDD inter frequency measurements when DRX is used

The requirements in this clause shall apply to UE supporting FDD and TDD.

When DRX or eDRX\_CONN cycle is used, the requirements in clause 8.1.2.3.2.2 shall also apply for this section.

##### 8.1.2.3.5 E-UTRAN FDD-FDD inter frequency measurements with autonomous gaps

8.1.2.3.5.1 Identification of a new CGI of E-UTRA FDD cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose of ‘reportCGI’. The UE may make autonomous gaps in both downlink reception and uplink transmission for receiving MIB and SIB1 message according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI, inter = 150 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI,inter is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the UE shall transmit at least 60 ACK/NACKs on PCell or each of activated SCell(s), provided that:

- there is continuous DL data allocation,

- no DRX and no eDRX\_CONN cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each subframe,

- no MBSFN subframes are configured in the PCell or each of activated SCell(s).

Note : ACK requirements for CGI reading were derived assuming *ShortTTI-r15* is not configured. When *ShortTTI-r15* is configured is used, a greater number of transmitted ACK/NACK is expected.

For the UE capable of SRS carrier based switching when configured to perform SRS carrier based switching for SRS transmission and/or RACH transmission via one or more SCells without PUSCH (NOTE: The requirement on the number of ACK/NACKs transmitted during SRS carrier based switching does not need to be tested):

- the requirements defined in this section shall be met provided during :

- the SRS carrier based switching does not cause any interruption on the PCell or on any activated SCell during and

- DL subframe #0 and DL subframe #5 per radio frame of the target E-UTRA are available at the UE.

- otherwise the time to acquire the new CGI of the E-UTRA cell may be extended or the UE may not be able to transmit the required number of ACK/NACKs on PCell or each of the activated SCell(s).

8.1.2.3.5.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

##### 8.1.2.3.6 E-UTRAN TDD-FDD inter frequency measurements using autonomous gaps

The requirements in this clause shall apply to UE supporting FDD and TDD.

8.1.2.3.6.1 Identification of a new CGI of E-UTRA FDD cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose of ‘reportCGI’. The UE may make autonomous gaps in both downlink reception and uplink transmission for receiving MIB and SIB1 message according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI, inter = 150 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.4 for a corresponding Band.

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI,inter is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the UE shall be able to transmit at least the number of ACK/NACKs stated in Table 8.1.2.3.6.1-1 on PCell or each of activated SCell(s), provided that:

- there is continuous DL data allocation,

- no DRX and no eDRX\_CONN cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each subframe,

- no MBSFN subframes are configured in the PCell or each of activated SCell(s).

Table 8.1.2.3.6.1-1: Requirement on minimum number of ACK/NACKs to transmit during Tbasic\_identify\_CGI, inter.

|  |  |
| --- | --- |
| TDD UL/DL configuration for serving cell | Minimum number of transmitted ACK/NACKs |
| 0 (Note 1) | 18 |
| 1 | 30 |
| Note 1: When a UE is configured with *EIMTA-MainConfigServCell* via RRC signalling [2] only this requirement shall apply.  Note 2: The requirement for other TDD UL/DL configuration is not specified. | |

Note : ACK requirements for CGI reading were derived assuming 1ms TTI duration for both UL and DL. When shorter TTI is used, a greater number of transmitted ACK/NACK is expected.

For the UE capable of SRS carrier based switching when configured to perform SRS carrier based switching for SRS transmission and/or RACH transmission via one or more SCells without PUSCH (NOTE: The requirement on the number of ACK/NACKs transmitted during SRS carrier based switching does not need to be tested):

- the requirements defined in this section shall be met provided during :

- the SRS carrier based switching does not cause any interruption on the PCell or on any activated SCell during and

- DL subframe #0 and DL subframe #5 per radio frame of the target E-UTRA are available at the UE.

- otherwise the time to acquire the new CGI of the E-UTRA cell may be extended or the UE may not be able to transmit at least the number of ACK/NACKs as specified in Table 8.1.2.3.6.1-1 on PCell or each of the activated SCell(s).

8.1.2.3.6.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

##### 8.1.2.3.7 E-UTRAN TDD-TDD inter frequency measurements with autonomous gaps

8.1.2.3.7.1 Identification of a new CGI of E-UTRA TDD cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose of ‘reportCGI’. The UE may make autonomous gaps in both downlink reception and uplink transmission for receiving MIB and SIB1 message according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI, inter = 150 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.4 for a corresponding Band.

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI,inter is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the UE shall be able to transmit at least the number of ACK/NACKs stated in Table 8.1.2.3.7.1-1 on PCell or each of activated SCell(s), provided that:

- there is continuous DL data allocation,

- no DRX and no eDRX\_CONN cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each subframe,

- no MBSFN subframes are configured in the PCell or each of activated SCell(s).

Table 8.1.2.3.7.1-1: Requirement on minimum number of ACK/NACKs to transmit during Tbasic\_identify\_CGI, inter.

|  |  |
| --- | --- |
| TDD UL/DL configuration for serving cell | Minimum number of transmitted ACK/NACKs |
| 0 (Note 1) | 18 |
| 1 | 30 |
| Note 1: When a UE is configured with *EIMTA-MainConfigServCell* via RRC signalling [2] only this requirement shall apply cell.  Note 2: The requirement for other TDD UL/DL configuration is not specified. | |

Note : ACK requirements for CGI reading were derived assuming 1ms TTI duration for both UL and DL. When shorter TTI is used, a greater number of transmitted ACK/NACK is expected.

For the UE capable of SRS carrier based switching when configured to perform SRS carrier based switching for SRS transmission and/or RACH transmission via one or more SCells without PUSCH (NOTE: The requirement on the number of ACK/NACKs transmitted during SRS carrier based switching does not need to be tested):

- the requirements defined in this section shall be met provided during :

- the SRS carrier based switching does not cause any interruption on the PCell or on any activated SCell during and

- DL subframe #0 and DL subframe #5 per radio frame of the target E-UTRA are available at the UE.

- otherwise the time to acquire the new CGI of the E-UTRA cell may be extended or the UE may not be able to transmit at least the number of ACK/NACKs as specified in Table 8.1.2.3.7.1-1 on PCell or each of the activated SCell(s).

8.1.2.3.7.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

##### 8.1.2.3.8 E-UTRAN FDD-TDD inter frequency measurements using autonomous gaps

The requirements in this clause shall apply to UE supporting FDD and TDD.

8.1.2.3.8.1 Identification of a new CGI of E-UTRA TDD cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose of ‘reportCGI’. The UE may make autonomous gaps in both downlink reception and uplink transmission for receiving MIB and SIB1 message according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI, inter = 150 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.4 for a corresponding Band.

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI,inter is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the UE shall have more than 60 ACK/NACKs transmitted on PCell or each of activated SCell(s), provided that:

- there is continuous DL data allocation,

- no DRX and no eDRX\_CONN cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each subframe,

- no MBSFN subframes are configured in the PCell or each of activated SCell(s).

Note : ACK requirements for CGI reading were derived assuming 1ms TTI duration for both UL and DL. When shorter TTI is used, a greater number of transmitted ACK/NACK is expected

For the UE capable of SRS carrier based switching when configured to perform SRS carrier based switching for SRS transmission and/or RACH transmission via one or more SCells without PUSCH (NOTE: The requirement on the number of ACK/NACKs transmitted during SRS carrier based switching does not need to be tested):

- the requirements defined in this section shall be met provided during :

- the SRS carrier based switching does not cause any interruption on the PCell or on any activated SCell during and

- DL subframe #0 and DL subframe #5 per radio frame of the target E-UTRA are available at the UE.

- otherwise the time to acquire the new CGI of the E-UTRA cell may be extended or the UE may not be able to transmit the required number of ACK/NACKs on PCell or each of the activated SCell(s).

8.1.2.3.8.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

##### 8.1.2.3.9 E-UTRAN FDD – FDD inter frequency measurements with FeMBMS/Unicast mixed cells

Requirements in this section apply for UE configured to perform inter-frequency measurements on a carrier with one or more FeMBMS/Unicast mixed cells and which are capable of receiving unicast from the FeMBMS/Unicast mixed cell and are capable of receiving at least one of *SystemInformationBlockType15* or *fembms-MixedCarrier-r14* indication and are provided with the information that one or more FeMBMS/Unicast mixed cells are present on the inter-frequency to be measured.

The minimum number of cells and the minimum number of inter-frequencies that the UE shall be able to measure on include also FeMBMS/Unicast mixed cells and the inter-frequencies with and without such cells.

8.1.2.3.9.1 E-UTRAN FDD – FDD inter frequency measurements with FeMBMS/unicast mixed cells when no DRX is used

When measurement gaps other than nonUniform1 – nonUniform4 are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new FDD inter-frequency within TIdentify\_Inter according to the following expression:

 (normal performance) and

 (reduced performance)

Where:

TBasic\_Identify\_Inter = 480 ms. It is the time period used in the inter frequency equation where the maximum allowed time for the UE to identify a new FDD inter-frequency cell is defined.

Nfreq,n Nfreq,r Kn and Kr are defined in clause 8.1.2.1.1 and Tinter1 is defined in clause 8.1.2.1

When measurement gaps nonUniform1 – nonUniform4 are scheduled, the UE shall be able to identify a new FDD inter-frequency within TIdentify\_Inter according to the following expressions:



If the UE requires measurement gaps to identify and measure inter-frequency and/or inter-RAT cells and the UE supports perServingCellMeasurementGap-r14 and is configured with per per-CC, or the UE supports parallel measurements, the UE shall be able to identify a new FDD inter-frequency within TIdentify\_Inter\_perCC according to the following expression:

 (normal performance) and

 (reduced performance)

where:

TBasic\_Identify\_Inter = 480 ms. It is the time period used in the inter frequency equation where the maximum allowed time for the UE to identify a new FDD inter-frequency cell is defined.

If the UE supports perServingCellMeasurementGap-r14 and is configured with per-CC gap, or the UE supports parallel measurements, Nfreq,n = Nfreq,n,effective shall be used in section 8.1.2.3.9 when deriving the UE requirements. Nfreq,n,effective Nfreq,r,effective are defined as effective number of layers to be monitored by the UE for normal performance group and reduced performance group. They are reported by the UE. Nfreq,n,effective should be equal or less than Nfreq,n defined in clause 8.1.2.1.1. and Nfreq,r,effective should be equal or less than Nfreq,r defined in clause 8.1.2.1.1Kn and Kr are defined in clause 8.1.2.1.1 and Tinter1 is defined in clause 8.1.2.1. For UE other than category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Sections 9.1.3.1 and 9.1.3.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.1 and 9.1.6.2 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Sections 9.1.17.3.1 and 9.1.17.3.2 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

For category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Sections 9.1.3.3 and 9.1.3.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.5 and 9.1.6.6 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

When measurement gaps are scheduled for FDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively, with measurement period given by table 8.1.2.3.9.1-1.

Table 8.1.2.3.9.1-1: Measurement period and measurement bandwidth

|  |  |  |  |
| --- | --- | --- | --- |
| Configuration | Physical Layer Measurement period: TMeasurement\_Period \_Inter\_FDD [ms] (normal performance) | Physical Layer Measurement period: TMeasurement\_Period \_Inter\_FDD [ms] (reduced performance) | Measurement bandwidth [RB] |
| 0 | 720 x Kn x Nfreq,n | 720 x Kr x Nfreq,r | 6 |
| 1 (Note 1) | 480 x Kn x Nfreq,n | 480 x Kr x Nfreq,r | 50 |
| 2 (Note 2) | 1.5∙Tburst x Nfreq | 1.5∙Tburst x Nfreq | 6 |
| 3 (Note 3) | Tburst x Nfreq | Tburst x Nfreq | 50 |
| Note 1: This configuration is optional  Note 2: This configuration is for when nonUniform1 – nonUniform4 are configured  Note 3: This configuration is optional and when nonUniform1 – nonUniform4 are configured | | | |

The UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements of at least 4 inter-frequency cells per FDD inter-frequency for up to 3 FDD inter-frequencies or 8 FDD interfrequencies if the UE supports Increased UE carrier monitoring E-UTRA and the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period defined in Table 8.1.2.3.9.1-1.

For category 1bis UE, when measurement gaps are scheduled for FDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.3.3, 9.1.3.4, 9.1.6.5 and 9.1.6.6, respectively, with measurement period given by table 8.1.2.3.9.1-2.

Table 8.1.2.3.9.1-2: Measurement period and measurement bandwidth (category 1bis UE)

|  |  |  |  |
| --- | --- | --- | --- |
| Configuration | Physical Layer Measurement period: TMeasurement\_Period \_Inter\_FDD [ms] (normal performance) | Physical Layer Measurement period: TMeasurement\_Period \_Inter\_FDD [ms] (reduced performance) | Measurement bandwidth [RB] |
| 0 | 1440 x Kn x Nfreq,n | 1440 x Kr x Nfreq,r | 6 |
| 1 (Note) | 960 x Kn x Nfreq,n | 960 x Kr x Nfreq,r | 50 |
| Note: This configuration is optional | | | |

The category 1bis UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency for up to 3 FDD inter-frequencies or 8 FDD interfrequencies if the UE supports Increased UE carrier monitoring E-UTRA and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period defined in Table 8.1.2.3.9.1-2.

8.1.2.3.9.1.1 Measurement Reporting Requirements

8.1.2.3.9.1.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

8.1.2.3.9.1.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.3.9.1.1.3.

8.1.2.3.9.1.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH . The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify -inter or T identify –inter-perCC when per-CC based measurement gap configured defined in clause 8.1.2.3.9.1.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter or T identify –inter-perCC when per-CC based measurement gap configured defined in clause 8.1.2.3.9.1 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_Inter\_FDD defined in clause 8.1.2.3.9.1 provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.3.9.2 E-UTRAN FDD – FDD inter frequency measurements with FeMBMS/Unicast mixed cells when DRX is used

When DRX or eDRX\_CONN is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable E-UTRAN FDD inter frequency cell within Tidentify\_inter or T identify –inter-perCC when per-CC based measurement gap configured. When DRX is in use, Tidentify\_inter is as defined in Table 8.1.2.3.9.2-1, and when eDRX\_CONN is in use, Tidentify\_inter is as defined in Table 8.1.2.3.9.2-1A for GP0 and GP1. If UE is configured with nonUniform1 – nonUniform4 Tidentify\_inter is as defined in Table 8.1.2.3.9.2-1B.

Table 8.1.2.3.9.2-1: Requirement to identify a newly detectable FDD interfrequency cell

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX cycle length (s) | Tidentify\_inter (s) (DRX cycles), normal performance | | Tidentify\_inter (s) (DRX cycles), reduced performance | |
| Gap period = 40 ms | Gap period = 80 ms | Gap period = 40 ms | Gap period = 80 ms |
| ≤0.16 | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable |
| 0.256 | 5.12\*Kn\*Nfreq,n  (20\*Kn\*Nfreq,n) | 7.68\*Kn \*Nfreq,n (30\*Kn \*Nfreq,n) | 5.12\*Kr\*Nfreq,r  (20\*Kr\*Nfreq,r) | 7.68\*Kr \*Nfreq,r (30\*Kr \*Nfreq,r) |
| 0.32 | 6.4\*Kn \*Nfreq,n (20\*Kn \*Nfreq,n) | 7.68\*Kn \*Nfreq,nl (24\*Kn \*Nfreq,n) | 6.4\*Kr \*Nfreq,r (20\*Kr \*Nfreq,r) | 7.68\*Kr \*Nfreq,r (24\*Kr \*Nfreq,r) |
| 0.32< DRX-cycle≤2.56 | Note (20\*Kn \*Nfreq,n) | Note (20\*Kn \*Nfreq,n) | Note (20\*Kr \*Nfreq,r) | Note (20\*Kr \*Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | | | |

Table 8.1.2.3.9.2-1A: Requirement to identify a newly detectable FDD inter-frequency cell when eDRX\_CONN cycle is used

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_inter (s) (eDRX\_CONN cycles), normal performance | | Tidentify\_inter (s) (eDRX\_CONN cycles), reduced performance | |
| **Gap period = 40 ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| 2.56< eDRX\_CONN cycle≤10.24 | Note (20\*Kn \*Nfreq,n) | Note (20\*Kn \*Nfreq,n) | Note (20\*Kr \*Nfreq,r) | Note (20\*Kr \*Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | | | |

Table 8.1.2.3.9.2-1B: Requirement to identify a newly detectable FDD inter-frequency cell when non-uniform gap pattern nonUniform1 – nonUniform4 is used

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX\_CONN cycle length (s) | Tidentify\_inter | | | |
| Tburst = 1280 ms | Tburst = 2560 ms | Tburst = 5120 ms | Tburst = 10240 ms |
| ≤0.16 | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable |
| 0.16< DRX-cycle<2.56 | 20\*Nfreq\*(Tburst/480) | 20\*Nfreq\*(Tburst/480) | 20\*Nfreq\*(Tburst/480) | 20\*Nfreq\*(Tburst/480) |

For UE other than category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Clause 9.1.3.1 and 9.1.3.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.1 and 9.1.6.2 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Sections 9.1.17.3.1 and 9.1.17.3.2 are fulfilled for a corresponding Band,

- SCH\_RP|dBm SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

For category 1bis UE, a cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Clause 9.1.3.3 and 9.1.3.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.5 and 9.1.6.6 are fulfilled for a corresponding Band,

- SCH\_RP|dBm SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements of at least 4 inter-frequency cells per FDD inter-frequency and the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period Tmeasure\_inter, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is used, Tmeasure\_inter is as defined in Table 8.1.2.3.9.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter is as defined in Table 8.1.2.3.9.2-3 for GP0 and GP1. If UE is configured with nonUniform1 – nonUniform4 Tidentify\_inter is as defined in Table 8.1.2.3.9.2-4.

Table 8.1.2.3.9.2-2: Requirement to measure FDD interfrequency cells

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | Tmeasure\_inter (s) (DRX cycles) (normal performance) | Tmeasure\_inter (s) (DRX cycles) (reduced performance) |
| ≤0.08 | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable |
| 0.128 | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable |
| 0.128<DRX-cycle≤2.56 | Note (5\*Kn\*Nfreq,n) | Note (5\*Kr\*Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | |

Table 8.1.2.3.9.2-3: Requirement to measure FDD inter-frequency cells when eDRX\_CONN cycle is used

|  |  |  |
| --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_inter (s) (eDRX\_CONN cycles) (normal performance) | Tmeasure\_inter (s) (eDRX\_CONN cycles) (reduced performance) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\*Kn\*Nfreq,n) | Note (5\*Kr\*Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

Table 8.1.2.3.9.2-4: Requirement to measure FDD inter-frequency cells when non-uniform gap pattern nonUniform1 – nonUniform4 is used

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX\_CONN cycle length (s) | Tmeasure\_inter | | | |
| Tburst = 1280 ms | Tburst = 2560 ms | Tburst = 5120 ms | Tburst = 10240 ms |
| DRX-cycle ≤2.56 | 5\*Nfreq\*(Tburst/480) | 5\*Nfreq\*(Tburst/480) | 5\*Nfreq\*(Tburst/480) | 5\*Nfreq\*(Tburst/480) |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.3.1 and 9.1.3.2, the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.6.1 and 9.1.6.2, and the RS-SINR measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.17.3.1 and 9.1.17.3.2.

For category 1bis UE, when DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period Tmeasure\_inter, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is used, Tmeasure\_inter is as defined in Table 8.1.2.3.9.2-5, and when eDRX\_CONN is in use, Tmeasure\_inter is as defined in Table 8.1.2.3.9.2-6.

Table 8.1.2.3.9.2-5: Requirement to measure FDD interfrequency cells (category 1bis UE)

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | Tmeasure\_inter (s) (DRX cycles) (normal performance) | Tmeasure\_inter (s) (DRX cycles) (reduced performance) |
| ≤0.08 | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable |
| 1.28 | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable | Non DRX Requirements in clause 8.1.2.3.9.1 are applicable |
| 1.28<DRX-cycle≤2.56 | Note (10\*Kn\*Nfreq,n) | Note (10\*Kr\*Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | |

Table 8.1.2.3.9.2-6: Requirement to measure FDD inter-frequency cells when eDRX\_CONN cycle is used (category 1bis UE)

|  |  |  |
| --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_inter (s) (eDRX\_CONN cycles) (normal performance) | Tmeasure\_inter (s) (eDRX\_CONN cycles) (reduced performance) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (10\*Kn\*Nfreq,n) | Note (5\*Kr\*Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.3.3 and 9.1.3.4 and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.6.5 and 9.1.6.6.

8.1.2.3.9.2.1 Measurement Reporting Requirements

8.1.2.3.9.2.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

8.1.2.3.9.2.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.3.9.2.1.3.

8.1.2.3.9.2.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_inter defined in clause 8.1.2.3.9.2.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter defined in clause 8.1.2.3.9.2 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasure\_inter defined in clause 8.1.2.3.9.2 provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.1.2.3.10 E-UTRAN TDD – FDD inter frequency measurements with FeMBMS/Unicast mixed cells

Requirements in this section apply for UE configured to perform inter-frequency measurements on a carrier with one or more FeMBMS/Unicast mixed cells and which are capable of receiving unicast from the FeMBMS/Unicast mixed cell and are capable of receiving at least one of *SystemInformationBlockType15* or *fembms-MixedCarrier-r14* indication and are provided with the information that one or more FeMBMS/Unicast mixed cells are present on the FDD inter-frequency to be measured.

8.1.2.3.10.1 E-UTRAN TDD – FDD inter frequency measurements with FeMBMS/Unicast mixed cells when no DRX is used

The requirements in clause 8.1.2.3.9.1 also apply for this section, where the minimum number of cells and the minimum number of inter-frequencies that the UE shall be able to measure on include also FeMBMS/Unicast mixed cells and the inter-frequencies with and without such cells.

8.1.2.3.10.2 E-UTRAN TDD – FDD inter frequency measurements with FeMBMS/Unicast mixed cells when DRX is used

When DRX or eDRX\_CONN cycle is used, the requirements in clause 8.1.2.3.9.2 shall also apply for this section, where the minimum number of cells and the minimum number of inter-frequencies that the UE shall be able to measure on include also FeMBMS/Unicast mixed cells and the inter-frequencies with and without such cells.

#### 8.1.2.4 Inter RAT measurements

The requirements in this section shall also appy, when the UE is configured to perform SRS carrier based switching and using measurement gaps.

##### 8.1.2.4.1 E-UTRAN FDD – UTRAN FDD measurements

8.1.2.4.1.1 E-UTRAN FDD – UTRAN FDD measurements when no DRX is used

8.1.2.4.1.1.1 Identification of a new UTRA FDD cell

When explicit neighbour list is provided and no DRX is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the monitored set within

 (normal performance),

and

 (reduced performance)

A cell shall be considered detectable when

- CPICH Ec/Io > -20 dB,

- SCH\_Ec/Io > -17 dB for at least one channel tap and SCH\_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.

8.1.2.4.1.1.1a Enhanced UTRA FDD cell identification requirements

When explicit neighbour list is provided and no DRX is used or when DRX cycle length ≤ 40 ms, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the monitored set within Tidentify, enhanced\_UTRA\_FDD:

 (normal performance)

and

 (reduced performance)

A cell shall be considered detectable when:

- CPICH Ec/Io > -15 dB,

- SCH\_Ec/Io > -15 dB for at least one channel tap and SCH\_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.

8.1.2.4.1.1.2 UE UTRA FDD CPICH measurement capability

When measurement gaps are scheduled for UTRA FDD inter RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting measurements to higher layers with measurement accuracy as specified in Clause 9.2 with measurement period given by

 (normal performance),

and

 (reduced performance)

The UE shall be capable of performing UTRA FDD CPICH measurements for Xbasic measurementUTRA\_FDD inter-frequency cells per FDD frequency and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of TMeasurement\_ UTRA\_FDD.

Xbasic measurement UTRA\_FDD = 6

TMeasurement\_Period UTRA\_FDD = 480 ms. The period used for calculating the measurement period Tmeasurement\_UTRA\_FDD for UTRA FDD CPICH measurements.

Tbasic\_identify\_UTRA\_FDD  = 300 ms. This is the time period used in the inter RAT equation in clause 8.1.2.4.1.1.1 where the maximum allowed time for the UE to identify a new UTRA FDD cell is defined.

Tbasic\_identify\_enhanced\_UTRA\_FDD  = 60 ms. This is the time period used in the inter RAT equation in clause 8.1.2.4.1.1.1a where the maximum allowed time for the UE to identify a new UTRA FDD cell is defined.

Tbasic\_measurement\_UTRA\_FDD = 50 ms. This is the time period used in the equation for defining the measurement period for inter RAT CPICH measurements.

Nfreq, n, Nfreq,r ,Kn and Kr are defined in clause 8.1.2.1.1 and Tinter1 is defined in clause 8.1.2.1

8.1.2.4.1.1.3 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

8.1.2.4.1.1.4 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify, UTRA\_FDD defined in Clause 8.1.2.4.1.1.1 for the minimum requirements or Tidentify, enhanced\_UTRA\_FDD defined in Clause 8.1.2.4.1.1.1a for the enhanced requirementsWhen L3 filtering is used or IDC autonomous denial or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify, UTRA\_FDD defined in clause 8.1.2.4.1.1.1 for the minimum requirements or Tidentify, enhanced\_UTRA\_FDD defined in Clause 8.1.2.4.1.1.1a for the enhanced requirements and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasurement\_UTRA\_FDD defined in clause 8.1.2.4.1.1.2 provided the timing to that cell has not changed more than ± 32 chips while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.4.1.1.5 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.4.1.1.4.

8.1.2.4.1.2 E-UTRAN FDD – UTRAN FDD measurements when DRX is used

When explicit neighbour list is provided and DRX or eDRX\_CONN is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the neighbour cell list within Tidentify,UTRA\_FDD. When DRX is used, Tidentify,UTRA\_FDD is as defined in table 8.1.2.4.1.2-1, and when eDRX\_CONN is used, Tidentify,UTRA\_FDD is as defined in table 8.1.2.4.1.2-1A.

Table 8.1.2.4.1.2-1: Requirement to identify a newly detectable UTRA FDD cell

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| DRX cycle length (s) | Tidentify\_UTRA\_FDD (s) (DRX cycles) normal requirement | | | Tidentify\_UTRA\_FDD (s) (DRX cycles) reduced requirement | |
|  | Gap period = 40 ms | Gap period = 80 ms | Gap period = 40 ms | | Gap period = 80 ms |
| ≤0.04 | Non DRX Requirements in clause 8.1.2.4.1.1 are applicable | Non DRX Requirements in clause 8.1.2.4.1.1 are applicable | | Non DRX Requirements in clause 8.1.2.4.1.1 are applicable | Non DRX Requirements in clause 8.1.2.4.1.1 are applicable |
| 0.064 | 2.56\*Kn\* Nfreq,n (40\* Nffreq,n) | 4.8\* Kn\* Nfreq,n (75\* Kn\* Nfreq,n) | | 2.56\*Kr\* Nfreq,r (40\* Kr\* Nffreq,r) | 4.8\* Kr\* Nfreq,r(75\* Kr\* Nfreq,r) |
| 0.08 | 3.2\* Kn\* Nfreq,n (40\* Kn\* Nfreq,n) | 4.8\* Kn\* Nfreq,n (60\* Kn\* Nfreq,n) | | 3.2\* Kr\* Nfreq,r (40\* Kr\* Nfreq,r) | 4.8\* Kr\* Nfreq,r (60\* Kr\* Nfreq,r) |
| 0.128 | 3.2\* Kn\* Nfreq,n (25\* Kn\* Nfreq) | 4.8\* Kn\* Nfreq,n (37.5\* Kn\* Nfreq,n) | | 3.2\* Kr\* Nfreq,n (25\* Kr\* Nfreq,r) | 4.8\* Kr\* Nfreq,r (37.5\* Kr\* Nfreq,r) |
| 0.16 | 3.2\* Kn\* Nfreq,n (20\* Kn\* Nfreq,n) | 4.8\* Kn\* Nfreq,n (30\* Kn\* Nfreq,n) | | 3.2\* Kr\* Nfreq,n (20\* Kr\* Nfreq,r) | 4.8\* Kr\* Nfreq,r (30\* Kr\* Nfreq,r) |
| 0.16<DRX-cycle≤2.56 | Note (20\* Kn\* Nfreq,n) | Note  (20\* Kn\* Nfreq,n) | | Note (20\* Kr\* Nfreq,r) | Note  (20\* Kr\* Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | | | | |

Table 8.1.2.4.1.2-1A: Requirement to identify a newly detectable UTRA FDD cell when eDRX\_CONN cycle is used

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_UTRA\_FDD (s) (eDRX\_CONN cycles) normal requirement | | Tidentify\_UTRA\_FDD (s) (eDRX\_CONN cycles) reduced requirement | |
|  | **Gap period = 40 ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (20\* Kn\* Nfreq,n) | Note (20\* Kn\* Nfreq,n) | Note (20\* Kr\* Nfreq,r) | Note (20\* Kr\* Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | | | |

A cell shall be considered detectable provided following conditions are fulfilled: A cell shall be considered detectable when

- CPICH Ec/Io > -20 dB,

- SCH\_Ec/Io > -17 dB for at least one channel tap and SCH\_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.

When DRX or eDRX\_CONN is used, the UE shall be capable of performing RSCP and Ec/Io measurements of at least 6 UTRA cells per UTRA FDD carrier for up to 3 UTRA FDD carriers and the UE physical layer shall be capable of reporting RSCP and Ec/Io measurements to higher layers within the measurement period Tmeasure\_ UTRA\_FDD, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. UE supporting Increased UE carrier monitoring UTRA shall be capable of performing RSCP and Ec/Io measurements of at least 6 UTRA cells per UTRA FDD carrier for up to 6 UTRA FDD carriers with maximum of 80 cells consisting of at most 32 cells per frequency layer in the neighbour cell list. When DRX is used, Tmeasure\_ UTRA\_FDD is defined in Table 8.1.2.3.1.2-2, and when eDRX\_CONN cycle is used, Tmeasure\_ UTRA\_FDD is defined in Table 8.1.2.3.1.2-3.

Table 8.1.2.4.1.2-2: Requirement to measure UTRA FDD cells

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX cycle length (s) | Tmeasure\_ UTRA\_FDD (s) (DRX cycles) normal requirement | | Tmeasure\_ UTRA\_FDD (s) (DRX cycles) normal requirement | |
|  | Gap period = 40 ms | Gap period = 80 ms | Gap period = 40 ms | Gap period = 80 ms |
| ≤0.04 | Non DRX Requirements in clause 8.1.2.4.1.1 are applicable | Non DRX Requirements in clause 8.1.2.4.1.1 are applicable | Non DRX Requirements in clause 8.1.2.4.1.1 are applicable | Non DRX Requirements in clause 8.1.2.4.1.1 are applicable |
| 0.064 | 0.48\*Kn\* Nfreq,n (7.5\* Kn\* Nfreq,n) | 0.8\* Kn\* Nfreq,n  (12.5\* Kn\* Nfreq,n) | 0.48\* Kr\* Nfreq,r (7.5\* Kr\* Nfreq,r) | 0.8\* Kr\* Nfreq,r  (12.5\* Kr\* Nfreq,r) |
| 0.08 | 0.48\* Kn\* Nfreq,n  (6\* Kn\* Nfreq,n) | 0. 8\* Kn\* Nfreq,n (10\* Nfreq,n) | 0.48\* Kr\* Nfreq,r  (6\* Kr\* Nfreq,r) | 0. 8\* Kr\* Nfreq,r (10\* Kr\* Nfreq,r) |
| 0.128 | 0.64\* Kn\* Nfreq,n  (5\* Kn\* Nfreq,n) | 0. 8\* Kn\* Nfreq,n (6.25\* Nfreq,n) | 0.64\* Kr\* Nfreq,r  (5\* Kr\* Nfreq,r) | 0. 8\* Kr\* Nfreq,r (6.25\* Nfreq,r) |
| 0.128<DRX-cycle≤2.56 | Note (5\* Kn\* Nfreq,n) | Note (5\* Kn\* Nfreq,n) | Note (5\* Kr\* Nfreq,r) | Note (5\* Kr\* Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | | | |

Table 8.1.2.4.1.2-3: Requirement to measure UTRA FDD cells when eDRX\_CONN cycle is used

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_ UTRA\_FDD (s) (eDRX\_CONN cycles) normal requirement | | Tmeasure\_ UTRA\_FDD (s) (eDRX\_CONN cycles) normal requirement | |
|  | Gap period = 40 ms | Gap period = 80 ms | Gap period = 40 ms | Gap period = 80 ms |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\* Kn\* Nfreq,n) | Note (5\* Kn\* Nfreq,n) | Note (5\* Kr\* Nfreq,r) | Note (5\* Kr\* Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | | | |

The measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.

8.1.2.4.1.2.1 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

8.1.2.4.1.2.2 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify,UTRA\_FDD defined in Clause 8.1.2.4.1.2.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify, UTRA\_FDD defined in clause 8.1.2.4.1.2and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasurement\_UTRA\_FDD defined in clause 8.1.2.4.1.2 provided the timing to that cell has not changed more than ± 32 chips while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.4.1.2.3 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.4.1.2.2.

##### 8.1.2.4.2 E-UTRAN TDD – UTRAN FDD measurements

The requirements in clause 8.1.2.4.1 also apply for this section.

8.1.2.4.2.1 E-UTRAN TDD – UTRAN FDD measurements when no DRX is used

8.1.2.4.2.2 E-UTRAN TDD – UTRAN FDD measurements when DRX is used

##### 8.1.2.4.3 E-UTRAN TDD – UTRAN TDD measurements

8.1.2.4.3.1 E-UTRAN TDD – UTRAN TDD measurements when no DRX is used

8.1.2.4.3.1.1 Identification of a new UTRA TDD cell

When explicit neighbour list is provided and no DRX is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the monitored set within

 (normal performance),

and

 (reduced performance)

A cell shall be considered detectable when

- P-CCPCH Ec/Io > -8 dB,

- DwPCH\_Ec/Io > -5 dB.

When L3 filtering is used an additional delay can be expected.

8.1.2.4.3.1.1a Enhanced UTRA TDD cell identification requirements

When explicit neighbour list is provided and no DRX is used or when DRX cycle length ≤ 40 ms, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the monitored set within Tidentify, enhanced\_UTRA\_TDD:

 (normal performance),

and

 (reduced performance)

A cell shall be considered detectable when:

- P-CCPCH\_Ec/Io > -6 dB,

- DwPCH\_Ec/Io > -1 dB

When L3 filtering is used an additional delay can be expected.

8.1.2.4.3.1.2 UE UTRA TDD P-CCPCH RSCP measurement capability

When measurement gaps are scheduled for UTRA TDD inter RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting measurements to higher layers with measurement accuracy as specified in Clause 9.3 with measurement period given by

 (normal performance)

 (reduced performance)

The UE shall be capable of performing UTRA TDD P-CCPCH RSCP measurements for Xbasic measurementUTRA\_TDD inter-frequency cells per TDD frequency of the monitored set, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of TMeasurement\_ UTRA\_TDD.

Xbasic measurementUTRA\_TDD = 6

TMeasurement\_Period UTRA\_TDD = 480 ms is the period used for calculating the measurement period Tmeasurement\_UTRA\_TDD for UTRA TDD P-CCPCH RSCP measurements.

Tbasic\_identify\_UTRA\_TDD = 800 ms is the time period used in the inter RAT equation in clause 8.1.2.4.3.1.1 where the maximum allowed time for the UE to identify a new UTRA TDD cell is defined.

Tbasic\_identify\_enhanced\_UTRA\_TDD  = 80 ms is the time period used in the inter RAT equation in clause 8.1.2.4.3.1.1a where the maximum allowed time for the UE to identify a new UTRA TDD cell is defined.

Tbasic\_measurement\_UTRA\_TDD = 50 ms is the time period used in the equation for defining the measurement period for inter RAT P-CCPCH RSCP measurements.

Nfreq,n, Nfreq,r, Kn and Kr are defined in clause 8.1.2.1.1 and Tinter1 is defined in clause 8.1.2.1

8.1.2.4.3.1.3 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

8.1.2.4.3.1.4 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify, UTRA\_TDD defined in Clause 8.1.2.4.3.1.1 for the minimum requirements or Tidentify, enhanced\_UTRA\_TDD defined in Clause 8.1.2.4.3.1.1a for the enhanced requirements. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify, UTRA\_TDD defined in clause 8.1.2.4.3.1.1 for the minimum requirements and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasurement\_UTRA\_TDD defined in clause 8.1.2.4.3.1.2 provided the timing to that cell has not changed more than ± 10 chips while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.4.3.1.5 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.4.3.1.4.

8.1.2.4.3.2 E-UTRAN TDD – UTRAN TDD measurements when DRX is used

When explicit neighbour list is provided and DRX or eDRX\_CONN is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the neighbour cell list within Tidentify,UTRA\_TDD. When DRX is used, Tidentify,UTRA\_TDD is as defined in table 8.1.2.4.3.2-1, and when eDRX\_CONN is used, Tidentify,UTRA\_TDD is as defined in table 8.1.2.4.3.2-1A.

Table 8.1.2.4.3.2-1: Requirement to identify a newly detectable UTRA TDD cell

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX cycle length (s) | Tidentify\_UTRA\_TDD (s) (DRX cycles) (normal requirement) | | Tidentify\_UTRA\_TDD (s) (DRX cycles) (reduced requirement) | |
| Gap period = 40 ms | Gap period = 80 ms | Gap period = 40 ms | Gap period = 80 ms |
| ≤0.32 | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable |
| 0.32<DRX-cycle≤0.512 | Note (20\*Kn\* Nfreq,n) | Note (25\*Kn \* Nfreq,n) | Note (20\*Kr\* Nfreq,r) | Note (25\*Kr \* Nfreq,r) |
| 0.512<DRX-cycle≤2.56 | Note (20\*Kn \* Nfreq,n) | Note  (20\*Kn \* Nfreq,n) | Note (20\*Kr \* Nfreq,r) | Note  (20\*Kr \* Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | | | |

Table 8.1.2.4.3.2-1A: Requirement to identify a newly detectable UTRA TDD cell when eDRX\_CONN cycle is used

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_UTRA\_TDD (s) (eDRX\_CONN cycles) (normal requirement) | | Tidentify\_UTRA\_TDD (s) (eDRX\_CONN cycles) (reduced requirement) | |
|  | Gap period = 40 ms | Gap period = 80 ms | Gap period = 40 ms | Gap period = 80 ms |
| 2.56<eDRX\_CONN cycle ≤10.24 | Note (20\*Kn \* Nfreq,n) | Note (20\*Kn \* Nfreq,n) | Note (20\*Kr \* Nfreq,r) | Note (20\*Kr \* Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | | | |

A cell shall be considered detectable provided following conditions are fulfilled: A cell shall be considered detectable when

- P-CCPCH Ec/Io > -8 dB,

- DwPCH\_Ec/Io > -5 dB.

When L3 filtering is used an additional delay can be expected.

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing UTRA TDD P-CCPCH RSCP measurements of at least 6 UTRA cells per UTRA TDD carrier for up to 3 UTRA TDD carriers and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period Tmeasure\_UTRA\_TDD, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. UE supporting Increased UE carrier monitoring UTRA shall be capable of performing UTRA TDD P-CCPCH RSCP measurements of at least 6 UTRA cells per UTRA TDD carrier for up to 7 UTRA TDD carriers with maximum of 80 cells consisting of at most 32 cells per frequency layer in the neighbour cell list. When DRX is used, Tmeasure\_UTRA\_TDD is as defined in Table 8.1.2.4.3.2-2, and when eDRX\_CONN is used, Tmeasure\_UTRA\_TDD is as defined in Table 8.1.2.4.3.2-3.

Table 8.1.2.4.3.2-2: Requirement to measure UTRA TDD cells

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX cycle length (s) | Tmeasure\_UTRA\_TDD (s) (DRX cycles) (normal requirement) | | Tmeasure\_UTRA\_TDD (s) (DRX cycles) (reduced requirement) | |
|  | Gap period = 40 ms | Gap period = 80 ms | Gap period = 40 ms | Gap period = 80 ms |
| ≤0.04 | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable |
| 0.064 | 0.48\*Kn\*Nfreq,n (7.5\*Kn \*Nfreq,n) | 0.8\*Kn \*Nfreq,n  (12.5\*Kn \*Nfreq,n) | 0.48\* Kr\* Nfreq,r (7.5\* Kr\* Nfreq,r) | 0.8\* Kr\* Nfreq,r  (12.5\* Kr\* Nfreq,r) |
| 0.08 | 0.48\*Kn \*Nfreq,n (6\*Kn \*Nfreq,n) | 0. 8\*Kn \*Nfreq,n (10\*Kn \*Nfreq,n) | 0.48\* Kr\* Nfreq,r  (6\* Kr\* Nfreq,r) | 0. 8\* Kr\* Nfreq,r (10\* Kr\* Nfreq,r) |
| 0.128 | 0.64\*Kn \*Nfreq,n (5\*Kn \*Nfreq,n) | 0. 8\*Kn \*Nfreq,n (6.25\*Kn \*Nfreq,n) | 0.64\* Kr\* Nfreq,r  (5\* Kr\* Nfreq,r) | 0. 8\* Kr\* Nfreq,r (6.25\* Nfreq,r) |
| 0. 128<DRX-cycle≤2.56 | Note (5\*Kn \*Nfreq,n) | Note (5\*Kn \*Nfreq,n) | Note (5\* Kr\* Nfreq,r) | Note (5\* Kr\* Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | | | |

Table 8.1.2.4.3.2-3: Requirement to measure UTRA TDD cells when eDRX\_CONN cycle is used

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_UTRA\_TDD (s) (eDRX\_CONN cycles) (normal requirement) | | Tmeasure\_UTRA\_TDD (s) (eDRX\_CONN cycles) (reduced requirement) | |
|  | Gap period = 40 ms | Gap period = 80 ms | Gap period = 40 ms | Gap period = 80 ms |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\*Kn \*Nfreq,n) | Note (5\*Kn \*Nfreq,n) | Note (5\* Kr\* Nfreq,r) | Note (5\* Kr\* Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | | | |

The measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.

8.1.2.4.3.2.1 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

8.1.2.4.3.2.2 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify, UTRA\_TDD defined in Clause 8.1.2.4.3.2When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify, UTRA\_TDD defined in clause 8.1.2.4.3.2and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasurement\_UTRA\_TDD defined in clause 8.1.2.4.3.2 provided the timing to that cell has not changed more than ± 10 chips while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.4.3.2.3 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.4.3.2.2.

##### 8.1.2.4.4 E-UTRAN FDD – UTRAN TDD measurements

The requirements in clause 8.1.2.4.3 also apply for this section.

##### 8.1.2.4.5 E-UTRAN FDD – GSM measurements

8.1.2.4.5.1 E-UTRAN FDD – GSM measurements when no DRX is used

The requirements in this clause apply only to UE supporting E-UTRAN FDD and GSM.

Measurements on GSM cells can be requested with BSIC verified.

In RRC\_CONNECTED state when a supported measurement gap pattern sequence according to Table 8.1.2.1-1 is configured by E-UTRAN, or the UE supports capability of conducting such measurements without gaps, the UE shall continuously measure GSM cells, search for new GSM cells given in the monitored set and re-confirm the BSIC for already detected cells.

8.1.2.4.5.1.1 GSM carrier RSSI

This measurement shall be based on measurement gaps allocated for GSM carrier RSSI measurement as described in clause 8.1.2.1. A UE supporting GSM measurements shall measure minimum number of 10 GSM carrier RSSI measurement samples (NGSM carrier RSSI) per measurement gap. In RRC\_CONNECTED state the measurement period, TMeasurement Period, GSM, for the GSM carrier RSSI measurement is Kn\*Nfreq,n \*480 ms. The parameters Nfreq,n and Kn are defined in clause 8.1.2.1.1.

The UE shall meet the measurement accuracy requirements stated for RXLEV in [8], when the given measurement time allows the UE to take at least 3 GSM carrier RSSI samples per GSM carrier in the monitored set during the measurement period.

In case the UE is not able to acquire the required number of samples per GSM carrier during one measurement period, the UE shall measure as many GSM carriers as possible during that measurement period using at least 3 samples per GSM carrier. The GSM carriers that were not measured during that measurement period shall be measured in the following measurement periods.

8.1.2.4.5.1.2 BSIC verification

Measurements on a GSM cell can be requested with BSIC verified. The UE shall be able to report the GSM cells with BSIC verified for those cells where the verification of BSIC has been successful.

The procedure for BSIC verification on a GSM cell can be divided into the following two tasks:

**- Initial BSIC identification:** Includes searching for the BSIC and decoding the BSIC for the first time when there is no knowledge about the relative timing between the E-UTRAN FDD and GSM cells. The UE shall trigger the initial BSIC identification within the available measurement gap pattern sequence. The requirements for BSIC re-confirmation can be found in clause 8.1.2.4.5.1.2.1.

**- BSIC re-confirmation:** Tracking and decoding the BSIC of a GSM cell after initial BSIC identification is performed. The UE shall trigger the BSIC re-confirmation within the available measurement gap pattern. The requirements for BSIC re-confirmation can be found in clause 8.1.2.4.5.1.2.2.

If the network requests measurements on a GSM cell the UE shall behave as follows:

- The UE shall perform GSM carrier RSSI measurements according to clause 8.1.2.4.5.1 when a measurement gap pattern sequence is activated, or the UE supports capability of conducting such measurements without gaps.

The UE shall perform measurement reporting as defined in TS 36.331 [2].

- The UE shall perform BSIC identification. The UE shall use the most recently available GSM carrier RSSI measurement results for arranging GSM cells in signal strength order for performing BSIC identification.

- The UE shall perform BSIC re-confirmation on all the GSM cells that have been successfully identified.

- The UE shall perform all configured event evaluation for event-triggered reporting after the BSIC has been verified for a GSM cell. The UE shall use the most recently available GSM carrier RSSI measurement results in event evaluation and event-triggered reporting.

- Event-triggered and periodic reports shall be triggered according to TS 36.331 [2].

The BSIC of a GSM cell is considered to be “verified” if the UE has decoded the SCH of the BCCH carrier and identified the BSIC at least one time (initial BSIC identification). Once a GSM cell has been identified the BSIC shall be re-confirmed at least once every 8\*Tre-confirm,GSM seconds. Otherwise the BSIC of the GSM cell is considered as "non-verified". If a measurement gap pattern sequence is deactivated by the network after BSIC has been identified or verified, the UE shall consider the BSIC as non-verified.

Tidentify,GSM indicates the maximum time allowed for the UE to decode the unknown BSIC of the GSM cell in one GSM BCCH carrier in the initial BSIC identification procedure.

Tre-confirm,GSM indicates the maximum time allowed for the re-confirmation of the BSIC of one GSM cell in the BSIC re-confirmation procedure.

The UE shall be able to decode a BSIC within a measurement gap when the time difference between the middle of the received GSM synchronisation burst at the UE and the middle of the effective measurement gap is within the limits specified in table 8.1.2.4.5.1.2-1.

Table 8.1.2.4.5.1.2-1: The gap length and maximum time difference for BSIC verification

|  |  |
| --- | --- |
| Gap length  [ms] | Maximum time difference [μs] |
| 6 | ± 2350 µs |

The UE shall be able to perform BSIC verification at levels down to the reference sensitivity level or reference interference levels as specified in [9].

8.1.2.4.5.1.2.1 Initial BSIC identification

This measurement shall be based on the measurement gaps used for Initial BSIC identification as described in clause 8.1.2.4.5.1.2.

The UE shall continuously attempt to decode the BSIC of SCH on the BCCH carrier of the 8 strongest BCCH carriers of the GSM cells indicated in the Inter-RAT cell info list. The UE shall give priority for BSIC decoding attempts in decreasing signal strength order to BCCH carriers with unknown BSIC. The strongest BCCH carrier is defined as the BCCH carrier having the highest measured GSM carrier RSSI value.

If the BSIC of the GSM BCCH carrier has been successfully decoded the UE shall immediately continue BSIC identification with the next GSM BCCH carrier, in signal strength order, with unknown BSIC. The GSM cell for which the BSIC has been successfully identified shall be moved to the BSIC re-confirmation procedure.

If the UE has not successfully decoded the BSIC of the GSM BCCH carrier within Tidentify,GSM ms, the UE shall abort the BSIC identification attempts for that GSM BCCH carrier. The UE shall continue to try to perform BSIC identification of the next GSM BCCH carrier in signal strength order. The GSM BCCH carrier for which the BSIC identification failed shall not be re-considered for BSIC identification until BSIC identification attempts have been made for all the rest of the 8 strongest GSM BCCH carriers in the monitored set with unknown BSIC.

Tidentify,GSM values are given for a set of reference gap patterns in table 8.1.2.4.5.1.2.1-1. The requirements in the table represent the time required to guarantee at least two attempts to decode the BSIC for one GSM BCCH carrier. If inter-frequency RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, then Tidentify,GSM shall be based on the 80ms gap configuration.

Table 8.1.2.4.5.1.2.1-1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ceil(Nfreq,n \* Kn –Mgsm) | Tidentify,gsm(ms) | | Treconfirm,gsm(ms) | |
| 40ms gap configuration (ID 0) | 80ms gap configuration (ID 1) | 40ms gap configuration (ID 0) | 80ms gap configuration (ID 1) |
| 0 | 2160 | 5280 | 1920 | 5040 |
| 1 | 5280 | 21760 | 5040 | 17280 |
| 2 | 5280 | 31680 | 5040 | 29280 |
| 3 | 19440 | No requirement | 13320 | No requirement |
| 4 | 31680 | No requirement | 29280 | No requirement |
| 5 | 31680 | No requirement | 29280 | No requirement |

8.1.2.4.5.1.2.2 BSIC re-confirmation

The UE shall maintain the timing information of up to 8 identified GSM cells. Initial timing information is obtained from the initial BSIC identification. The timing information shall be updated every time the BSIC is decoded.

For each measurement gap used for GSM BSIC reconfirmation as described in clause 8.1.2.4.5.1.2, the UE shall attempt to decode the BSIC falling within the measurement gap according to table 8.1.2.4.5.1.2.1-1. If more than one BSIC can be decoded within the same measurement gap, priority shall be given to the least recently decoded BSIC. If inter-frequency RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, then Tre-confirm,GSM shall be based on the 80ms gap configuration.

If the UE fails to decode the BSIC after two successive attempts or if the UE has not been able to re-confirm the BSIC for a GSM cell within Tre-confirm,GSM seconds, the UE shall abort the BSIC re-confirmation attempts for that GSM cell. The GSM cell shall be treated as a new GSM cell with unidentified BSIC and the GSM cell shall be moved to the initial BSIC identification procedure, see clause 8.1.2.4.5.1.2.1.

8.1.2.4.5.1.2a Enhanced BSIC verification

In addition to the BSIC verification requirements in clause 8.1.2.4.5.1.2, when the UE receives the GSM cell at levels down to 10 dB + the reference sensitivity level or reference interference levels as specified in [9] the BSIC identification requirement in table 8.1.2.4.5.1.2a-1 applies. The BSIC verification requirements in table 8.1.2.4.5.1.2a-1 shall apply when no DRX is used or when DRX cycle length ≤ 40 ms.

Table 8.1.2.4.5.1.2a-1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ceil(Nfreq,n \* Kn –Mgsm) | Tenhanced\_identify,gsm(ms) | | Tenhanced\_reconfirm,gsm(ms) | |
| 40ms gap configuration (ID 0) | 40ms gap configuration when interfrequency RSTD measurement is also configured and the UE requires measurement gaps for performing such measurements | 40ms gap configuration (ID 0) | 40ms gap configuration when interfrequency RSTD measurement is also configured and the UE requires measurement gaps for performing such measurements |
| 0 | 1320 | 2160 | 1080 | 1920 |

8.1.2.4.5.1.3 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

8.1.2.4.5.1.4 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH.

The event triggered reporting delay requirement is valid when the UE for each GSM carrier in the monitored set can take the required number of samples during the measurement period TMeasurement Period, GSM (see clause 8.1.2.4.5.1).

The event triggered measurement reporting delay for a GSM cell with verified BSIC , measured without L3 filtering shall be less than 2\*TMeasurement Period, GSM, where TMeasurement Period, GSM is defined in clause 8.1.2.4.5.1. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.4.5.1.5 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.4.5.1.4.

8.1.2.4.5.2 E-UTRAN FDD – GSM measurements when DRX is used

The requirements in this clause apply only to UE supporting E-UTRAN FDD and GSM.

Measurements on GSM cells can be requested with BSIC verified.

In RRC\_CONNECTED state when a supported measurement gap pattern sequence according to Table 8.1.2.1-1 is configured by E-UTRAN, or the UE supports capability of conducting such measurements without gaps, the UE shall continuously measure GSM cells, search for new GSM cells given in the monitored set and re-confirm the BSIC for already detected cells. During DRX or eDRX\_CONN periods the UE may use other periods of time outside the specified measurement gap patterns. The UE is not required to make measurements of GSM cells during DRX or eDRX\_CONN periods if a measurement gap pattern has not been configured, unless the UE supports capability of conducting such measurements without gaps.

8.1.2.4.5.2.1 GSM carrier RSSI

This measurement shall be based on measurement gaps allocated for GSM carrier RSSI measurement as described in clause 8.1.2.1. A UE supporting GSM measurements shall measure minimum number of 10 GSM carrier RSSI measurement samples (NGSM carrier RSSI) per DRX or eDRX\_CONN cycle. When DRX is used in RRC\_CONNECTED state, the measurement period, TMeasurement Period, GSM, for the GSM carrier RSSI measurement is shown in table 8.1.2.4.5.2.1-1. When eDRX\_CONN is used in RRC\_CONNECTED state, the measurement period, TMeasurement Period, GSM, for the GSM carrier RSSI measurement is shown in table 8.1.2.4.5.2.1-2. The parameters Nfreq,n and Kn are defined in clause 8.1.2.1.1.

Table 8.1.2.4.5.2.1-1: GSM measurement period for large DRX

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure,GSM (s) (DRX cycles) |
| ≤0.064 | Non DRX Requirements are applicable |
| 0.064<DRX-cycle≤ 0.08 | Note (6\*Kn\*Nfreq,n) |
| 0.08<DRX-cycle≤ 2.56 | Note (5\*Kn\*Nfreq,n) |
| Note: Time depends upon the DRX cycle in use | |

Table 8.1.2.4.5.2.1-2: GSM measurement period for large DRX when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure,GSM (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\*Kn\*Nfreq,n) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The UE shall meet the measurement accuracy requirements stated for RXLEV in [8], when the given measurement time allows the UE to take at least 3 GSM carrier RSSI samples per GSM carrier in the monitored set during the measurement period.

In case the UE is not able to acquire the required number of samples per GSM carrier during one measurement period, the UE shall measure as many GSM carriers as possible during that measurement period using at least 3 samples per GSM carrier. The GSM carriers that were not measured during that measurement period shall be measured in the following measurement periods.

8.1.2.4.5.2.2 BSIC verification

Measurements on a GSM cell can be requested with BSIC verified. The UE shall be able to report the GSM cells with BSIC verified for those cells where the verification of BSIC has been successful.

The procedure for BSIC verification on a GSM cell can be divided into the following two tasks:

**- Initial BSIC identification:** Includes searching for the BSIC and decoding the BSIC for the first time when there is no knowledge about the relative timing between the E-UTRAN FDD and GSM cells.

**- BSIC re-confirmation:** Tracking and decoding the BSIC of a GSM cell after initial BSIC identification is performed. The UE shall trigger the BSIC re-confirmation within the available measurement gap pattern

If the network requests measurements on a GSM cell, the UE shall behave as follows:

- The UE shall perform GSM carrier RSSI measurements according to clause 8.1.2.4.5.2.1 when a measurement gap pattern sequence is activated, or the UE supports capability of conducting such measurements without gaps.

The UE shall perform measurement reporting as defined in TS 36.331 [2].

- The UE shall perform BSIC identification. The UE shall use the most recently available GSM carrier RSSI measurement results for arranging GSM cells in signal strength order for performing BSIC identification.

- The UE shall perform BSIC re-confirmation on all the GSM cells that have been successfully identified.

- The UE shall perform all configured event evaluation for event-triggered reporting after the BSIC has been verified for a GSM cell. The UE shall use the most recently available GSM carrier RSSI measurement results in event evaluation and event-triggered reporting.

- Event-triggered and periodic reports shall be triggered according to TS 36.331 [2].

The BSIC of a GSM cell is considered to be “verified” if the UE has decoded the SCH of the BCCH carrier and identified the BSIC at least one time (initial BSIC identification). Once a GSM cell has been identified the BSIC shall be re-confirmed at least once every 30 seconds. Otherwise the BSIC of the GSM cell is considered as "non-verified".

The UE shall be able to perform BSIC verification at levels down to the reference sensitivity level or reference interference levels as specified in [9].

8.1.2.4.5.2.2.1 Initial BSIC identification

This measurement shall be made on GSM cells that are requested with BSIC verified.

For DRX cycle length ≤ 40 ms, the initial GSM BSIC identification requirements corresponding to the non DRX requirements as specified in clause 8.1.2.4.5.1.2.1 shall apply.

For DRX cycle length > 40 ms and any eDRX\_CONN cycle, the UE shall make at least one attempt every Kn\*Nfreq,n \*30s to decode the BSIC of SCH on the BCCH carrier of the 8 strongest BCCH carriers of the GSM cells indicated in the Inter-RAT cell info list. If the UE has not successfully decoded the BSIC of the GSM BCCH carrier within Kn\*Nfreq,n \*60 s, the UE shall abort the BSIC identification attempts for that GSM BCCH carrier. The UE shall give priority for BSIC decoding attempts in decreasing signal strength order to BCCH carriers with unknown BSIC. The strongest BCCH carrier is defined as the BCCH carrier having the highest measured GSM carrier RSSI value. The parameters Nfreq,n and Kn are defined in clause 8.1.2.1.1.

If the BSIC of the GSM BCCH carrier has been successfully decoded the UE shall continue BSIC identification with the next GSM BCCH carrier, in signal strength order, with unknown BSIC. The GSM cell for which the BSIC has been successfully identified shall be moved to the BSIC re-confirmation procedure.

8.1.2.4.5.2.2.2 BSIC re-confirmation

The UE shall maintain the timing information of up to 8 identified GSM cells. Initial timing information is obtained from the initial BSIC identification. The timing information shall be updated every time the BSIC is decoded.

For DRX cycle length ≤ 40 ms, the GSM BSIC re-conformation requirements corresponding to the non DRX requirements as specified in clause 8.1.2.4.5.1.2.2 shall apply.

For DRX cycle length > 40 ms and any eDRX\_CONN cycle, at least every Kn\*Nfreq,n \*30 seconds, the UE shall attempt to decode the BSIC of each identified GSM cell.If the UE fails to decode the BSIC after two successive attempts or if the UE has not been able to re-confirm the BSIC for a GSM cell within Kn\*Nfreq,n \*60 seconds, the UE shall abort the BSIC re-confirmation attempts for that GSM cell. The GSM cell shall be treated as a new GSM cell with unidentified BSIC and the GSM cell shall be moved to the initial BSIC identification procedure, see clause 8.1.2.4.5.2.2.1. The parameters Nfreq,n and kn are defined in clause 8.1.2.1.1.

8.1.2.4.5.2.3 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

8.1.2.4.5.2.4 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH.

The event triggered reporting delay requirement is valid when the UE for each GSM carrier in the monitored set can take the required number of samples during the measurement period TMeasurement Period, GSM (see clause 8.1.2.4.5.2.1).

The event triggered measurement reporting delay for a GSM cell with verified BSIC , measured without L3 filtering shall be less than 2\*TMeasurement Period, GSM, where TMeasurement Period, GSM is defined in clause 8.1.2.4.5.2.1. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.4.5.2.5 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.4.5.2.4.

##### 8.1.2.4.6 E-UTRAN TDD – GSM measurements

The requirements in clause 8.1.2.4.5 also apply for this section.

##### 8.1.2.4.7 E-UTRAN FDD – UTRAN FDD measurements for SON

8.1.2.4.7.1 Identification of a new UTRA FDD cell for SON

No explicit neighbour list is provided to the UE for identifying a UTRA cell for SON. The UE shall identify and report only the strongest cell when requested by the network for the purpose of SON.

8.1.2.4.7.1.1 Requirements when no DRX is used

When no DRX is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new cell within:

 (normal performance)

and

(reduced performance)

Tbasic\_identify\_UTRA\_FDD  = 300 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new UTRA FDD cell is defined.

A cell shall be considered identifiable following conditions are fulfilled:

- CPICH Ec/Io > -20 dB,

- SCH\_Ec/Io > -17 dB for at least one channel tap and SCH\_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.

If the UE is unable to identify the UTRA cell for SON within 8\*Tidentify, UTRA\_FDD ms, the UE may stop searching UTRA cells for SON.

8.1.2.4.7.1.2 Requirements when DRX is used

When DRX or eDRX\_CONN is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new cell within Tidentify, UTRA\_FDD. When DRX is used, Tidentify, UTRA\_FDD is as defined in table 8.1.2.4.7.1.2-1, and when eDRX\_CONN is used, Tidentify, UTRA\_FDD is as defined in table 8.1.2.4.7.1.2-2.

Table 8.1.2.4.7.1.2-1: Requirement to identify a new UTRA FDD cell for SON

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX cycle length (s) | Tidentify, UTRA\_FDD (s) (DRX cycles) (normal requirement) | | Tidentify, UTRA\_FDD (s) (DRX cycles) (reduced requirement) | |
|  | **Gap period = 40 ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| ≤0.04 | Non DRX Requirements in clause 8.1.2.4.7.1.1are applicable | Non DRX Requirements in clause 8.1.2.4.7.1.1 are applicable | Non DRX Requirements in clause 8.1.2.4.7.1.1are applicable | Non DRX Requirements in clause 8.1.2.4.7.1.1 are applicable |
| 0.04<DRX cycle≤0.08 | Note (45\*Kn\* Nfreq,n) | Note (95\*Kn \* Nfreq,n) | Note (45\*Kr\* Nfreq,r) | Note (95\*Kr \* Nfreq,r) |
| 0.128 | 3.84\*Kn \* Nfreq,n (30\*Kn \* Nfreq,n) | 8.0\*Kn \* Nfreq,n (62.5\*Kn \* Nfreq,n) | 3.84\*Kr \* Nfreq,r (30\*Kr \* Nfreq,r) | 8.0\*Kr \* Nfreq,r (62.5\*Kr \* Nfreq,r) |
| 0.16 | 4.0\*Kn \* Nfreq,n (25\*Kn \* Nfreq,n) | 8.0\*Kn \* Nfreq,n (50\*Kn \* Nfreq,n) | 4.0\*Kr \* Nfreq,r (25\*Kr \* Nfreq,r) | 8.0\*Kr \* Nfreq,r (50\*Kr \* Nfreq,r) |
| 0.256 | 6.4\*Kn \* Nfreq,n (25\*Kn \* Nfreq,n) | 8.96\*Kn \* Nfreq,n (35\*Kn \* Nfreq,n) | 6.4\*Kr \* Nfreq,r (25\*Kr \* Nfreq,r) | 8.96\*Kr \* Nfreq,r (35\*Kr \* Nfreq,r) |
| 0.32 | 8\*Kn \* Nfreq,n (25\*Kn \* Nfreq,n) | 8.96\*Kn \* Nfreq,n (28\*Kn \* Nfreq,n) | 8\*Kr \* Nfreq,r (25\*Kr \* Nfreq,r) | 8.96\*Kr \* Nfreq,r (28\*Kr \* Nfreq,r) |
| 0.32<DRX cycle≤2.56 | Note(25\*Kn \* Nfreq,n) | Note (25\*Kn \* Nfreq,n) | Note(25\*Kr \* Nfreq,r) | Note (25\*Kr \* Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | |  |  |

Table 8.1.2.4.7.1.2-2: Requirement to identify a new UTRA FDD cell for SON when eDRX\_CONN cycle is used

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify, UTRA\_FDD (s) (eDRX\_CONN cycles) (normal requirement) | | Tidentify, UTRA\_FDD (s) (eDRX\_CONN cycles) (reduced requirement) | |
|  | **Gap period = 40 ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note(25\*Kn \* Nfreq,n) | Note (25\*Kn \* Nfreq,n) | Note(25\*Kr \* Nfreq,r) | Note (25\*Kr \* Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | | | |

A cell shall be considered identifiable provided following conditions are fulfilled:

- CPICH Ec/Io > -20 dB,

- SCH\_Ec/Io > -17 dB for at least one channel tap and SCH\_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.

If the UE is unable to identify the UTRA cell for SON within 8\*Tidentify, UTRA\_FDD seconds, the UE may stop searching UTRA cells for SON; when DRX is used Tidentify, UTRA\_FDD is defined in table 8.1.2.4.7.1.2-1, and when eDRX\_CONN is used Tidentify, UTRA\_FDD is defined in table 8.1.2.4.7.1.2-2.

8.1.2.4.7.1.3 Reporting Delay

The UE shall not report the physical cell identity of an identifiable cell for SON as long as the reporting criteria are not fulfilled.

The reporting delay is defined as the time between the identification of the strongest cell for SON until the UE starts to transmit its physical cell identity over the Uu interface. This requirement assumes that the reporting of the physical cell identity is not delayed by other RRC signalling on the DCCH. This reporting delay excludes a delay uncertainty resulted when inserting the physical cell identity of the strongest cell for SON to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This reporting delay excludes any delay caused by unavailability of UL resources for UE sending the physical cell identity of the strongest cell for SON.

The reporting delay of the physical cell identity of the strongest cell for SON without L3 filtering shall be less than Tidentify, UTRA\_FDD defined in clause 8.1.2.4.7.1.1 and in clause 8.1.2.4.7.1.2 for non DRX and DRX or eDRX\_CONN cases respectively. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.1.2.4.8 E-UTRAN TDD – UTRAN FDD measurements for SON

The requirements in clause 8.1.2.4.7 also apply for this section.

##### 8.1.2.4.9 E-UTRAN FDD – cdma2000 1xRTT measurements

UE shall perform cdma2000 1xRTT measurements according to the procedure defined in [15] on the cdma2000 1xRTT neighbor cells indicated by the serving eNode B. If measurement gaps are required, the UE shall perform cdma2000 1xRTT measurements only during the measurement gaps configured by the serving eNode B.

##### 8.1.2.4.9.1A E-UTRAN FDD – cdma2000 1xRTT measurements when no DRX is used

When measurement gaps are scheduled for CDMA2000 1xRTT inter RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting CDMA2000 1xRTT Pilot Strength measurements to higher layers with measurement accuracy as specified in Clause 9.5, corresponding to a 90% measurement success rate, with measurement period given by



where Tbasic\_measurement\_CDMA2000\_1x = 100 ms and the measurement gap specific scale factor Sgap is based on the measurement gap pattern in use as defined in Table 8.1.2.4.9.1-1. If inter-frequency RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, then Sgap shall be based to the Gap Pattern Id 1.

Table 8.1.2.4.9.1-1: Gap Pattern Specific Scale Factor

|  |  |
| --- | --- |
| Gap Pattern Id | Sgap |
| 0 | 32/3 |
| 1 | 64/3 |

8.1.2.4.9.1 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

The measurement reporting delay of each periodic report is defined as the time between the end of the last measurement period and the moment when the UE starts to transmit the measurement report over the Uu interface. This delay shall be less than T71m defined in [15] for each periodic report. This measurement reporting delay excludes a delay which is caused by the unavailability of the uplink resources for the UE to send the measurement report.

##### 8.1.2.4.10 E-UTRAN TDD – cdma2000 1xRTT measurements

The requirements in clause 8.1.2.4.9 also apply for this section.

##### 8.1.2.4.11 E-UTRAN FDD – HRPD measurements

UE shall perform HRPD measurements according to the procedure defined in [11] on the HRPD neighbor cells indicated by the serving eNode B. If measurement gaps are required, the UE shall perform HRPD measurements only during the measurement gaps configured by the serving eNode B.

##### 8.1.2.4.12 E-UTRAN TDD – HRPD measurements

The requirements in clause 8.1.2.4.11 also apply for this section.

##### 8.1.2.4.13 E-UTRAN TDD – UTRAN TDD measurements for SON

8.1.2.4.13.1 Identification of a new UTRA TDD cell for SON

No explicit neighbour list is provided to the UE for identifying a UTRA TDD cell for SON. The UE shall identify and report only the strongest cell when requested by the network for the purpose of SON.

8.1.2.4.13.1.1 Requirements when no DRX is used

When no DRX is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new cell within:

 (normal performance)

and

 (reduced performance)

Tbasic\_identify\_UTRA\_TDD  = 800 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new UTRA TDD cell is defined.

A cell shall be considered identifiable following conditions are fulfilled:

- P-CCPCH Ec/Io > -8 dB,

- DwPCH\_Ec/Io > -5 dB.

When L3 filtering is used an additional delay can be expected.

If the UE is unable to identify the UTRA TDD cell for SON within 8\*Tidentify, UTRA\_TDD ms, the UE may stop searching UTRA TDD cells for SON.

8.1.2.4.13.1.2 Requirements when DRX is used

When DRX or eDRX\_CONN is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new cell within Tidentify, UTRA\_TDD. When DRX is used, Tidentify, UTRA\_TDD is as defined in table 8.1.2.4.13.1.2-1, and when eDRX\_CONN is used, Tidentify, UTRA\_TDD is as defined in table 8.1.2.4.13.1.2-2.

Table 8.1.2.4.13.1.2-1: Requirement to identify a new UTRA TDD cell for SON

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX cycle length (s) | Tidentify, UTRA\_TDD (s) (DRX cycles) | | Tidentify, UTRA\_TDD (s) (DRX cycles) | Tidentify, UTRA\_TDD (s) (DRX cycles) |
|  | **Gap period = 40 ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| ≤0.16 | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable |
| 0.16<DRX cycle≤0.256 | Note (25\*Kn\* Nfreq,n) | Note (50\*Kn \* Nfreq,n) | Note (25\*Kr\* Nfreq,r) | Note (50\*Kr \* Nfreq,r) |
| 0.256<DRX cycle≤0.32 | Note (25\*Kn \* Nfreq,n) | Note (45\*Kn \* Nfreq,n) | Note (25\*Kr \* Nfreq,r) | Note (45\*Kr \* Nfreq,r) |
| 0.32<DRX cycle≤2.56 | Note(25\*Kn \* Nfreq,n) | Note (25\*Kn \* Nfreq,n) | Note(25\*Kr \* Nfreq,r) | Note (25\*Kr \* Nfreq,r) |
| Note: Time depends upon the DRX cycle in use | | | | |

Table 8.1.2.4.13.1.2-2: Requirement to identify a new UTRA TDD cell for SON when eDRX\_CONN cycle is used

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify, UTRA\_TDD (s) (eDRX\_CONN cycles) | | Tidentify, UTRA\_TDD (s) (eDRX\_CONN cycles) | |
|  | **Gap period = 40 ms** | **Gap period = 80 ms** | **Gap period = 40 ms** | **Gap period = 80 ms** |
| 2.56<eDRX\_CONN cycle≤10.24 | Note(25\*Kn \* Nfreq,n) | Note (25\*Kn \* Nfreq,n) | Note(25\*Kr \* Nfreq,r) | Note (25\*Kr \* Nfreq,r) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | | | |

A cell shall be considered identifiable provided following conditions are fulfilled:

- P-CCPCH Ec/Io > -8 dB,

- DwPCH\_Ec/Io > -5 dB.

When L3 filtering is used an additional delay can be expected.

If the UE is unable to identify the UTRA TDD cell for SON within 8\*Tidentify, UTRA\_TDD seconds, the UE may stop searching UTRA TDD cells for SON; when DRX is used Tidentify, UTRA\_TDD is defined in table 8.1.2.4.13.1.2-1, and when eDRX\_CONN is used Tidentify, UTRA\_TDD is defined in table 8.1.2.4.13.1.2-2.

8.1.2.4.13.1.3 Reporting Delay

The UE shall not report the physical cell identity of an identifiable cell for SON as long as the reporting criteria are not fulfilled.

The reporting delay is defined as the time between the identification of the strongest cell for SON until the UE starts to transmit its physical cell identity over the Uu interface. This requirement assumes that the reporting of the physical cell identity is not delayed by other RRC signalling on the DCCH. This reporting delay excludes a delay uncertainty resulted when inserting the physical cell identity of the strongest cell for SON to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This reporting delay excludes any delay caused by unavailability of UL resources for UE sending the physical cell identity of the strongest cell for SON.

The reporting delay of the physical cell identity of the strongest cell for SON without L3 filtering shall be less than Tidentify, UTRA\_TDD defined in clause 8.1.2.4.13.1.1 and in clause 8.1.2.4.13.1.2 for non DRX and DRX and eDRX\_CONN cases respectively. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.1.2.4.14 E-UTRAN FDD – UTRAN TDD measurements for SON

The requirements in clause 8.1.2.4.13 also apply for this section.

##### 8.1.2.4.15 E-UTRAN FDD – cdma2000 1xRTT measurements for SON ANR

8.1.2.4.15.1 Identification of a new cdma2000 1xRTT cell for SON ANR

No explicit neighbour list is provided to the UE for identifying a cdma2000 1xRTT cell for SON ANR. The UE shall identify and report only the strongest cell when requested by the network for the purpose of SON ANR.

8.1.2.4.15.1.1 Requirement when no DRX is used

When measurement gaps are scheduled for CDMA2000 1xRTT inter RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting CDMA2000 1xRTT Pilot Strength measurements to higher layers with measurement accuracy as specified in Clause 9.5, corresponding to a 90% measurement success rate, with measurement period given by



where Tbasic\_measurement\_CDMA2000\_1x = 100 ms and the measurement gap specific scale factor Sgap is based on the measurement gap pattern in use as defined in Table 8.1.2.4.15.1.1-1. If inter-frequency RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, then Sgap shall be based to the Gap Pattern Id 1.

Table 8.1.2.4.15.1.1-1: Gap Pattern Specific Scale Factor

|  |  |
| --- | --- |
| Gap Pattern Id | Sgap |
| 0 | 32/3 |
| 1 | 64/3 |

If the UE is unable to identify the CDMA2000 1xRTT cell for SON ANR, the UE may stop searching CDMA2000 1xRTT cells for SON ANR. The time after which the UE may stop searching is up to UE implementation.

8.1.2.4.15.1.2 Reporting Delay

The UE shall not report the physical cell identity of an identifiable cell for SON ANR as long as the reporting criteria are not fulfilled.

The reporting delay is defined as the time between the identification of the strongest cell for SON ANR until the UE starts to transmit its physical cell identity over the Uu interface. This delay shall be less than T71m defined in [15]. This measurement reporting delay excludes a delay which is caused by the unavailability of the uplink resources for the UE to send the measurement report.

##### 8.1.2.4.16 E-UTRAN TDD – cdma2000 1xRTT measurements for SON ANR

The requirements in clause 8.1.2.4.15 also apply for this section.

##### 8.1.2.4.17 E-UTRAN FDD-UTRAN FDD measurements with autonomous gaps

The requirements in this clause apply only to UE supporting E-UTRA FDD and UTRA FDD.

8.1.2.4.17.1 Identification of a new CGI of UTRA FDD cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of UTRA FDD cell. The UE shall identify and report the CGI when requested by the network for the purpose of ‘reportCGI’. The UE may make autonomous gaps in both downlink reception and uplink transmission for decoding SFN and receiving UTRAN MIB and SIB3 messages according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, the UE shall be able to identify a new CGI of UTRA FDD cell within:

Tidentify\_CGI, UTRAN FDD = 630 + 40\*SIB3\_REP ms

where SIB3\_REP is the repetition period at which the UTRAN cell schedules SIB3 blocks in units of frames specified in TS 25.331 [7] , provided that the UTRAN cell has been already identified by the UE.

This requirement is applicable for UTRA FDD target cell configurations where the information required to make the SI report can be determined from the MIB and SIB3 alone, and MIB and SIB3 are not segmented into multiple TTIs. Additionally, for the requirement to be applicable, the reception conditions shall be such that the system frame number of the target UTRA FDD cell, the MIB and SIB3 can each be successfully decoded in no more than four attempts.

According to the reception conditions:

A cell shall be considered identifiable following conditions are fulfilled:

- CPICH Ec/Io > -20 dB,

- SCH\_Ec/Io > -17 dB for at least one channel tap and SCH\_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.The system frame number, the MIB and SIB3 of the target cell shall be considered decodable provided the BCH demodulation requirements are met according to [29].

The requirement for identifying a new CGI of an UTRA FDD cell within Tidentify\_CGI, UTRAN FDD is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in TS 36.331 [2] is used.

The UE capable of SRS carrier based switching when configured to perform SRS transmission and/or PRACH transmission over one or more SCells without PUSCH shall meet the requirements defined in Section 8.1.2.4.17.1 provided the following condition is met:

- all MIB/SIB3/SCH specified in Section 8.1.2.4.17.1 are available for CGI reading at the UE in the measured cell.

Otherwise the time to acquire the new CGI of the UTRA FDD cell may be extended.

8.1.2.4.17.2 CGI Reporting Delay

The CGI reporting delay occurs due to the delay uncertainty when inserting the CGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. In case DRX is used, the CGI reporting may be delayed until the next DRX cycle. In case eDRX is used, the CGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

##### 8.1.2.4.18 E-UTRAN TDD-UTRAN FDD measurements with autonomous gaps

The requirements in this clause apply only to UE supporting E-UTRA TDD and UTRA FDD.

8.1.2.4.18.1 Identification of a new CGI of UTRA FDD cell with autonomous gaps

The requirements in clause 8.1.2.4.17.1 also apply for this section.

8.1.2.4.18.2 CGI Reporting Delay

The requirements in clause 8.1.2.4.17.2 also apply for this section.

##### 8.1.2.4.19 E-UTRAN FDD – WLAN measurements

8.1.2.4.19.1 Introduction

The requirements in this section shall apply for a UE capable of E-UTRA FDD and LTE-WLAN Aggregation [2].

8.1.2.4.19.2 Requirements

8.1.2.4.19.2.1 E-UTRAN FDD – WLAN measurements when no DRX is used

In the RRC\_CONNECTED state when no DRX is used the measurement period for WLAN RSSI shall be TWLAN\_RSSI as defined in table 8.1.2.4.19.2.1-1.

The value of TWLAN\_RSSI depends upon whether the WLAN RSSI measurement is performed on the serving access point (AP) or on a neighbour AP and in case of the neighbour AP whether the neighbour AP is known or unknown to the UE:

- Measurement of known single neighbor AP is time-sensitive and is performed on the AP for which information about the operating channel is known to the UE; and

- - Measurement of unknown neighbor AP is not time-sensitive and is performed on the AP for which information about the operating channel is not known to the UE.

The UE shall be capable of performing WLAN RSSI measurements for certain minimum number of APs during TWLAN\_RSSI as defined in table 8.1.2.4.19.2.1-1 provided that the beacon frame of the measured AP is available at the UE at least once every 102.4 ms. The UE physical layer shall be capable of reporting WLAN RSSI measurements to higher layers with the measurement period of TWLAN\_RSSI.

Table 8.1.2.4.19.2.1-1: WLAN RSSI measurement period

|  |  |  |
| --- | --- | --- |
| WLAN RSSI measurement configuration | | TWLAN\_RSSI [seconds] |
| Type of Measurement | Minimum number of APs measured during TWLAN\_RSSI |
| Measurement of serving AP | 1 | 0.5 |
| Measurement of known neighbor AP on a single channel | 1 | 5 |
| Measurement of multiple unknown neighbor APs | 3 | 30 |

The WLAN RSSI measurement accuracy for all measured access points shall be fulfilled according to the accuracy as specified in the sub-clause 9.7.1.

8.1.2.4.19.2.2 E-UTRAN FDD – WLAN measurements when DRX is used

In the RRC\_CONNECTED state when DRX is used the measurement period for WLAN RSSI shall be TRSSI\_DRX as defined in table 8.1.2.4.19.2.2-1.

The value of TWLAN\_RSSI\_DRX depends upon whether the WLAN RSSI measurement is performed on the serving access point (AP) or on a neighbour AP and in case of the neighbour AP whether the neighbour AP is known or unknown to the UE:

- Measurement of known single neighbor AP is time-sensitive and is performed on the AP for which information about the operating channel is known to the UE; and

- Measurement of unknown neighbor AP is not time-sensitive and is performed on the AP for which information about the operating channel is not known to the UE

The UE shall be capable of performing WLAN RSSI measurements for certain minimum number of APs during TWLAN\_RSSI\_DRX as defined in table 8.1.2.4.19.2.2-1 provided that the beacon frame of the measured AP is available at the UE at least once every 102.4 ms. The UE physical layer shall be capable of reporting WLAN RSSI measurements to higher layers with the measurement period of TWLAN\_RSSI\_DRX.

Table 8.1.2.4.19.2.2-1: Requirement to measure WLAN RSSI in DRX

|  |  |  |  |
| --- | --- | --- | --- |
| WLAN RSSI measurement configuration | | DRX cycle length (s) | TWLAN\_RSSI\_DRX (s) |
| Type of Measurement | Minimum number of APs measured during TWLAN\_RSSI |
| Measurement of serving AP | 1 | 0.002 ≤ DRX-cycle ≤ 0.320 | MAX (0.5, 5\*LDRX) |
| Measurement of one known neighbor AP on a single channel | 1 | 0.002 ≤ DRX-cycle ≤ 0.320 | MAX (5, 25\*LDRX) |
| 0.320 < DRX-cycle ≤ 2.56 | MAX (5, 20\*LDRX) |
| Measurement of 3 unknown neighbor APs | 3 | 0.002 ≤ DRX-cycle ≤ 0.320 | MAX (30, 150\*LDRX) |
| 0.320 < DRX-cycle ≤ 2.56 | MAX (30, 120\*LDRX) |
| Note 1: LDRX is the length of DRX cycle in second(s) | | | |

The WLAN RSSI measurement accuracy for all measured access points shall be fulfilled according to the accuracy as specified in the sub-clause 9.7.1.

8.1.2.4.19.2.3 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.7.1.

8.1.2.4.19.2.4 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.7.1.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than TWLAN\_RSSI when no DRX is used as defined in section 8.1.2.4.19.2.1 and TWLAN\_RSSI\_DRX when DRX is used as defined in section 8.1.2.4.19.2.2. When L3 filtering is used or IDC autonomous denial or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching,an additional delay can be expected.

8.1.2.4.19.2.5 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.7.1.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.4.19.2.3.

##### 8.1.2.4.20 E-UTRAN TDD – WLAN measurements

The requirements in this section shall apply for a UE capable of E-UTRA TDD and LTE-WLAN Aggregation [2].

The requirements in clause 8.1.2.4.19 also apply for this section.

##### 8.1.2.4.21 E-UTRAN FDD – NR measurements

Requirements in this clause shall apply for NR capable UE when not configured with EN-DC.

The UE shall be able to identify new inter-RAT E-UTRAN FDD - NR cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified inter-RAT cells if carrier frequency information is provided by the PCell, even if no explicit neighbour list with physical layer cell identities is provided.

8.1.2.4.21.1 E-UTRAN FDD – NR measurements

8.1.2.4.21.1.1 Identification of a new NR cell

When measurement gaps are scheduled, the UE shall be able to identify a new detectable cell within Tidentify\_irat\_without\_index if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise, UE shall be able to identify a new detectable inter-RAT cell within Tidentify\_irat\_with\_index. The UE shall be able to identify a new detectable inter-RAT SS block of an already detected cell within Tidentify\_irat\_without\_index.

Tidentify\_irat\_without\_index = (TPSS/SSS\_sync\_irat + T SSB\_measurement\_period\_irat) ms

Tidentify\_irat\_with\_index = (TPSS/SSS\_sync\_irat + T SSB\_measurement\_period\_irat + TSSB\_time\_index\_irat) ms

Where:

TPSS/SSS\_sync\_irat: it is the time period used in PSS/SSS detection given in table 8.1.2.4.21.1.1-1, 8.1.2.4.21.1.1-1A and table 8.1.2.4.21.1.1-2.

TSSB\_time\_index\_irat: it is the time period used to acquire the index of the SSB being measured given in table 8.1.2.4.21.1.1-3, 8.1.2.4.21.1.1-3A and table 8.1.2.4.21.1.1-4.

TSSB\_measurement\_period\_irat: equal to a measurement period of SSB based measurement given in table 8.1.2.4.21.1.1-5, 8.1.2.4.21.1.1-5A and table 8.1.2.4.21.1.1-6.

Mpss/sss\_sync\_irat: For a UE supporting FR2 power class 1, Mpss/sss\_sync\_irat = 64 samples. For a UE supporting FR2 power class 2 (vehicle mounted), Mpss/sss\_sync\_irat = 40 samples. For a UE supporting FR2 power class 3 (handheld), Mpss/sss\_sync\_irat = 40 samples. For a UE supporting FR2 power class 4, Mpss/sss\_sync\_irat = 40 samples.

MSSB\_index\_irat: For a UE supporting FR2 power class 1 or 5, MSSB\_index\_irat = 40 samples. For a UE supporting FR2 power class 2 (vehicle mounted), MSSB\_index\_irat = 24 samples. For a UE supporting FR2 power class 3 (handheld), MSSB\_index\_irat = 24 samples. For a UE supporting FR2 power class 4, MSSB\_index\_irat = 24 samples.

Mmeas\_period\_irat: For a UE supporting FR2 power class 1 or 5, Mmeas\_period\_irat = 64 samples. For a UE supporting FR2 power class 2 (vehicle mounted), Mmeas\_period\_irat = 40 samples. For a UE supporting FR2 power class 3 (handheld), Mmeas\_period\_irat = 40 samples. For a UE supporting FR2 power class 4, Mmeas\_period\_irat = 40 samples.

Nfreq is defined in clause 8.1.2.1.1

For per-FR measurement gap capable UE, when serving cells are in E-UTRA and measurement objects are only in FR2,

- UE can perform such measurements without gap, and

- UE fulfils the requirements for FR2 measurement objects based on effective MGRP = 20 ms.

Table 8.1.2.4.21.1.1-1: Time period for PSS/SSS detection (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TPSS/SSS\_sync\_irat |
| No DRX | Max(600ms, 8 × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(8×1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | 8 × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 5. | |

Table 8.1.2.4.21.1.1-1A: Time period for PSS/SSS detection for UE configured with *highSpeedInterRAT-r16* (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TPSS/SSS\_sync\_irat |
| No DRX | Max(600ms, 8 × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle < 320ms | Max(600ms, ceil( 8 × M) × max(MGRP, SMTC period, DRX cycle)) ×Nfreq |
| DRX cycle ≥ 320ms | 8× DRX cycle ×Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 5.  NOTE 3: M = 1 when SMTC < = 40ms, and M = 1.5 when SMTC > 40ms | |

Table 8.1.2.4.21.1.1-2: Time period for PSS/SSS detection (Frequency range FR2)

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_irat** |
| No DRX | Max(600ms, Mpss/sss\_sync\_irat × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(600ms, (1.5 × Mpss/sss\_sync\_irat) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | Mpss/sss\_sync\_irat × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 5. | |

Table 8.1.2.4.21.1.1-3: Time period for time index detection (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TSSB\_time\_index\_irat |
| No DRX | Max(120ms, 3 × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(120ms, Ceil(3 × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | 3 × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 5. | |

Table 8.1.2.4.21.1.1-3A: Time period for time index detection for UE configured with *highSpeedInterRAT-r16* (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TSSB\_time\_index\_irat |
| No DRX | Max(120ms, 3 × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle < 320ms | Max(120ms, Ceil(3 × M) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle ≥ 320ms | 3 × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 5.  NOTE 3: M = 1 when SMTC < = 40ms, and M = 1.5 when SMTC > 40ms | |

Table 8.1.2.4.21.1.1-4: Time period for time index detection (Frequency range FR2)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TSSB\_time\_index\_irat |
| No DRX | Max(200ms, MSSB\_index\_irat × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(200ms, (1.5 × MSSB\_index\_irat) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | MSSB\_index\_irat × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 5. | |

In the requirements, an NR cell is considered detectable when:

- NR SS-RSRP related conditions in the accuracy requirements in Section 9.11.1 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 of TS 38.133 [50],

- NR SS-RSRQ related conditions in the accuracy requirements in Section 9.11.2 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 of TS 38.133 [50],

- NR SS-SINR related conditions in the accuracy requirements in Section 9.11.3 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 of TS 38.133 [50].

When measurement gaps are scheduled for NR measurements the UE physical layer shall be capable of reporting NR SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clause 9.11, with measurement period as shown in table 8.1.2.4.21.1.1-5, 8.1.2.4.21.1.1-5A and 8.1.2.4.21.1.1-6:

Table 8.1.2.4.21.1.1-5: Measurement period for inter-RAT measurements (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TSSB\_measurement\_period\_irat |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(8 × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | 8 × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 5. | |

Table 8.1.2.4.21.1.1-5A: Measurement period for inter-RAT measurements for UE configured with *highSpeedInterRAT-r16* (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TSSB\_measurement\_period\_irat |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle < 320ms | Max(200ms, ceil(8 × M) x max(MGRP, SMTC period, DRX cycle))×Nfreq |
| DRX cycle ≥ 320ms | 4× M × DRX cycle ×Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 5.  NOTE 3: M = 1 when SMTC < = 40ms, and M = 1.5 when SMTC > 40ms | |

Table 8.1.2.4.21.1.1-6: Measurement period for inter-RAT measurements (Frequency range FR2)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TSSB\_measurement\_period\_irat |
| No DRX | Max(400ms, Mmeas\_period\_irat × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(400ms, (1.5 × Mmeas\_period\_irat) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | Mmeas\_period\_irat × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 5. | |

The UE shall be capable of performing NR SS-RSRP, SS-RSRQ and SS-SINR for up to 7 NR carrier frequencies.

For each RAT E-UTRAN FDD-NR layer on FR1 or FR2, the UE shall be capable of monitoring at least 4 cells.

For each RAT E-UTRAN FDD-NR layer on FR1, during each layer 1 measurement period, the UE shall be capable of monitoring at least 7 SSBs with different SSB index and/or PCI on the RAT E-UTRAN FDD-NR layer.

For each RAT E-UTRAN FDD-NR layer on FR2, during each layer 1 measurement period, the UE shall be capable of monitoring at least 10 SSBs with different SSB index and/or PCI on the RAT E-UTRAN FDD-NR layer. The UE shall be capable of monitoring at least one SSB per cell.

The NR SS-RSRP measurement accuracy for all measured NR cells shall be as specified in clause 9.11.1. The NR SS-RSRQ measurement accuracy for all measured NR cells shall be as specified in clause 9.11.2. The NR SS-SINR measurement accuracy for all measured NR cells shall be as specified in clause 9.11.3.

NOTE: When inter-frequency RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, gap pattern 0 is assumed and requirements in this clause are derived assuming MGRP=80ms is used.

8.1.2.4.21.1.2 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

8.1.2.4.21.1.3 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_irat\_without\_index or Tidentify\_irat\_with\_index defined in Clause 8.1.2.4.21.1.1 for the minimum requirements.When L3 filtering is used or IDC autonomous denial or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If an NR cell which has been detectable at least for the time period Tidentify\_irat\_without\_index. or Tidentify\_irat\_with\_index defined in clause 8.1.2.4.21.1.1 for the minimum requirements and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TSSB\_measurement\_period\_irat defined in clause 8.1.2.4.21.1.1 provided the timing to that cell has not changed more than ±3200 Tc while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.4.21.1.4 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.4.21.1.3.

8.1.2.4.21.2 Void

##### 8.1.2.4.21A E-UTRAN FDD – NR measurements when CCA is used

Requirements in this clause shall apply for NR capable UE, when NR is in carrier frequencies with CCA and not configured with EN-DC.

The UE shall be able to identify new RAT E-UTRAN FDD-NR cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified inter-RAT cells if carrier frequency information is provided by the PCell, even if no explicit neighbour list with physical layer cell identities is provided.

In the requirements of clause 8.1.2.4.21A, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but the *N* candidate SSB positions for the same SS/PBCH block index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding period, where:

- For the cell detection procedure: *N* is at least one candidate SSB position (NOTE: the one candidate SSB position for the cell detection shall not be impacted by the set of candidate SSB positions which are already being measured by the UE within the current measurement period of the on-going measurements), and

- For other procedures in clause 8.1.2.4.21A: *N* are the first two successive candidate SSB positions when two or more candidate SSB positions are configured for this SSB index in one discovery burst transmission window, otherwise N is one candidate SSB position;

otherwise the SMTC occasion is considered as available at the UE.

8.1.2.4.21A.1 E-UTRAN FDD – NR measurements

8.1.2.4.21A.1.1 Identification of a new NR cell

When measurement gaps are scheduled, the UE shall be able to identify a new detectable cell within Tidentify\_irat\_cca\_without\_index if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise, UE shall be able to identify a new detectable inter-RAT frequency cell within Tidentify\_irat\_cca\_with\_index. The UE shall be able to identify a new detectable inter-RAT frequency SSB of an already detected cell within Tidentify\_irat\_cca\_without\_index.

Tidentify\_irat\_cca\_without\_index = (TPSS/SSS\_sync\_irat\_cca + T SSB\_measurement\_period\_irat\_cca) ms

Tidentify\_irat\_cca\_with\_index = (TPSS/SSS\_sync\_irat\_cca + T SSB\_measurement\_period\_irat\_cca + TSSB\_time\_index\_irat\_cca) ms

Where:

TPSS/SSS\_sync\_irat\_cca: it is the time period used in PSS/SSS detection given in table 8.1.2.4.21A.1.1-1.

TSSB\_time\_index\_irat\_cca: it is the time period used to acquire the index of the SSB being measured given in table 8.1.2.4.21A.1.1-2.

T SSB\_measurement\_period\_irat\_cca: equal to a measurement period of SSB based measurement given in table 8.1.2.4.21A.1.1-3.

Nfreq is defined in clause 8.1.2.1.1.

Table 8.1.2.4.21A.1.1-1: Time period for PSS/SSS detection, in NR carrier frequencies with CCA

|  |  |
| --- | --- |
| Condition NOTE1,2,3,4 | TPSS/SSS\_sync\_irat\_cca |
| No DRX | Max(600ms, (8 +LPSS/SSS,gaps)  × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(600ms, Ceil((8+LPSS/SSS,gaps) ×1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | (8+LPSS/SSS,gaps) × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 5.  NOTE 3: LPSS/SSS,gaps is the number of SMTC occasions not available at the UE during TPSS/SSS\_sync\_irat\_cca, where LPSS/SSS,gaps ≤ LPSS/SSS,gaps,max. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement gaps, the UE is not required to determine the availability of SMTC occasions more frequent than once during MGRP.  NOTE 4: LPSS/SSS,gaps = 12 for max(DRX cycle, SMTC period, MGRP) ≤ 40 ms LPSS/SSS,gaps = 8 for 40 ms < max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and LPSS/SSS,gaps = 5 for DRX cycle > 320 ms. | |

Upon exceeding LPSS/SSS,gaps,max, the UE is not required to meet the corresponding PSS/SSS detection requirement. The requirements apply provided that any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

Table 8.1.2.4.21A.1.1-2: Time period for time index detection, in NR carrier frequencies with CCA

|  |  |
| --- | --- |
| Condition NOTE1,2,3,4 | TSSB\_time\_index\_irat\_cca |
| No DRX | Max(120ms, (3 + Lind,gaps)  × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(120ms, ceil((3+ Lind,gaps)  x 1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | (3+ Lind,gaps) × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 5  NOTE 3: Lind,gaps is the number of SMTC occasions not available at the UE during TSSB\_time\_index\_irat\_cca, where Lind,gaps ≤ Lind,gaps,max. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement gaps, the UE is not required to determine the availability of SMTC occasions more frequent than once during MGRP.  NOTE 4: Lind,gaps,max = 5 for Max(DRX cycle, SMTC period, MGRP) ≤ 40 ms, Lind,gaps,max = 3 for Max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and Lind,gaps,max = 2 for DRX cycle > 320 ms. | |

The UE shall restart the time index detection upon exceeding Lind,gaps,max. The requirements apply provided that any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

In the requirements, an NR cell is considered to be detectable when:

- NR SS-RSRP related conditions in the accuracy requirements in Section TBD are fulfilled for a corresponding Band, together with the corresponding side conditions in TBD of TS 38.133 [50],

- NR SS-RSRQ related conditions in the accuracy requirements in Section TBD are fulfilled for a corresponding Band, together with the corresponding side conditions in TBD of TS 38.133 [50],

- NR SS-SINR related conditions in the accuracy requirements in Section TBD are fulfilled for a corresponding Band, together with the corresponding side conditions in TBD of TS 38.133 [50].

When measurement gaps are scheduled for NR measurements the UE physical layer shall be capable of reporting NR SS-RSRP, SS-RSRQ, and SS-SINR measurements to higher layers with measurement accuracy as specified in clause TBD, with measurement period as shown in table 8.1.2.4.21A.1.1-3:

Table 8.1.2.4.21A.1.1-3: Measurement period for inter-RAT measurements

|  |  |
| --- | --- |
| Condition NOTE1,2,3,4 | T SSB\_measurement\_period\_irat\_cca |
| No DRX | Max(200ms, (8+ Lmeas) × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(200ms, ceil((8+ Lmeas) x 1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | (8+ Lmeas) × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 5  NOTE 3: Lmeas is the number of SMTC occasions not available at the UE during T SSB\_measurement\_period\_irat\_cca, where Lmeas ≤ Lmeas,max. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement gaps, the UE is not required to determine the availability of SMTC occasions more frequent than once during MGRP.  NOTE 4:   Lmeas,max = 12 for Max(DRX cycle, SMTC period, MGRP) ≤ 40 ms, Lmeas,max = 8 for Max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and Lmeas,max = 5 for DRX cycle > 320 ms. | |

The UE shall restart the measurement upon exceeding Lmeas,max. The requirements apply provided that any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

When the time period of unsuccessful measurement attemps due to exceeding the maximum number of unavailable at the UE SMTC occasions of an already identified cell exceeds the maximum time requirement for the cell to remain known defined in clause 9.3A.6.3, the UE shall stop the measurement attempts on this SSB and perform the detection procedure again, like for any other SSB.

The UE shall be capable of performing SSB based SS-RSRP, SS-RSRQ, and SS-SINR for up to [7] NR carrier frequencies.

For each RAT E-UTRAN FDD-NR layer on, in carrier frequencies with CCA, the UE shall be capable of monitoring at least 4 cells.

For each RAT E-UTRAN FDD-NR layer in carrier frequencies with CCA, during each layer 1 measurement period, the UE shall be capable of monitoring at least 7 SSBs with different SSB indexes and/or PCI on the RAT E-UTRAN FDD-NR layer.

The NR SS-RSRP measurement accuracy for all measured cells shall be as specified in clause TBD. The NR SS-RSRQ measurement accuracy for all measured cells shall be as specified in clause TBD. The NR SS-SINR measurement accuracy for all measured cells shall be as specified in clause TBD.

8.1.2.4.21A.1.2 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

8.1.2.4.21A.1.3 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report and all delays due to UL CCA failures until the successful transmission of the report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_irat\_cca\_without\_index or Tidentify\_irat\_cca\_with\_index defined in Clause 8.1.2.4.21A.1.1 for the minimum requirements.When L3 filtering is used or IDC autonomous denial or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_irat\_cca\_without\_index or Tidentify\_irat\_cca\_with\_index defined in clause 8.1.2.4.21A.1.1 for the minimum requirements and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasurement\_NR\_cca\_FDD defined in clause 8.1.2.4.21A.1.1 provided the timing to that cell has not changed more than ±3200 Tc while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.4.21A.1.4 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.4.21A.1.3.

8.1.2.4.21A.1.5 NR inter-RAT RSSI measurements

The UE physical layer shall be capable of performing the RSSI measurements, defined in TS 38.215 [58], on one or more inter-RAT carriers operating with CCA, TS 37.213 [57], if the carrier(s) are indicated by higher layers [38], and reporting the RSSI measurements to higher layers. The UE physical layer shall provide to higher layers a single RSSI sample for each OFDM symbol within each configured RSSI measurement duration [38] occurring with a configured RSSI measurement timing configuration periodicity, *rmtc-Periodicity,* according to [38].

Table 8.1.2.4.21A.1.5-1: Measurement period for inter-RAT RSSI measurements with gaps

|  |  |
| --- | --- |
| Condition NOTE1,2,3,4 | T RSSI\_measurement\_period\_NR\_cca |
| No DRX | max(*reportInterval*, max(*rmtc-Periodicity, MGRP*) x CSSFNR,EN-DC) |
| DRX | max(*reportInterval*, max(*rmtc-Periodicity*, MGRP,DRX cycle) x CSSFNR,EN-DC) |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50]. | |

If the UE requires measurement gaps to perform inter-frequency measurements, a single measurement gap pattern is used for all concurrent inter-frequency measurements, including inter-frequency RSSI measurements. The RSSI measurement duration and the measurement gap should be aligned, and the following additional condition should be fulfilled:

- Entire RSSI measurement duration should be contained in the measurement gap.

The RSSI measurement performed and reported according to this section shall meet the RSSI measurement accuracy requirement in Section TBD in TS 38.133 [50].

8.1.2.4.21A.1.6 NR inter-RAT channel occupancy measurements

The UE shall be capable of estimating the channel occupancy on one or more carrier frequencies indicated by higher layers [2], based on RSSI samples provided by the physical layer.

**Table 8.1.2.4.21A.1.6-1: Measurement period for inter-RAT Channel Occupancy measurements with gaps**

|  |  |
| --- | --- |
| **Condition NOTE1,2,3,4** | **T CO\_measurement\_period\_NR\_cca** |
| No DRX | max(*reportInterval*, max(*rmtc-Periodicity, MGRP*) x CSSFNR,EN-DC) |
| DRX | max(*reportInterval*, max(*rmtc-Periodicity*, MGRP,DRX cycle) x CSSFNR,EN-DC) |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50]. | |

If the UE requires measurement gaps to perform inter-frequency measurements, a single measurement gap pattern is used for all concurrent inter-frequency measurements, including inter-frequency channel occupancy measurements.

The channel occupancy measurement performed and reported according to this section shall meet the channel occupancy measurement accuracy requirements in Section TBD of TS 38.133 [50].

##### 8.1.2.4.22 E-UTRAN TDD – NR measurements

Requirements in this clause shall apply for NR capable UE when not configured with EN-DC.

The requirements in clause 8.1.2.4.21 also apply for this section.

##### 8.1.2.4.22A E-UTRAN TDD – NR measurements when CCA is used

Requirements in this clause shall apply for NR capable UE when not configured with EN-DC, considering NR carrier frequencies with CCA.

The requirements in clause 8.1.2.4.21A also apply for this section.

##### 8.1.2.4.23 Void

##### 8.1.2.4.24 Void

##### 8.1.2.4.25 E-UTRAN FDD – NR SFTD Measurements

8.1.2.4.25.1 Introduction

This clause contains requirements for a UE supporting E-UTRAN FDD – NR dual connectivity and is applicable in RRC\_CONNECTED state and conditioned on that no NR PSCell is configured. The UE shall perform inter-RAT SFTD measurement and report SFTD result with/without SS-RSRP after the network requests with *reportSFTD-Meas* set to neighbour cells. The overall delay includes RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2] and SFTD measurement reporting delay in clause 8.1.2.4.25.3.

8.1.2.4.25.2 SFTD Measurement delay

The requirements on SFTD measurement delay defined in this section are applicable under the side condition SCH Ês/Iot ≥ -3 dB for the NR cell. Depending on configuration, the SFTD measurement may be carried out with or without the support of configured measurement gaps. In the current release, indication on whether to carry out the SFTD measurement with or without measurement gaps is implicit and depending on whether measurement gaps are configured.

The UE shall be able to detect, identify and measure SFTD of up to 3 of the strongest NR cells on the carrier frequency provided in the SFTD measurement configuration. Further depending on the SFTD measurement configuration, the UE shall additionally report SS-RSRP for the one or more NR cells. The UE may or may not be configured with *cellsForWhichToReportSFTD*. The UE does not expect *cellsForWhichToReportSFTD* to change during an ongoing SFTD measurement.

When no measurement gaps are provided, the UE shall be capable of finding the NR cell regardless of its SSB position in the SMTC period. The SFTD measurement shall be conducted with sustained connection to the E-UTRA PCell and activated SCell(s), however, the UE may be allowed to cause a certain amount of interruptions for reconfiguration of the radio receiver, as specified in clause 7.35.

When measurement gaps are provided, the UE shall be capable of finding the NR cell under the additional condition that the SSB at least occasionally falls within the measurement gap.

When no MCG DRX is used, the UE shall be capable of determining SFTD within a physical layer measurement period of Tmeasure\_SFTD1 as follows:

- For SFTD measurements without measurement gaps, and without additional SS-RSRP reporting:

- For NR carrier in FR1: Tmeasure\_SFTD1 = 14 SMTC periods

- For NR carrier in FR2: Tmeasure\_SFTD1 = 112 SMTC periods

- For SFTD measurements in measurement gaps, and without additional SS-RSRP reporting:

- For NR carrier in FR1: Tmeasure\_SFTD1 = Nfreq × 8 × Max(MGRP, SMTC period)

- For NR carrier in FR2: Tmeasure\_SFTD1 = Nfreq × 64 × Max(MGRP, SMTC period)

- For SFTD measurements without measurement gaps, and with additional SS-RSRP reporting:

- For NR carrier in FR1: Tmeasure\_SFTD1 = 19 SMTC periods

- For NR carrier in FR2: Tmeasure\_SFTD1 = 152 SMTC periods

- For SFTD measurements in measurement gaps, and with additional SS-RSRP reporting:

- For NR carrier in FR1: Tmeasure\_SFTD1 = Nfreq × 13 × Max(MGRP, SMTC period)

- For NR carrier in FR2: Tmeasure\_SFTD1 = Nfreq × 104 × Max(MGRP, SMTC period)

where Nfreq is the number of carriers monitored in measurement gaps.

When MCG DRX is used, the same Tmeasure\_SFTD1 as for non-DRX applies, but the reporting delay depends on the DRX cycle length in use.

In case an NR PSCell is added, the UE shall terminate the inter-RAT SFTD measurement.

In case PCell is changed due to handover, the UE shall terminate the inter-RAT SFTD measurement.

The measurement accuracy for the SFTD measurement shall fulfill the requirement in clause 9.1.27. The measurement accuracy for additionally reported NR SS-RSRP shall fulfil the requirement in clause 9.11.1.

8.1.2.4.25.2a SFTD Measurement delay with CCA on target frequency

The requirements on SFTD measurement delay defined in this section are applicable to a UE configured with a target NR carrier for which CCA is used and under the side condition SCH Ês/Iot ≥ -3 dB for the NR cell. Depending on configuration, the SFTD measurement may be carried out with or without the support of configured measurement gaps. In the current release, indication on whether to carry out the SFTD measurement with or without measurement gaps is implicit and depending on whether measurement gaps are configured.

The UE shall be able to detect, identify and measure SFTD of up to 3 of the strongest NR cells on the carrier frequency provided in the SFTD measurement configuration. Further depending on the SFTD measurement configuration, the UE shall additionally report SS-RSRP for the one or more NR cells. The UE may or may not be configured with *cellsForWhichToReportSFTD*. The UE does not expect *cellsForWhichToReportSFTD* to change during an ongoing SFTD measurement.

When no measurement gaps are provided, the UE shall be capable of finding the NR cell regardless of its SSB position in the SMTC period. The SFTD measurement shall be conducted with sustained connection to the E-UTRA PCell and activated SCell(s), however, the UE may be allowed to cause a certain amount of interruptions for reconfiguration of the radio receiver, as specified in clause 7.35.

When measurement gaps are provided, the UE shall be capable of finding the NR cell under the additional condition that the SSB at least occasionally falls within the measurement gap.

When no MCG DRX is used, the UE shall be capable of determining SFTD within a physical layer measurement period of Tmeasure\_SFTD\_LBT\_max = 4 × Tmeasure\_SFTD1, where Tmeasure\_SFTD1 is defined in clause 8.1.2.4.25.2. If the UE is unable to meet the requirement, it shall terminate the inter-RAT SFTD measurement.

When MCG DRX is used, the same Tmeasure\_SFTD\_LBT\_max as for non-DRX applies, but the reporting delay depends on the DRX cycle length in use.

In case an NR PSCell is added, the UE shall terminate the inter-RAT SFTD measurement.

In case PCell is changed due to handover, the UE shall terminate the inter-RAT SFTD measurement.

The measurement accuracy for the SFTD measurement shall fulfill the requirement in clause 9.1.28. The measurement accuracy for additionally reported NR SS-RSRP shall fulfil the requirement in clause 9.11.1.

8.1.2.4.25.3 SFTD Measurement reporting delay

The SFTD measurement reporting delay is defined as the time between a command that will trigger an SFTD measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 × TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report and all delays due to UL CCA failures until the successful transmission of the report. When the UE is configured to perform SRS carrier-based switching, an additional delay can be expected.

The SFTD measurement reporting delay shall be less than Tmeasure\_SFTD1 defined in clause 8.1.2.4.25.2 and Tmeasure\_SFTD\_LBT\_max defined in clause 8.1.2.4.25.2a for target carrier without and with CCA, respectively.

##### 8.1.2.4.26 E-UTRAN TDD – NR SFTD Measurements

8.1.2.4.26.1 Introduction

This clause contains requirements for a UE supporting E-UTRAN TDD – NR dual connectivity and is applicable in RRC\_CONNECTED state and conditioned on that no NR PSCell is configured.

When no measurement gap is provided, the UE is not required to perform SFTD measurement during the UL subframes of an E-UTRAN serving cell which is on the same TDD band with the NR target cell.

When no measurement gap is provided, the UE is not required to perform SFTD measurement during the UL subframes of a TDD E-UTRAN serving cell which is on the different band with the NR target cell when UE doesn’t support *simultaneousRxTxInterBandENDC* in this band combination.

The requirements in clause 8.1.2.4.25 also apply for this section.

##### 8.1.2.4.27 E-UTRA FDD - NR measurements with autonomous gaps

8.1.2.4.27.1 Introduction

The requirements in this clause are specified for CGI identification of an NR target cell and are applicable for a UE:

- in RRC\_CONNECTED state, and

- configured with LTE-FDD standalone

The overall CGI reporting delay is defined in Clause 8.1.2.4.27.3.

8.1.2.4.27.2 CGI identification of an NR cell with autonomous gaps

The UE shall identify and report the CGI of a known NR target cell when requested by the network for the purpose of ‘reportCGI’. Only one cell is provided to the UE with *cellForWhichToReportCGI* for identifying the CGI. The UE may make autonomous gaps in both downlink reception and uplink transmission of both E-UTRA and NR serving cell(s) for receiving MIB and SIB1 message according to clause 5.5.3 of TS 38.331 [38]. Note that E-UTRAN does not configure si-RequestForHO if *reportConfig* is linked to a *measObject* set to *measObjectNR*. The UE shall be able to identify a new CGI of a known NR cell within:

Tidentify\_CGI\_NR = ( TMIB\_NR + T SIB1\_NR) ms

Where:

TMIB\_NR is the maximum time to acquire MIB message. TMIB\_NR = 6 \* TSMTC ms for NR cells on FR1 or 25 \* TSMTC ms, for NR cells on FR2.

TSIB1\_NR is the maximuim time period to acquire SIB1 message. TSIB1\_NR = 6 \* TRMSI-scheduling ms, where TRMSI-scheduling is the periodicity with which the SIB1 is actually transmitted by the NR target cell.

The requirement for identifying the CGI of an NR cell within Tidentify\_CGI\_NR is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in [2] is used.

Within the time Tidentify\_CGI\_NR, over which the UE identifies the CGI of an NR cell, the UE shall fulfil interruption requirements specified in

Clause 7.37.

In the requirement a cell is known if,

- During the last 5 seconds for FR1 or 3 seconds for FR2 before the reception of the report CGI command:

- The UE has sent a valid L3-RSRP measurement report with SSB index for the NR target cell and

- During MIB decoding at least reported SSBs remains detectable according to the SSB Es/Iot conditions specified in clause 9.2 or 9.3 of TS 38.133 [50], and

- During SIB1 decoding the SSB used for MIB decoding remains detectable according to the SSB Es/Iot conditions specified in clause 9.2 or 9.3 of TS 38.133 [50], and

- During MIB decoding, the SSB for MIB decoding remains detectable with SNR ≥ -3dB

- During SIB1 decoding, the PDSCH for SIB1 decoding remains detectable with SNR ≥ -3dB

8.1.2.4.27.3 CGI reporting delay

The CGI reporting delay is defined as the time between a command that will trigger a CGI report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty of 2 x TTIDCCH resulting when inserting the measurement report to the TTI of the uplink DCCH. This measurement reporting delay excludes any delay caused by lack of UL resources for UE to send the measurement report.

The CGI reporting delay shall be less than Tidentify\_CGI\_NR defined in clause 8.1.2.4. 27.2 plus RRC procedure delay defined in clause 11 in TS 36.331 [2], an additional 30ms margin, and additional 20ms margin if NR target cell is on FR2.

##### 8.1.2.4.28 E-UTRA TDD - NR measurements with autonomous gaps

8.1.2.4.28.1 Introduction

The requirements in this clause are specified for CGI identification of an NR target cell and are applicable for a UE:

- in RRC\_CONNECTED state, and

- configured with LTE-TDD standalone

The overall CGI reporting delay is defined in Clause 8.1.2.4.28.3.

8.1.2.4.28.2 CGI identification of an NR cell with autonomous gaps

The requirements in clause 8.1.2.4. 27.2 shall apply.

8.1.2.4.28.3 CGI reporting delay

The requirements in clause 8.1.2.4. 27.3 shall apply.

#### 8.1.2.5 E-UTRAN OTDOA Intra-Frequency RSTD Measurements

All intra-frequency RSTD measurement requirements specified in Sections 8.1.2.5.1 and 8.1.2.5.2 shall apply without DRX as well as for any DRX and eDRX\_CONN cycles specified in TS 36.331 [2].

When using CRS, in addition to PRS, is enabled in the OTDOA assistance data, it is up to UE implementation whether to use or not the CRS for RSTD measurements, but in either case the RSTD measurements reported by the UE shall meet the requirements specified in this section.

If network-based CRS interference mitigation is enabled in a cell for which the UE performs RSTD measurements, the UE capable of supporting network-based CRS interference mitigation shall perform RSTD measurements and meet all the requirements in this section, provided the CRS are available within at least the PRS bandwidth in the subframes with PRS during all positioning occasions within the RSTD measurement period.

##### 8.1.2.5.1 E-UTRAN FDD Intra-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below (see also Figure 8.1.2.5.1-1):

 ,

where

 is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

 is the number of PRS positioning occasions as defined in Table 8.1.2.5.1-1, where each PRS positioning occasion comprises of  (1≤≤6) consecutive downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time.

Table 8.1.2.5.1-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f1 Note1 | f1 and f2 Note2 |
| 160 ms | 16 | 32 |
| >160 ms | 8 | 16 |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.5 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE as illustrated in Figure 8.1.2.5.1-1.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.1.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

is the number of times the intra-frequency handover occurs during.

is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover; it can be up to 45 ms.



Figure 8.1.2.5.1-1. Illustration of the RSTD reporting time requirement in an FDD system.

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

8.1.2.5.1.1 RSTD Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.1.2.5.2 E-UTRAN TDD Intra-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

 ,

where

 is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

 is the number of PRS positioning occasions as defined in Table 8.1.2.5.2-1, where a PRS positioning occasion is as defined in Clause 8.1.2.5.1, and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time.

Table 8.1.2.5.2-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f1 Note1 | f1 and f2 Note2 |
| 160 ms | 16 | 32 |
| >160 ms | 8 | 16 |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving TDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving TDD carrier frequency f1 and one inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.5 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.1.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the intra-frequency handover occurs during,

 is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover; it can be up to 45 ms.

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

The intra-frequency requirements in this clause (8.1.2.5.2) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.1.2.5.2-2.

Table 8.1.2.5.2-2: TDD uplink-downlink subframe configurations applicable for TDD intra-frequency requirements

|  |  |
| --- | --- |
| PRS Transmission Bandwidth [RB] | Applicable TDD uplink-downlink configurations |
| 6, 15 | 1, 2, 3, 4 and 5 |
| 25, 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| Note: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.1.2.5.2.1 RSTD Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.1.2.5.3 E-UTRAN FDD Intra-Frequency OTDOA Measurements for UE Category 1bis

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below (see also Figure 8.1.2.5.3-1):

,

where

 is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

 is the number of PRS positioning occasions as defined in Table 8.1.2.5.3-1, where a PRS positioning occasion is as defined in Clause 8.1.2.5.1, and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time.

Table 8.1.2.5.3-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f1 Note1 | f1 and f2 Note2 |
| 160 ms | 32 | 64 |
| >160 ms | 16 | 32 |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.5 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE as illustrated in Figure 8.1.2.5.3-1.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.5.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

is the number of times the intra-frequency handover occurs during.

is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover; it can be up to 45 ms.



Figure 8.1.2.5.3-1. Illustration of the RSTD reporting time requirement in an FDD system.

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

8.1.2.5.3.1 RSTD Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.1.2.5.4 E-UTRAN TDD Intra-Frequency OTDOA Measurements for UE Category 1bis

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

,

where

 is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

 is the number of PRS positioning occasions as defined in Table 8.1.2.5.4-1, where a PRS positioning occasion is as defined in Clause 8.1.2.5.1, and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time.

Table 8.1.2.5.4-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f1 Note1 | f1 and f2 Note2 |
| 160 ms | 32 | 64 |
| >160 ms | 16 | 32 |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving TDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving TDD carrier frequency f1 and one inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.5 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.5.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the intra-frequency handover occurs during,

 is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover; it can be up to 45 ms.

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

The intra-frequency requirements in this clause (8.1.2.5.4) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.1.2.5.4-2.

Table 8.1.2.5.4-2: TDD uplink-downlink subframe configurations applicable for TDD intra-frequency requirements

|  |  |
| --- | --- |
| PRS Transmission Bandwidth [RB] | Applicable TDD uplink-downlink configurations |
| 6, 15 | 1, 2, 3, 4 and 5 |
| 25, 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| Note: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.1.2.5.4.1 RSTD Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.1.2.6.5 Void

##### 8.1.2.6.6 Void

##### 8.1.2.6.7 Void

##### 8.1.2.6.8 Void

#### 8.1.2.6 E-UTRAN Inter-Frequency OTDOA Measurements

All inter-frequency RSTD measurement requirements specified in Sections 8.1.2.6.1-8.1.2.6.4 shall apply, provided that

- the UE is capable of inter-frequency RSTD measurements for OTDOA [24], and

- either the measurement gap pattern ID # 0 specified in Clause 8.1.2.1 is used or the UE supports capability of conducting inter-frequency measurements without gaps.

All inter-frequency RSTD measurement requirements specified in Sections 8.1.2.6.1-8.1.2.6.4 shall apply without DRX as well as for any DRX or eDRX\_CONN cycles specified in TS 36.331 [2].

The UE capable of SRS carrier based switching when configured to perform SRS transmission and/or RACH transmission over one or more SCells without PUSCH shall meet the requirements defined in Section 8.1.2.6 provided the following condition is met:

- all positioning subframes indicated in the OTDOA assistance data and specified in Section 9.1.10 are available for RSTD measurements at the UE in the measured and reference cells.

The requirements in this section shall also appy, when the UE is configured to perform SRS carrier based switching and using measurement gaps.

When using CRS, in addition to PRS, is enabled in the OTDOA assistance data, it is up to UE implementation whether to use or not the CRS for RSTD measurements, but in either case the RSTD measurements reported by the UE shall meet the requirements specified in this section.

If network-based CRS interference mitigation is enabled in a cell for which the UE performs RSTD measurements, the UE capable of supporting network-based CRS interference mitigation shall perform RSTD measurements and meet all the requirements in this section, provided the CRS are available within at least the PRS bandwidth in the subframes with PRS during all positioning occasions within the RSTD measurement period.

##### 8.1.2.6.1 E-UTRAN FDD-FDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within *k* \*  ms as given below:

 ,

where

*k* = 2 if the UE is configured with inter-RAT measurement on one or more NR carriers, *k* = 1 otherwise,

is the total time for detecting and measuring at least *n* cells,

 is the the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.1-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

Table 8.1.2.6.1-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f2 Note1 | f1 and f2 Note2 |
| 160 ms | 16 | 32 |
| >160 ms | 8 | 16 |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the FDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving FDD carrier frequency f1 and the FDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.2.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

8.1.2.6.1.1 RSTD Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.1.2.6.2 E-UTRAN TDD-FDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within *k* \*  ms as given below:

 ,

where

*k* = 2 if the UE is configured with inter-RAT measurement on one or more NR carriers, *k* = 1 otherwise,

 is the total time for detecting and measuring at least *n* cells,

 is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.2-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

Table 8.1.2.6.2-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f2 Note1 | f1 and f2 Note2 |
| 160 ms | 16 | 32 |
| >160 ms | 8 | 16 |
| NOTE 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the FDD inter-frequency carrier frequency f2.  NOTE 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving TDD carrier frequency f1 and the FDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within , provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band,

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.2.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

The inter-frequency requirements in this clause (8.1.2.6.2) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.1.2.6.2-2.

Table 8.1.2.6.2-2: TDD uplink-downlink subframe configurations applicable for TDD-FDD inter-frequency requirements

|  |  |
| --- | --- |
| PRS Transmission Bandwidth [RB] | Applicable TDD uplink-downlink configurations |
| 6, 15 | 1, 2, 3, 4 and 5 |
| 25, 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| NOTE: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.1.2.6.2.1 RSTD Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.1.2.6.3 E-UTRAN TDD-TDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within *k* \*  ms as given below:

 ,

where

*k* = 2 if the UE is configured with inter-RAT measurement on one or more NR carriers, *k* = 1 otherwise,

is the total time for detecting and measuring at least *n* cells,

 is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.1-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

Table 8.1.2.6.3-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f2 Note1 | f1 and f2 Note2 |
| 160 ms | 16 | 32 |
| >160 ms | 8 | 16 |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the TDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving TDD carrier frequency f1 and the TDD inter-frequency carrier frequency f2 respectively. | | |

The inter-frequency requirements in this clause (8.1.2.6.3) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.1.2.6.3-2.

Table 8.1.2.6.3-2: TDD uplink-downlink subframe configurations applicable for inter-frequency requirements

|  |  |
| --- | --- |
| PRS Transmission Bandwidth [RB] | Applicable TDD uplink-downlink configurations |
| 6, 15 | 3, 4 and 5 |
| 25 | 1, 2, 3, 4, 5 and 6 |
| 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| Note 1: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16].  Note2: For UEs capable of performing inter-frequency measurements without measurement gaps, TDD uplink-downlink subframe configurations as specified in Table 8.1.2.5.2-2 shall apply. | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.2.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

8.1.2.6.3.1 RSTD Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.1.2.6.4 E-UTRAN FDD-TDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within *k* \*  ms as given below:

 ,

where

*k* = 2 if the UE is configured with inter-RAT measurement on one or more NR carriers, *k* = 1 otherwise,

 is the total time for detecting and measuring at least *n* cells,

 is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.4-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

Table 8.1.2.6.4-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f2 Note1 | f1 and f2 Note2 |
| 160 ms | 16 | 32 |
| >160 ms | 8 | 16 |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the TDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving FDD carrier frequency f1 and the TDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within , provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.2.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

The inter-frequency requirements in this clause (8.1.2.6.4) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.1.2.6.4-2.

Table 8.1.2.6.4-2: TDD uplink-downlink subframe configurations applicable for inter-frequency requirements

|  |  |
| --- | --- |
| PRS Transmission Bandwidth [RB] | Applicable TDD uplink-downlink configurations |
| 6, 15 | 3, 4 and 5 |
| 25 | 1, 2, 3, 4, 5 and 6 |
| 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| Note 1: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16].  Note2: For UEs capable of performing inter-frequency measurements without measurement gaps, TDD uplink-downlink subframe configurations as specified in Table 8.1.2.5.2-2 shall apply. | |

8.1.2.6.4.1 RSTD Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.1.2.6.5 E-UTRAN FDD-FDD Inter-Frequency OTDOA Measurements for UE Category 1bis

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within  ms as given below:

 ,

where

is the total time for detecting and measuring at least *n* cells,

 is the the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.5-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

Table 8.1.2.6.5-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f2 Note1 | f1 and f2 Note2 |
| 160 ms | 32 | 64 |
| >160 ms | 16 | 32 |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the FDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving FDD carrier frequency f1 and the FDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.6.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

8.1.2.6.5.1 RSTD Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.1.2.6.6 E-UTRAN TDD-FDD Inter-Frequency OTDOA Measurements for UE Category 1bis

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within  ms as given below:

,

where

 is the total time for detecting and measuring at least *n* cells,

 is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.6-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

Table 8.1.2.6.6-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f2 Note1 | f1 and f2 Note2 |
| 160 ms | 32 | 64 |
| >160 ms | 16 | 32 |
| NOTE 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the FDD inter-frequency carrier frequency f2.  NOTE 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving TDD carrier frequency f1 and the FDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within , provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band,

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.6.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

The inter-frequency requirements in this clause (8.1.2.6.6) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.1.2.6.6-2.

Table 8.1.2.6.6-2: TDD uplink-downlink subframe configurations applicable for TDD-FDD inter-frequency requirements

|  |  |
| --- | --- |
| PRS Transmission Bandwidth [RB] | Applicable TDD uplink-downlink configurations |
| 6, 15 | 1, 2, 3, 4 and 5 |
| 25, 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| NOTE: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.1.2.6.6.1 RSTD Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.1.2.6.7 E-UTRAN TDD-TDD Inter-Frequency OTDOA Measurements for UE Category 1bis

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within  ms as given below:

 ,

where

is the total time for detecting and measuring at least *n* cells,

 is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.7-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

Table 8.1.2.6.7-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f2 Note1 | f1 and f2 Note2 |
| 160 ms | 32 | 6] |
| >160 ms | 16 | 32 |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the TDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving TDD carrier frequency f1 and the TDD inter-frequency carrier frequency f2 respectively. | | |

The inter-frequency requirements in this clause (8.1.2.6.7) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.1.2.6.7-2.

Table 8.1.2.6.7-2: TDD uplink-downlink subframe configurations applicable for inter-frequency requirements

|  |  |
| --- | --- |
| PRS Transmission Bandwidth [RB] | Applicable TDD uplink-downlink configurations |
| 6, 15 | 3, 4 and 5 |
| 25 | 1, 2, 3, 4, 5 and 6 |
| 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| Note 1: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16].  Note2: For UEs capable of performing inter-frequency measurements without measurement gaps, TDD uplink-downlink subframe configurations as specified in Table 8.1.2.5.2-2 shall apply. | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.6.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

8.1.2.6.7.1 RSTD Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.1.2.6.8 E-UTRAN FDD-TDD Inter-Frequency OTDOA Measurements for UE Category 1bis

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within  ms as given below:

 ,

where

 is the total time for detecting and measuring at least *n* cells,

 is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.8-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

Table 8.1.2.6.8-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f2 Note1 | f1 and f2 Note2 |
| 160 ms | 32 | 64 |
| >160 ms | 16 | 32 |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the TDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving FDD carrier frequency f1 and the TDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within , provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.6.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

The inter-frequency requirements in this clause (8.1.2.6.8) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.1.2.6.8-2.

Table 8.1.2.6.8-2: TDD uplink-downlink subframe configurations applicable for inter-frequency requirements

|  |  |
| --- | --- |
| PRS Transmission Bandwidth [RB] | Applicable TDD uplink-downlink configurations |
| 6, 15 | 3, 4 and 5 |
| 25 | 1, 2, 3, 4, 5 and 6 |
| 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| Note 1: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16].  Note 2: For UEs capable of performing inter-frequency measurements without measurement gaps, TDD uplink-downlink subframe configurations as specified in Table 8.1.2.5.2-2 shall apply. | |

8.1.2.6.8.1 RSTD Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

#### 8.1.2.7 E-UTRAN E-CID Measurements

##### 8.1.2.7.1 E-UTRAN FDD UE Rx-Tx Time Difference Measurements

When no DRX is used the physical layer measurement period of the UE Rx-Tx time difference measurement shall be 200 ms.

When DRX is used in RRC\_CONNECTED state the physical layer measurement period (Tmeasure\_FDD\_UE\_Rx\_Tx1) of the UE Rx-Tx time difference measurement shall be as specified in table 8.1.2.7.1-1. When eDRX\_CONN is used in RRC\_CONNECTED state, the physical layer measurement period (Tmeasure\_FDD\_UE\_Rx\_Tx1) of the UE Rx-Tx time difference measurement shall be as specified in table 8.1.2.7.1-2.

Table 8.1.2.7.1-1: FDD UE Rx-Tx time difference measurement requirement when DRX is used

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_FDD\_UE\_Rx\_Tx1 (s) (DRX cycles) |
| ≤0.04 | 0.2 (Note1) |
| 0.04<DRX-cycle≤2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | |

Table 8.1.2.7.1-2: FDD UE Rx-Tx time difference measurement requirement when eDRX\_CONN is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_FDD\_UE\_Rx\_Tx1 (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

If the UE is performing UE Rx-Tx time difference measurement while the PCell is changed due to the handover then the UE shall restart the Rx-Tx measurement on the new cell. In this case the UE shall also meet the UE Rx-Tx time difference measurement and accuracy requirements. However the physical layer measurement period of the UE Rx-Tx measurement shall not exceed Tmeasure\_FDD\_UE\_Rx\_Tx3 as defined in the following expression:

Tmeasure\_FDD\_UE\_Rx\_Tx3 = (K+1)\*(Tmeasure\_FDD\_UE\_Rx\_Tx1) + K\*TPCcell\_change\_handover

Where:

K is the number of times the PCell is changed over the measurement period (Tmeasure\_FDD\_UE\_Rx\_Tx3),

TPCell\_change\_handover is the time necessary to change the PCell due to handover; it can be up to 45 ms.

If the UE supporting E-UTRA carrier aggregation when configured with the secondary component carrier(s) is performing UE Rx-Tx time difference measurement while the PCell is changed regardless whether the primary component carrier is changed or not then the UE shall restart the Rx-Tx measurement on the new PCell. In this case the UE shall also meet the UE Rx-Tx time difference measurement and accuracy requirements corresponding to the new PCell. However the physical layer measurement period of the UE Rx-Tx measurement shall not exceed Tmeasure\_FDD\_UE\_Rx\_Tx2 as defined in the following expression:

Tmeasure\_FDD\_UE\_Rx\_Tx2 = (N+1)\*(Tmeasure\_FDD\_UE\_Rx\_Tx1) + N\*TPCell\_change\_CA

Where:

N is the number of times the PCell is changed over the measurement period (Tmeasure\_FDD\_UE\_Rx\_Tx2),

TPCell\_change\_CA is the time necessary to change the PCell; it can be up to 25 ms.

If IDC autonomous denial is configured then the UE shall also meet the requirements, provided not more than 30 IDC autonomous denial suframes are configured over an IDC autonomous denial validity period of at least 200 ms.

The UE capable of SRS carrier based switching, when configured to perform SRS carrier based switching for SRS transmission and/or RACH transmission over one or more SCells without PUSCH, shall perform UE Rx-Tx time difference measurement and meet the requirements defined in Section 8.1.2.7.1 provided the following condition is met:

- at least one downlink subframe and one uplink subframe per radio frame are available for doing UE Rx-Tx time difference measurement at the UE in the PCell.

The measurement accuracy for the UE Rx-Tx time difference measurement when DRX or eDRX\_CONN is used as well as when no DRX is used shall be as specified in the sub-clause 9.1.9.

8.1.2.7.1.1 UE Rx-Tx Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other RRC or LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

Reported measurements contained in periodically triggered measurement reports shall meet the requirements in sub-clause 9.1.9.

##### 8.1.2.7.2 E-UTRAN TDD UE Rx-Tx Time Difference Measurements

When no DRX is used the physical layer measurement period of the UE Rx-Tx time difference measurement shall be 200 ms.

When DRX is used in RRC\_CONNECTED state the physical layer measurement period (Tmeasure\_TDD\_UE\_Rx\_Tx1) of the UE Rx-Tx time difference measurement shall be as specified in table 8.1.2.7.2-1. When eDRX\_CONN is used in RRC\_CONNECTED state the physical layer measurement period (Tmeasure\_TDD\_UE\_Rx\_Tx1) of the UE Rx-Tx time difference measurement shall be as specified in table 8.1.2.7.2-2.

Table 8.1.2.7.2-1: TDD UE Rx-Tx time difference measurement requirement when DRX is used

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_TDD\_UE\_Rx\_Tx1 (s) (DRX cycles) |
| ≤0.04 | 0.2 (Note1) |
| 0.04<DRX-cycle≤2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | |

Table 8.1.2.7.2-2: TDD UE Rx-Tx time difference measurement requirement when eDRX\_CONN is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_TDD\_UE\_Rx\_Tx1 (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

If the UE is performing UE Rx-Tx time difference measurement while the PCell is changed due to the handover then the UE shall restart the Rx-Tx measurement on the new cell. In this case the UE shall also meet the UE Rx-Tx time difference measurement and accuracy requirements. However the physical layer measurement period of the UE Rx-Tx measurement shall not exceed Tmeasure\_TDD\_UE\_Rx\_Tx3 as defined in the following expression:

Tmeasure\_TDD\_UE\_Rx\_Tx3 = (K+1)\*(Tmeasure\_TDD\_UE\_Rx\_Tx1) + K\*TPCell\_change\_handover

Where:

K is the number of times the PCell is changed over the measurement period (Tmeasure\_TDD\_UE\_Rx\_Tx3),

TPCell\_change\_handover is the time necessary to change the PCell due to handover; it can be up to 45 ms.

If the UE supporting E-UTRA carrier aggregation when configured with the secondary component carrier(s) is performing UE Rx-Tx time difference measurement while the PCell is changed regardless whether the primary component carrier is changed or not then the UE shall restart the Rx-Tx measurement on the new PCell. In this case the UE shall also meet the UE Rx-Tx time difference measurement and accuracy requirements corresponding to the new PCell. However the physical layer measurement period of the UE Rx-Tx measurement shall not exceed Tmeasure\_TDD\_UE\_Rx\_Tx2 as defined in the following expression:

Tmeasure\_TDD\_UE\_Rx\_Tx2 = (N+1)\*(Tmeasure\_TDD\_UE\_Rx\_Tx1) + N\*TPCell\_change\_CA

Where:

N is the number of times the PCell is changed over the measurement period (Tmeasure\_TDD\_UE\_Rx\_Tx2),

TPCell\_change\_CA is the time necessary to change the PCell; it can be up to 25 ms.

If IDC autonomous denial is configured then the UE shall also meet the requirements, provided not more than 30 IDC autonomous denial suframes are configured over an IDC autonomous denial validity period of at least 200 ms.

The measurement accuracy for the UE Rx-Tx time difference measurement when DRX or eDRX\_CONN is used as well as when no DRX is used shall be as specified in the sub-clause 9.1.9.

For UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 36.331 [2], and is compliant to the requirements for inter-band CA with uplink in one E-UTRA band and without simultaneous Rx/Tx specified in TS 36.101 [5], the UE Rx-Tx time difference measurement requirements in Section 8.1.2.7.2 shall apply also with different TDD UL/DL subframe configurations and/or different special subframe configurations used in CCs of different bands, under the following additional conditions:

- UE is not simultaneously scheduled in UL and DL on the different CCs, and

- At least one downlink and one uplink subframes per radio frame are available for the UE Rx-Tx time difference measurement in the measured cell.

The UE capable of SRS carrier based switching, when configured to perform SRS carrier based switching for SRS transmission and/or RACH transmission over one or more SCells without PUSCH, shall perform UE Rx-Tx time difference measurement and meet the requirements defined in Section 8.1.2.7.2 provided the following condition is met:

- at least one downlink subframe and one uplink subframe per radio frame are available for doing UE Rx-Tx time difference measurement at the UE in the PCell.

8.1.2.7.2.1 UE Rx-Tx Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other RRC or LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

Reported measurements contained in periodically triggered measurement reports shall meet the requirements in sub-clause 9.1.9.

##### 8.1.2.7.3 E-UTRAN FDD Intra-frequency E-CID RSRP and RSRQ Measurements

8.1.2.7.3.1 Introduction

The requirements in section 8.1.2.7.3 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN FDD intra-frequency RSRP and RSRQ measurements [24].

The UE capable of SRS carrier based switching, when configured to perform SRS carrier based switching for SRS transmission and/or RACH transmission over one or more SCells without PUSCH, shall perform UE Rx-Tx time difference measurement and meet the requirements defined in Section 8.1.2.7.3 provided the following condition is met:

- at least one downlink subframe and one uplink subframe per radio frame are available for doing UE Rx-Tx time difference measurement at the UE in the PCell.

8.1.2.7.3.2 Measurement Requirements

The requirements in section 8.1.2.2.1 and section 8.1.2.8.1 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.1.2.7.3.3.

8.1.2.7.3.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.2 and 9.1.5 respectively.

##### 8.1.2.7.4 E-UTRAN TDD Intra-frequency E-CID RSRP and RSRQ Measurements

8.1.2.7.4.1 Introduction

The requirements in section 8.1.2.7.4 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN TDD intra-frequency RSRP and RSRQ measurements [24].

The UE capable of SRS carrier based switching, when configured to perform SRS carrier based switching for SRS transmission and/or RACH transmission over one or more SCells without PUSCH, shall perform UE Rx-Tx time difference measurement and meet the requirements defined in Section 8.1.2.7.4 provided the following condition is met:

- at least one downlink subframe and one uplink subframe per radio frame are available for doing UE Rx-Tx time difference measurement at the UE in the PCell.

8.1.2.7.4.2 Measurement Requirements

The requirements in section 8.1.2.2.2 and section 8.1.2.8.2 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.1.2.7.4.3.

8.1.2.7.4.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.2 and 9.1.5 respectively.

#### 8.1.2.8 E-UTRAN intra-frequency measurements under time domain measurement resource restriction

The requirements in sections 8.1.2.8.1 and 8.1.2.8.2 shall apply for cells for which time domain measurement resource restriction patterns for performing E-UTRAN FDD intra-frequency measurements and E-UTRAN TDD intra-frequency measurements, respectively, are configured by higher layers (TS 36.331 [2]), provided that also the following additional conditions are fulfilled:

The time domain measurement resource restriction pattern configured for the measured cell indicates at least one subframe per radio frame for performing the intra-frequency measurements, and

Four symbols containing CRS are available in all subframes indicated by the time domain measurement resource restriction pattern.

For cells which are not configured for measurements in the subframes indicated by the time-domain measurement resource restriction pattern, the corresponding requirements specified in Clause 8.1.2.2 apply.

##### 8.1.2.8.1 E-UTRAN FDD intra-frequency measurements

8.1.2.8.1.1 E-UTRAN intra-frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify a new detectable FDD intra-frequency cell within



where

Tbasic\_identify\_E-UTRA\_FDD\_eICIC, intra is 1000 ms.

TIntra is the minimum time available for intra-frequency measurements, during the measurement period with an arbitrarily chosen timing. The time is assumed to be available for performing intra-frequency measurements whenever the receiver is guaranteed to be active on the intra-frequency carrier.

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.2.3 and 9.1.2.4 and RSRQ related side conditions given in Clause 9.1.5.2 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.8 for a corresponding Band.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period\_eICIC, Intra. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra-frequency measurements is 200 ms. When no measurement gaps are activated, the UE shall be capable of performing RSRP and RSRQ measurements for 8 identified intra-frequency cells, including also the cells which are not measured in the subframes indicated by the time-domain measurement resource restriction pattern, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of 200 ms. When measurement gaps are activated the UE shall be capable of performing measurements for at least Ymeasurement\_intra\_eICIC cells , where Ymeasurement\_intra\_eICIC is defined in the following equation. If the UE has identified more than Ymeasurement\_intra\_eICIC cells, the UE shall perform measurements of at least 8 identified intra-frequency cells but the reporting rate of RSRP and RSRQ measurements of cells from UE physical layer to higher layers may be decreased.

 cells

where

Xbasic\_measurement\_FDD\_eICIC = 8 (cells)

TMeasurement\_Period\_eICIC, Intra = 200 ms is the measurement period for intra-frequency RSRP and RSRQ measurements.

The RSRP and RSRQ measurement accuracy for the measured cells configured with a time-domain measurement resource restriction pattern for RRM intra-frequency measurements shall be as specified in the sub-clauses 9.1.2.3, 9.1.2.4, and 9.1.5.2, respectively.

8.1.2.8.1.1.1 Measurement Reporting Requirements

8.1.2.8.1.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.2.3, 9.1.2.4, and 9.1.5.2, respectively.

8.1.2.8.1.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.2.3, 9.1.2.4, and 9.1.5.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.8.1.1.1.3.

8.1.2.8.1.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.2.3, 9.1.2.4, and 9.1.5.2, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_intra\_eICIC defined in Clause 8.1.2.8.1.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_eICIC defined in clause 8.1.2.8.1.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_eICIC, Intra provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.1.2.8.1.2 E-UTRAN intra-frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra\_eICIC as shown in table 8.1.2.8.1.2-1.

Table 8.1.2.8.1.2-1: Requirement to identify a newly detectable FDD intra-frequency cell

|  |  |
| --- | --- |
| DRX cycle length (s) | Tidentify\_intra\_eICIC (s) (DRX cycles) |
| ≤0.04 | 1 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2 (52) |
| 0.128 | 4.22 (33) |
| 0.128<DRX-cycle≤2.56 | Note2 (28) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.2.3 and 9.1.2.4 and RSRQ related side conditions given in Clause 9.1.5.2 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.8 for a corresponding Band.

In the RRC\_CONNECTED state the measurement period for intra-frequency measurements is Tmeasure\_intra\_eICIC as shown in table 8.1.2.8.1.2-2. The UE shall be capable of performing RSRP and RSRQ measurements for 8 identified intra-frequency cells, including also the cells which are not measured in the subframes indicated by the time-domain measurement resource restriction pattern, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_eICIC.

Table 8.1.2.8.1.2-2: Requirement to measure FDD intra-frequency cells

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_intra\_eICIC (s) (DRX cycles) |
| ≤0.04 | 0.2 (Note1) |
| 0.04<DRX-cycle≤0.16 | Note2 (7) |
| 0.16<DRX-cycle≤2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | |

The RSRP and RSRQ measurement accuracy for the measured cells configured with a time-domain measurement resource restriction pattern for RRM intra-frequency measurements shall be as specified in the sub-clauses 9.1.2.3, 9.1.2.4, and 9.1.5.2, respectively.

8.1.2.8.1.2.1 Measurement Reporting Requirements

8.1.2.8.1.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.2.3, 9.1.2.4, and 9.1.5.2, respectively.

8.1.2.8.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.2.3, 9.1.2.4, and 9.1.5.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.8.1.2.1.3.

8.1.2.8.1.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.2.3, 9.1.2.4, and 9.1.5.2, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra\_eICIC defined in Clause 8.1.2.8.1.2.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_eICIC defined in clause 8.1.2.8.1.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_eICIC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

##### 8.1.2.8.2 E-UTRAN TDD intra-frequency measurements

8.1.2.8.2.1 E-UTRAN intra-frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify a new detectable TDD intra-frequency cell within



where

Tbasic\_identify\_E-UTRA\_TDD\_eICIC, intra is 1000 ms.

TIntra is the minimum time available for intra-frequency measurements, during the measurement period with an arbitrarily chosen timing. The time is assumed to be available for performing intra-frequency measurements whenever the receiver is guaranteed to be active on the intra-frequency carrier.

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.2.3 and 9.1.2.4 and RSRQ related side conditions given in Clause 9.1.5.2 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.8 for a corresponding Band.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period\_eICIC, Intra. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra-frequency measurements is 200 ms. When no measurement gaps are activated, the UE shall be capable of performing RSRP and RSRQ measurements for 8 identified intra-frequency cells , including also the cells which are not measured in the subframes indicated by the time-domain measurement resource restriction pattern, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of 200 ms. When measurement gaps are activated the UE shall be capable of performing measurements for at least Ymeasurement\_intra\_eICIC cells , where Ymeasurement\_intra\_eICIC is defined in the following equation. If the UE has identified more than Ymeasurement\_intra\_eICIC cells, the UE shall perform measurements of at least 8 identified intra-frequency cells but the reporting rate of RSRP and RSRQ measurements of cells from UE physical layer to higher layers may be decreased.

 cells

where

Xbasic\_measurement\_TDD\_eICIC = 8 (cells)

TMeasurement\_Period\_eICIC, Intra = 200 ms is the measurement period for intra-frequency RSRP and RSRQ measurements.

The RSRP and RSRQ measurement accuracy for the measured cells configured with a time-domain measurement resource restriction pattern for RRM intra-frequency measurements shall be as specified in the sub-clauses 9.1.2.3, 9.1.2.4, and 9.1.5.2, respectively.

8.1.2.8.2.1.1 Measurement Reporting Requirements

8.1.2.8.2.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.2.3, 9.1.2.4, and 9.1.5.2, respectively.

8.1.2.8.2.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.2.3, 9.1.2.4, and 9.1.5.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.8.2.1.1.3.

8.1.2.8.2.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.2.3, 9.1.2.4, and 9.1.5.2, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra\_eICIC defined in Clause 8.1.2.8.2.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_eICIC defined in clause 8.1.2.8.2.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_eICIC, Intra provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.1.2.8.2.2 E-UTRAN intra-frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable TDD intra frequency cell within Tidentify\_intra\_eICIC as shown in table 8.1.2.8.2.2-1.

Table 8.1.2.8.2.2-1: Requirement to identify a newly detectable TDD intra-frequency cell

|  |  |
| --- | --- |
| DRX cycle length (s) | Tidentify\_intra\_eICIC (s) (DRX cycles) |
| ≤0.04 | 1 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2 (52) |
| 0.128 | 4.22 (33) |
| 0.128<DRX-cycle≤2.56 | Note2 (28) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.2.3 and 9.1.2.4 and RSRQ related side conditions given in Clause 9.1.5.2 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.8 for a corresponding Band.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra\_eICIC as shown in table 8.1.2.8.2.2-2. The UE shall be capable of performing RSRP and RSRQ measurements for 8 identified intra-frequency cells, including also the cells which are not measured in the subframes indicated by the time-domain measurement resource restriction pattern, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_eICIC.

Table 8.1.2.8.2.2-2: Requirement to measure TDD intra-frequency cells

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_intra\_eICIC (s) (DRX cycles) |
| ≤0.04 | 0.2 (Note1) |
| 0.04<DRX-cycle≤0.16 | Note2 (7) |
| 0.16<DRX-cycle≤2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

The RSRP and RSRQ measurement accuracy for the measured cells configured with a time-domain measurement resource restriction pattern for RRM intra-frequency measurements shall be as specified in the sub-clauses 9.1.2.3, 9.1.2.4, and 9.1.5.2, respectively.

8.1.2.8.2.2.1 Measurement Reporting Requirements

8.1.2.8.2.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.2.3, 9.1.2.4, and 9.1.5.2, respectively.

8.1.2.8.2.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.2.3, 9.1.2.4, and 9.1.5.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.8.2.2.1.3.

8.1.2.8.2.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.2.3, 9.1.2.4, and 9.1.5.2, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra\_eICIC defined in Clause 8.1.2.8.2.2.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_eICIC defined in clause 8.1.2.8.2.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_eICIC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

##### 8.1.2.8.3 E-UTRAN FDD intra-frequency measurements with CRS assistance information

The requirements in clause 8.1.2.8.3 shall apply for the UEs supporting the PSS/SSS and common channel interference handling, and CRS interference handling features. Moreover, the core requirements shall be satisfied provided that the following additional conditions are fulfilled:

- The UE is provided with the CRS assistance information via higher layers (TS 36.331 [2]),

- The CRS assistance information is valid during the entire measurement period.

The requirements in this section shall also be met when the number of transmit antenna ports [16] of one or more cells whose CRS assistance information is provided [2] is different from the number of transmit antenna ports of the measured cell.

8.1.2.8.3.1 E-UTRAN intra-frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify a new detectable FDD intra-frequency cell within:



where

Tbasic\_identify\_E-UTRA\_FDD\_FeICIC, intra is 1000 ms.

TIntra is the minimum time available for intra-frequency measurements, during the measurement period with an arbitrarily chosen timing. The time is assumed to be available for performing intra-frequency measurements whenever the receiver is guaranteed to be active on the intra-frequency carrier.

A cell shall be considered detectable when:

- RSRP related side conditions given in Sections 9.1.2.5 and 9.1.2.6 and RSRQ related side conditions given in Section 9.1.5.3 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B, clause B.2.9 for a corresponding Band (Notes 1, 2).

Note 1: Part of the Iot includes the interference from at least:

- the PCell , or

- PCell and one intra-frequency neighbouring cell indicated in the CRS assistance information, or

- One or two intra-frequency neighbouring cells indicated in the CRS assistance information.

CRS assistance information has been provided for the intra-frequency neighbouring cells that generate interference. UE may use the CRS assistance information to mitigate the interference.

Note 2: An intra-frequency cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period\_FeICIC, Intra. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra-frequency measurements is 200 ms. When no measurement gaps are activated, the UE shall be capable of performing RSRP and RSRQ measurements for 8 identified intra-frequency cells, including also the cells which are not measured in the subframes indicated by the time-domain measurement resource restriction pattern and the cells indicated in the CRS assistance information, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of 200 ms. When measurement gaps are activated the UE shall be capable of performing measurements for at least Ymeasurement\_intra\_FeICIC cells , where Ymeasurement\_intra\_FeICIC is defined in the following equation. If the UE has identified more than Ymeasurement\_intra\_FeICIC cells, the UE shall perform measurements of at least 8 identified intra-frequency cells but the reporting rate of RSRP and RSRQ measurements of cells from UE physical layer to higher layers may be decreased.

 cells

where

Xbasic\_measurement\_FDD\_FeICIC = 8 (cells).

TMeasurement\_Period\_FeICIC, Intra = 200 ms is the measurement period for intra-frequency RSRP and RSRQ measurements.

The RSRP and RSRQ measurement accuracy for the measured cells configured with a time-domain measurement resource restriction pattern for RRM intra-frequency measurements with CRS assistance information shall be as specified in the sub-clauses 9.1.2.5, 9.1.2.6, and 9.1.5.3, respectively.

8.1.2.8.3.1.1 Measurement Reporting Requirements

8.1.2.8.3.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.2.5, 9.1.2.6, and 9.1.5.3, respectively.

8.1.2.8.3.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.2.5, 9.1.2.6, and 9.1.5.3, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.8.3.1.1.3.

8.1.2.8.3.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.2.5, 9.1.2.6, and 9.1.5.3, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_intra\_FeICIC defined in Clause 8.1.2.8.3.1. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_FeICIC defined in clause 8.1.2.8.3.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_FeICIC, Intra provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.1.2.8.3.2 E-UTRAN intra-frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra\_FeICIC as shown in table 8.1.2.8.3.2-1.

Table 8.1.2.8.3.2-1: Requirement to identify a newly detectable FDD intra-frequency cell

|  |  |
| --- | --- |
| DRX cycle length (s) | Tidentify\_intra\_FeICIC (s) (DRX cycles) |
| ≤0.04 | 1 (Note 1) |
| 0.04<DRX-cycle≤0.08 | Note 2 (52) |
| 0.128 | 4.22 (33) |
| 0.128<DRX-cycle≤2.56 | Note 2 (28] |
| NOTE 1: Number of DRX cycle depends upon the DRX cycle in use.  NOTE 2: Time depends upon the DRX cycle in use. | |

A cell shall be considered detectable when:

- RSRP related side conditions given in Sections 9.1.2.5 and 9.1.2.6 and RSRQ related side conditions given in Section 9.1.5.3 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B, clause B.2.9 for a corresponding Band (Notes 1, 2).

Note 1: Part of the Iot includes the interference from at least:

- the PCell , or

- PCell and one intra-frequency neighbouring cell indicated in the CRS assistance information, or

- One or two intra-frequency neighbouring cells indicated in the CRS assistance information.

CRS assistance information has been provided for the intra-frequency neighbouring cells that generate interference. UE may use the CRS assistance information to mitigate the interference.

Note 2: An intra-frequency cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds.

In the RRC\_CONNECTED state the measurement period for intra-frequency measurements is Tmeasure\_intra\_FeICIC as shown in table 8.1.2.8.3.2-2. The UE shall be capable of performing RSRP and RSRQ measurements for 8 identified intra-frequency cells, including also the cells which are not measured in the subframes indicated by the time-domain measurement resource restriction pattern and the cell indicated in CRS assistance information, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_FeICIC.

Table 8.1.2.8.3.2-2: Requirement to measure FDD intra-frequency cells

|  |  |
| --- | --- |
| DRX cycle length (s) | Tidentify\_intra\_FeICIC (s) (DRX cycles) |
| ≤0.04 | 0.2 (Note 1) |
| 0.04<DRX-cycle≤0.16 | Note 2 (7) |
| 0.16<DRX-cycle≤2.56 | Note 2 (5) |
| NOTE 1: Number of DRX cycle depends upon the DRX cycle in use.  NOTE 2: Time depends upon the DRX cycle in use. | |

The RSRP and RSRQ measurement accuracy for the measured cells configured with a time-domain measurement resource restriction pattern for RRM intra-frequency measurements shall be as specified in the sub-clauses 9.1.2.5, 9.1.2.6, and 9.1.5.3, respectively.

8.1.2.8.3.2.1 Measurement Reporting Requirements

8.1.2.8.3.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.2.5, 9.1.2.6, and 9.1.5.3, respectively.

8.1.2.8.3.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.2.5, 9.1.2.6, and 9.1.5.3, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.8.3.2.1.3.

8.1.2.8.3.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.2.5, 9.1.2.6, and 9.1.5.3, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_intra\_FeICIC defined in clause 8.1.2.8.3.2. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_FeICIC defined in clause 8.1.2.8.3.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_FeICIC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

##### 8.1.2.8.4 E-UTRAN TDD intra-frequency measurements with CRS assistance infromation

The requirements in clause 8.1.2.8.3 shall apply for the UEs upporting the PSS/SSS and common channel interference handling, and CRS interference handling features. Moreover, the core requirements shall be satisfied provided that the following additional conditions are fulfilled:

- The UE is provided with the CRS assistance information via higher layers (TS 36.331 [2]),

- The CRS assistance information is valid during the entire measurement period.

The requirements in this section shall also be met when the number of transmit antenna ports [16] of one or more cells whose CRS assistance information is provided [2] is different from the number of transmit antenna ports of the measured cell.

8.1.2.8.4.1 E-UTRAN intra-frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify a new detectable TDD intra-frequency cell within



where

Tbasic\_identify\_E-UTRA\_TDD\_eICIC, intra is 1000 ms.

TIntra is the minimum time available for intra-frequency measurements, during the measurement period with an arbitrarily chosen timing. The time is assumed to be available for performing intra-frequency measurements whenever the receiver is guaranteed to be active on the intra-frequency carrier.

A cell shall be considered detectable when:

- RSRP related side conditions given in Sections 9.1.2.5 and 9.1.2.6 and RSRQ related side conditions given in Section 9.1.5.3 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.9 for a corresponding Band (Notes 1, 2).

Note 1: Part of the Iot includes the interference from at least:

- the PCell , or

- PCell and one intra-frequency neighbouring cell indicated in the CRS assistance information, or

- One or two intra-frequency neighbouring cells indicated in the CRS assistance information

CRS assistance information has been provided for the intra-frequency neighbouring cells that generate interference. UE may use the CRS assistance information to mitigate the interference.

Note 2: An intra-frequency cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period\_FeICIC, Intra. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra-frequency measurements is 200 ms. When no measurement gaps are activated, the UE shall be capable of performing RSRP and RSRQ measurements for 8 identified intra-frequency cells , including also the cells which are not measured in the subframes indicated by the time-domain measurement resource restriction pattern and the cells indicated in the CRS assistance information, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of 200 ms. When measurement gaps are activated the UE shall be capable of performing measurements for at least Ymeasurement\_intra\_FeICIC cells , where Ymeasurement\_intra\_FeICIC is defined in the following equation. If the UE has identified more than Ymeasurement\_intra\_FeICIC cells, the UE shall perform measurements of at least 8 identified intra-frequency cells but the reporting rate of RSRP and RSRQ measurements of cells from UE physical layer to higher layers may be decreased.

 cells

where

Xbasic\_measurement\_TDD\_FeICIC = 8 (cells)

TMeasurement\_Period\_FeICIC, Intra = 200ms is the measurement period for intra-frequency RSRP and RSRQ measurements.

The RSRP and RSRQ measurement accuracy for the measured cells configured with a time-domain measurement resource restriction pattern for RRM intra-frequency measurements with CRS assistance information shall be as specified in the sub-clauses 9.1.2.5, 9.1.2.6, and 9.1.5.3, respectively.

8.1.2.8.4.1.1 Measurement Reporting Requirements

8.1.2.8.4.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.2.5, 9.1.2.6, and 9.1.5.3, respectively.

8.1.2.8.4.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.2.5, 9.1.2.6, and 9.1.5.3, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.8.4.1.1.3.

8.1.2.8.4.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.2.5, 9.1.2.6, and 9.1.5.3, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_intra\_FeICIC defined in clause 8.1.2.8.4.1. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_FeICIC defined in clause 8.1.2.8.4.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_FeICIC, Intra provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.1.2.8.4.2 E-UTRAN intra-frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable TDD intra frequency cell within Tidentify\_intra\_FeICIC as shown in table 8.1.2.8.4.2-1.

Table 8.1.2.8.4.2-1: Requirement to identify a newly detectable TDD intra-frequency cell

|  |  |
| --- | --- |
| DRX cycle length (s) | Tidentify\_intra\_FeICIC (s) (DRX cycles) |
| ≤0.04 | 1 (Note 1) |
| 0.04<DRX-cycle≤0.08 | Note 2 (52) |
| 0.128 | 4.22 (33) |
| 0.128<DRX-cycle≤2.56 | Note 2 (28) |
| NOTE 1: Number of DRX cycle depends upon the DRX cycle in use.  NOTE 2: Time depends upon the DRX cycle in use. | |

A cell shall be considered detectable when:

- RSRP related side conditions given in Sections 9.1.2.5 and 9.1.2.6 and RSRQ related side conditions given in Section 9.1.5.3 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.9 for a corresponding Band (Notes 1, 2).

Note 1: Part of the Iot includes the interference from at least:

- the PCell , or

- PCell and one intra-frequency neighbouring cell indicated in the CRS assistance information, or

- One or two intra-frequency neighbouring cells indicated in the CRS assistance information.

CRS assistance information has been provided for the intra-frequency neighbouring cells that generate interference. UE may use the CRS assistance information to mitigate the interference.

Note 2: An intra-frequency cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra\_FeICIC as shown in table 8.1.2.8.4.2-2. The UE shall be capable of performing RSRP and RSRQ measurements for 8 identified intra-frequency cells, including also the cells which are not measured in the subframes indicated by the time-domain measurement resource restriction pattern and the cell indicated in CRS assistance information, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_FeICIC.

Table 8.1.2.8.4.2-2: Requirement to measure TDD intra-frequency cells

|  |  |
| --- | --- |
| DRX cycle length (s) | Tidentify\_intra\_FeICIC (s) (DRX cycles) |
| ≤0.04 | 0.2 (Note 1) |
| 0.04<DRX-cycle≤0.16 | Note 2 (7) |
| 0.16<DRX-cycle≤2.56 | Note 2 (5) |
| NOTE 1: Number of DRX cycle depends upon the DRX cycle in use.  NOTE 2: Time depends upon the DRX cycle in use. | |

The RSRP and RSRQ measurement accuracy for the measured cells configured with a time-domain measurement resource restriction pattern for RRM intra-frequency measurements shall be as specified in the sub-clauses 9.1.2.5, 9.1.2.6, and 9.1.5.3, respectively.

8.1.2.8.4.2.1 Measurement Reporting Requirements

8.1.2.8.4.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.2.5, 9.1.2.6, and 9.1.5.3, respectively.

8.1.2.8.4.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.2.5, 9.1.2.6, and 9.1.5.3, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.8.2.2.1.3.

8.1.2.8.4.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.2.5, 9.1.2.6, and 9.1.5.3, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra\_FeICIC defined in clause 8.1.2.8.4.2. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_FeICIC defined in clause 8.1.2.8.4.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_FeICIC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

#### 8.1.2.9 E-UTRAN E-CID Measurements when Time Domain Measurement Resource Restriction Pattern is Configured

##### 8.1.2.9.1 E-UTRAN FDD UE Rx-Tx Time Difference Measurements

The requirements in this clause apply for UE configured with a time-domain measurement resource restriction pattern for PCell measurements, provided that also the following additional conditions are fulfilled:

- The time domain measurement resource restriction pattern configured for the PCell (TS 36.331 [2]) indicates at least one subframe per radio frame for performing the PCell measurements, and

- Four symbols containing CRS are available in all subframes indicated by the time domain measurement resource restriction pattern.

When the UE is provided with a time-domain measurement resource restriction pattern for PCell measurements, the UE Rx-Tx time difference measurement shall meet the measurement requirements specified in Clause 8.1.2.7.1 and accuracy requirements specified in Clause 9.1.9.3, where the condition Ês/Iot ≥ -3dB in Table 9.1.9.3-1 corresponds to the CRS Ês/Iot in subframes indicated by the time-domain measurement resource restriction pattern for PCell measurements (TS 36.331 [2]).

NOTE: It is up to the UE implementation whether the UE Rx-Tx time difference measurement is performed in any subframe or in subframes indicated by the time-domain measurement resource restriction pattern.

##### 8.1.2.9.2 E-UTRAN TDD UE Rx-Tx Time Difference Measurements

The requirements in this clause apply for UE configured with a time-domain measurement resource restriction pattern for PCell measurements, provided that also the following additional conditions are fulfilled:

- The time domain measurement resource restriction pattern configured for the PCell (TS 36.331 [2]) indicates at least one subframe per radio frame for performing the PCell measurements, and

- Four symbols containing CRS are available in all subframes indicated by the time domain measurement resource restriction pattern.

When the UE is provided with a time-domain measurement resource restriction pattern for PCell measurements, the UE Rx-Tx time difference measurement shall meet the measurement requirements specified in Clause 8.1.2.7.2 and accuracy requirements specified in Clause 9.1.9.3, where the condition Ês/Iot ≥ -3dB in Table 9.1.9.3-1 corresponds to the CRS Ês/Iot in subframes indicated by the time-domain measurement resource restriction pattern for PCell measurements (TS 36.331 [2]).

NOTE: It is up to the UE implementation whether the UE Rx-Tx time difference measurement is performed in any subframe or in subframes indicated by the time-domain measurement resource restriction pattern.

##### 8.1.2.9.3 E-UTRAN FDD UE Rx-Tx Time Difference Measurements with CRS Assistance Information

For UE configured with a time-domain measurement resource restriction pattern for PCell measurements, the requirements in this section apply under the following conditions:

- The time domain measurement resource restriction pattern configured for the PCell (TS 36.331 [2]) indicates at least one subframe per radio frame for performing the PCell measurements, and

- Four symbols containing CRS are available in all subframes indicated by the time domain measurement resource restriction pattern, and

- The UE is provided with the CRS assistance information (TS 36.331 [2]) and the CRS assistance information is valid throughout the entire evaluation period.

When the UE is provided with a time-domain measurement resource restriction pattern for serving cell measurements, the UE Rx-Tx time difference measurement shall meet the measurement requirements specified in Section 8.1.2.7.1 and accuracy requirements specified in Section 9.1.9.4.

The requirements in this section shall also be met when the number of transmit antenna ports [16] of one or more cells whose CRS assistance information is provided [2] is different from the number of transmit antenna ports of the measured cell.

NOTE: It is up to the UE implementation whether the UE Rx-Tx time difference measurement is performed in any subframe or in subframes indicated by the time-domain measurement resource restriction pattern.

##### 8.1.2.9.4 E-UTRAN TDD UE Rx-Tx Time Difference Measurements with CRS Assistance Information

For UE configured with a time-domain measurement resource restriction pattern for PCell measurements, the requirements in this section apply under the following conditions:

- The time domain measurement resource restriction pattern configured for the PCell (TS 36.331 [2]) indicates at least one subframe per radio frame for performing the PCell measurements, and

- Four symbols containing CRS are available in all subframes indicated by the time domain measurement resource restriction pattern, and

- The UE is provided with the CRS assistance information (TS 36.331 [2]) and the CRS assistance information is valid throughout the entire evaluation period.

When the UE is provided with a time-domain measurement resource restriction pattern for serving cell measurements, the UE Rx-Tx time difference measurement shall meet the measurement requirements specified in Section 8.1.2.7.2 and accuracy requirements specified in Section 9.1.9.4.

The requirements in this section shall also be met when the number of transmit antenna ports [16] of one or more cells whose CRS assistance information is provided [2] is different from the number of transmit antenna ports of the measured cell.

NOTE: It is up to the UE implementation whether the UE Rx-Tx time difference measurement is performed in any subframe or in subframes indicated by the time-domain measurement resource restriction pattern.

#### 8.1.2.10 Void

## 8.2 Capabilities for Support of Event Triggering and Reporting Criteria

### 8.2.1 Introduction

This clause contains requirements on UE capabilities for support of event triggering and reporting criteria. As long as the measurement configuration does not exceed the requirements stated in clause 8.2.2, the UE shall meet the performance requirements defined in clause 9.

The UE can be requested to make measurements under different measurement identities defined in TS 36.331 [2]. Each measurement identity corresponds to either event based reporting, periodic reporting, logged measurement reporting [2] or no reporting. In case of event based reporting, each measurement identity is associated with an event. In case of periodic reporting, a measurement identity is associated with one periodic reporting criterion. In case of logged measurement reporting, a measurement identity is associated with one logged measurement reporting criterion. In case of no reporting, a measurement identity is associated with one no reporting criterion.

The purpose of this clause is to set some limits on the number of different event, periodic, logged measurement and no reporting criteria the UE may be requested to track in parallel.

### 8.2.2 Requirements

In this clause a reporting criterion corresponds to either one event (in the case of event based reporting), or one periodic reporting criterion (in case of periodic reporting), or one logged measurement reporting criterion (in case of logged measurement reporting), or one no reporting criterion (in case of no reporting). For event based reporting, each instance of event, with the same or different event identities, is counted as separate reporting criterion in table 8.2.2-1.

The UE shall be able to support in parallel per category up to Ecat reporting criteria according to table 8.2.2-1. For the measurement categories belonging to measurements on: E-UTRA intra-frequency cells, E-UTRA inter-frequency cells, and inter-RAT per supported RAT(i.e. without counting other categories that the UE shall always support in parallel), the UE need not support more than the total number of reporting criteria as follows:

- 26 reporting criteria in total if the UE is not configured with any SCell or PSCell carrier frequency,

- 35 reporting criteria in total if the UE is configured with one SCell carrier frequency,

- 44 reporting criteria in total if the UE is configured with two SCell carrier frequencies,

- 53 reporting criteria in total if the UE is configured with three SCell carrier frequencies,

- 62 reporting criteria in total if the UE is configured with four SCell carrier frequencies,

- 71 reporting criteria in total if the UE is configured with five SCell carrier frequencies,- 80 reporting criteria in total if the UE is configured with six SCell carrier frequencies,

- 35 reporting criteria in total if the UE is configured with one PSCell carrier frequency, and

- 44 reporting criteria in total if the UE is configured with one PSCell carrier frequency and one SCell carrier frequency.

Editor’s note: the total reporting criteria are to be verified when the UE capabilities related to frame structure 3 are decided.

A UE supporting increased number of carriers to monitor beyond 3 carriers shall be able to support up to 20 reporting criteria for inter-frequency measurement category according to table 8.2.2-1. Additionally such UE shall be able to support in parallel per category up to Ecat reporting criteria according to table 8.2.2-1. For the measurement categories belonging to measurements on: E-UTRA intra-frequency cells, E-UTRA inter-frequency cells, and inter-RAT per supported RAT, the UE need not support more than the total number of reporting criteria as follows:

- 39 reporting criteria in total if the UE is not configured with any SCell carrier frequency,

- 48 reporting criteria in total if the UE is configured with one SCell carrier frequency,

- 57 reporting criteria in total if the UE is configured with two SCell carrier frequencies,

- 48 reporting criteria in total if the UE is configured with one PSCell carrier frequency,

- 57 reporting criteria in total if the UE is configured with one PSCell carrier frequency and one SCell carrier frequencies,

- 66 reporting criteria in total if the UE is configured with three SCell carrier frequencies, and

- 75 reporting criteria in total if the UE is configured with four SCell carrier frequencies.

- 84 reporting criteria in total if the UE is configured with five SCell carrier frequencies

- 93 reporting criteria in total if the UE is configured with six SCell carrier frequencies

Editor’s note: the total reporting criteria are to be verified when the UE capabilities related to frame structure 3 are decided.

The UE, which is capable of supporting EN-DC operation with NR PSCell and one or more NR carrier frequencies, in total shall be able to support in parallel per category up to Ecat reporting criteria according to table 8.2.2-1 in this section and table 9.1.4.2-1 in TS 38.133 [50]. For the measurement categories belonging to measurements on: E-UTRA intra-frequency cells, E-UTRA inter-frequency cells, inter-RAT per supported RAT, and NR cells on serving and non-serving carrier frequencies (i.e. without counting other categories that the UE shall always support in parallel), the UE, when configured with EN-DC, needs not support more than the number of reporting criteria in total, , where

is specified in section 9.1.4.2 in TS 38.133 [50], and

is the total number of reporting criteria configured by PCell, except NR PSCell and NR SCells carrier frequencies:

- [36] reporting criteria if the UE is not configured with any SCell or PSCell carrier frequency , regardless of the number of NR SCell carrier frequencies if any,

-

- reporting criteria if the UE is configured with at least one SCell, regardless of the number of NR SCell carrier frequencies if any, where is the number of configured SCells carrier frequencies.

The UE, which is capable of supporting and configured with NE-DC operation with PSCell and NR PCell and one or more NR carrier frequencies, in total shall be able to support in parallel per category up to Ecat reporting criteria according to table 8.2.2-1 in this section and table 9.1.4.2-1 in TS 38.133 [50]. For the measurement categories belonging to measurements on: E-UTRA intra-frequency cells and E-UTRA inter-frequency cells, inter-RAT per supported RAT, and NR cells on serving and non-serving carrier frequencies (i.e. without counting other categories that the UE shall always support in parallel), the UE, when configured with NE-DC, needs not support more than the number of reporting criteria , where:

is specified in section 9.1.4.2 in TS 38.133 [50], and

, where

is specified in section 9.1.4.2 in TS 38.133 [50], and

is the total number of E-UTRA reporting criteria, including PSCell and SCells carrier frequencies:

- 19 reporting criteria if the UE is not configured with any SCell, regardless of the number of NR SCell carrier frequencies if any.

- reporting criteria if the UE is configured with at least one SCell, where *k* is the number of configured E-UTRA serving carrier frequencies, including PSCell and SCells carrier frequencies, regardless of the number of NR SCell carrier frequencies if any.

Table 8.2.2-1: Requirements for reporting criteria per measurement category

|  |  |  |  |
| --- | --- | --- | --- |
| Measurement category | Ecat | Note | |
| Intra-frequency Note 1, 5, 6 | 10 | Events for any one or a combination of intra-frequency RSRP, RSRQ, and RS-SINRNote4 for E-UTRA intra-frequency cells | |
| Intra-frequency UE Rx-Tx time difference Note 5 | 2 | Intra-frequency UE Rx-Tx time difference measurements reported to E-UTRAN via RRC and to positioning server via LPP. Applies for UE supporting both LPP and UE Rx-Tx time difference measurement. | |
| Intra-frequency RSTD Note 2, 5, 6 | 1 | Intra-frequency RSTD measurement reporting for UE supporting OTDOA; 1 report capable of minimum 16 cell measurements for the intra-frequency | |
| Intra-frequency RSRP and RSRQ measurements for E-CID Note 5, 6 | 1 | Intra-frequency RSRP and RSRQ measurements for E-CID reported to E-SMLC via LPP [24]. One report capable of at least in total 9 intra-frequency RSRP and RSRQ measurements. Applicable to UE capable of reporting RSRP and RSRQ to E-SMLC via LPP. | |
| Intra-frequency RSSI and channel occupancy measurements under operation with frame structure 3 | 1 | One report capable of one UE RSSI and channel occupancy measurement s per serving carrier frequency. Applicable for UE capable of performing and reporting UE RSSI and channel occupancy under operation with frame structure 3. | |
| Inter-frequency Note 5, 6 | 10 / 28 | Events for any one or a combination of inter-frequency RSRP, RSRQ, and RS-SINRNote4 for E-UTRA inter-frequency cells (see note 3) | |
| Inter-frequency RSTD Note 2, 5, 6 | 1 | Inter-frequency RSTD measurement reporting for UE supporting OTDOA; 1 report capable of minimum 16 cell measurements for at least one inter-frequency. Only applicable as specified in Section 8.1.2.6. | |
| Inter-frequency RSSI and channel occupancy measurements under operation with frame structure 3 | 1 | One report capable of one UE RSSI and channel occupancy measurement s for an inter-frequency. Applicable for UE capable of performing and reporting UE RSSI and channel occupancy under operation with frame structure 3. | |
| Inter-RAT (GSM, cdma2000 1 x RTT and HRPD) Note 5 | 5 | Only applicable for UE with this (inter-RAT) capability. This requirement (**Ecat** = 5) is per supported RAT. | |
| Inter-RAT (UTRAN FDD, UTRAN TDD) Note 5 | 5 or 11 | Only applicable for UE with this (inter-RAT) capability. This requirement (**Ecat** = 5 or 11) is per supported RAT. For UE which indicate support for Increased UE carrier monitoring UTRA **Ecat** = 11. | |
| Inter-RAT NR carrier frequency Note 5 | 10 | Events for NR cells on all inter-RAT NR carrier frequencies for UE capable of EN-DC operation. Only applicable for UE with this capability and measurements on any of the NR carrier frequencies other than the carrier frequency of the NR PSCell or NR SCell. | |
| MBSFN measurements for MDT | 1 | MBSFN measurement reporting for UE supporting MBSFN measurements (MBSFN RSRP, MBSFN RSRQ, and MCH BLER) for MDT [2]; 1 report capable of minimum 1 MBSFN RSRP measurement [4], 1 MBSFN RSRQ measurement [4], and 1 MCH BLER measurement [4]. | |
| Note 1: When the UE is configured with SCell, PSCell, PCell or NR PSCell carrier frequency, Ecat for Intra-frequency is applied per serving frequency.  Note 2: When the UE is configured with one SCell carrier frequency, the UE shall be capable of supporting at least 2 reporting criteria for all RSTD measurements configured to be performed on PCell carrier frequency, SCell carrier frequency and inter-frequency carrier. When the UE is configured with two SCell carrier frequencies, the UE shall be capable of supporting at least 3 reporting criteria for all RSTD measurements configured to be performed on PCell carrier frequency, the two SCell carrier frequencies and inter-frequency carrier. These requirements apply when there is a single on-going LPP OTDOA location session.  Note 3: Support of Ecat of 28 for Measurement category Inter-frequency is applied for a UE supporting increased number of carriers to monitor beyond 3.  Note 4: For UEs supporting RS-SINR measurements  Note 5: Applicable for UE configured with EN-DC operation mode.  Note 6: Applicable for UE configured with NE-DC operation mode. | | | |

## 8.3 Measurements for E-UTRA carrier aggregation

### 8.3.1 Introduction

Requirements in this clause are applicable to UE supporting E-UTRA FDD, E-UTRA TDD and/or E-UTRA TDD-FDD carrier aggregation.

Non configured frequencies may be measured with measurement gaps or autonomous gaps according to the requirements in clause 8.1.2.3 (E-UTRAN inter frequency measurements and E-UTRAN inter frequency measurements with autonomous gaps).

For UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 36.331, and is compliant to the requirements for inter-band CA with uplink in one E-UTRA band and without simultaneous Rx/Tx specified in TS 36.101, the inter-band CA requirements in Section 8.3 shall apply also with different TDD UL/DL subframe configurations and/or different special subframe configurations used in CCs of different bands, under the following additional conditions:

- UE is not simultaneously scheduled in UL and DL on the different CCs, and

- at least DL subframe #0 or DL subframe #5 are available for measurements in the measured cell.

The UE capable of SRS carrier based switching, when configured to perform SRS transmission and/or RACH transmission over one or more SCells without PUSCH shall meet the requirements defined in Section 8.3 provided the following condition is met:

- at least DL subframe #0 or DL subframe #5 per radio frame is available for measurements at the UE in the measured cell.

### 8.3.2 Measurements of the primary component carrier

Measurements of cells on the primary component carrier shall meet all applicable requirements (FDD or TDD) in clause 8.1.2.2 (E-UTRAN intra frequency measurements and E-UTRAN intra frequency measurements with autonomous gaps)

### 8.3.3 Measurements of a secondary component carrier

A Secondary component carrier may be activated, hibernated and deactivated by MAC-CE commands as specified in [17]. The applicable performance requirements depend on whether the SCell on the corresponding frequency is actived, dormant or deactivated.

#### 8.3.3.1 Measurements of a secondary component carrier with active SCell

When the SCell is activated or dormant, measurement performance requirements for the frequency are those given in clause 8.1.2.2 (E-UTRAN intra frequency measurements and E-UTRAN intra frequency measurements with autonomous gaps). If common DRX is in use, then the requirements for that secondary component carrier are given by the applicable DRX requirements (FDD or TDD) in clause 8.1.2.2, otherwise the non DRX requirements are applicable. When *highSpeedEnhancedMeasFlag* or *highSpeedEnhMeasFlag2-r16* is configured and *highSpeedEnhMeasFlagSCell-r16 is not configured,* the enhanced measurement requirements apply only to measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell. When *highSpeedEnhancedMeasFlag* and *highSpeedEnhMeasFlagSCell-r16* are configured*,* the enhanced measurement requirements apply to measurements of the primary component carrier and all secondary component carriers with active or dormant SCells. The applicable measurement accuracy requirements are in clause 9.1.11 (Carrier aggregation measurement accuracy)

#### 8.3.3.2 Measurements of a secondary component carrier with deactivated SCell

This clause defines the measurement requirements of a secondary component carrier with deactivated SCell based on the parameter *measCycleSCell* defined in TS 36.331 [2].

##### 8.3.3.2.1 E-UTRAN secondary component carrier measurements when no common DRX is used

When no DRX is in use the UE shall be able to identify a new detectable FDD or TDD cell on a secondary component carrier within Tidentify\_scc, according to the parameter *measCycleSCell* where Tidentify\_scc = 20 *measCycleSCell* when *highSpeedEnhMeasFlagSCell-r16* is not configured or Tidentify\_scc = 10 *measCycleSCell* when *highSpeedEnhMeasFlagSCell-r16* is configured.

A cell shall be considered detectable when

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Clause 9.1.17.2.1 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.7 for a corresponding Band.

The measurement period for deactivated scell measurements is Tmeasure\_scc according to the parameter *measCycleSCell* where Tmeasure\_scc = 5 *measCycleSCell* when *highSpeedEnhMeasFlagSCell-r16* is not configured or Tmeasure\_scc = 3 *measCycleSCell* when *highSpeedEnhMeasFlagSCell-r16* is configured.

The UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements for 8 identified cells on a secondary component carrier, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_scc.

The measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.11 (Carrier aggregation measurement accuracy)

A UE may reconfigure the receiver bandwidth or turn on/off one of the RF chains when performing measurements on up to six SCCs with deactivated SCell. This may cause interruptions on PCell or activated SCell(s) or both that are specified in Section 7.8.

8.3.3.2.1.1 Measurement Reporting Requirements

8.3.3.2.1.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the applicable requirements in clause 9.

8.3.3.2.1.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the applicable requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.3.3.2.1.1.3.

8.3.3.2.1.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the applicable requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which is caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_scc defined in Clause 8.3.3.2.1. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_scc defined in clause 8.3.3.2.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_scc provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering, or the UE is configured to perform SRS carrier based switching, is used an additional delay can be expected.

##### 8.3.3.2.2 E-UTRAN secondary component carrier measurements when common DRX is used

When DRX is in use and *highSpeedEnhMeasFlagSCell-r16* is not configured, the UE shall be able to identify a new detectable FDD or TDD cell on a secondary component carrier within Tidentify\_scc, according to the parameter *measCycleSCell* where Tidentify\_scc = max(20 *measCycleSCell*, Tidentify\_scc1). Tidentify\_scc1 is given in table 8.3.3.2.2-1. When DRX is in use and *highSpeedEnhMeasFlagSCell-r16* is configured, the UE shall be able to identify a new detectable FDD or TDD cell on a secondary component carrier within Tidentify\_scc, according to the parameter *measCycleSCell* where Tidentify\_scc = max(10 *measCycleSCell*, Tidentify\_scc1). Tidentify\_scc1 is given in table 8.3.3.2.2-1a.

Table 8.3.3.2.2-1: Requirement for Tidentify\_scc1when *highSpeedEnhMeasFlagSCell-r16* is not configured

|  |  |
| --- | --- |
| DRX cycle length (s) | Tidentify\_scc1 (s) (DRX cycles) |
| ≤0.04 | 0.8 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2 (40) |
| 0.128 | 3.2 (25) |
| 0.128<DRX-cycle≤2.56 | Note2(20) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | |

Table 8.3.3.2.2-1a: Requirement for Tidentify\_scc1 *when highSpeedEnhMeasFlagSCell-r16* is configured

|  |  |
| --- | --- |
| DRX cycle length (s) | Tidentify\_scc1 (s) (DRX cycles) |
| ≤0.04 | 0.8 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2(15) |
| 0.08<DRX-cycle≤1.28 | Note2(10) |
| 1.28<DRX-cycle≤2.56 | Note2(20) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

A cell shall be considered detectable when

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Clause 9.1.17.2.1 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.7 for a corresponding Band.

When *highSpeedEnhMeasFlagSCell-r16* is not configured, the measurement period for deactivated scell measurements is Tmeasure\_scc according to the parameter *measCycleSCell* where Tmeasure\_scc =max( 5 *measCycleSCell*, Tmeasure\_scc1). When *highSpeedEnhMeasFlagSCell-r16* is configured , the measurement period for deactivated scell measurements is Tmeasure\_scc according to the parameter *measCycleSCell* where Tmeasure\_scc =max( 3 *measCycleSCell*, Tmeasure\_scc1). The UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements for 8 identified cells on a secondary component carrier, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_scc. Tmeasure\_scc1 is given in table 8.3.3.2.2-2 and table 8.3.3.2.2-2a.

Table 8.3.3.2.2-2: Requirement for Tmeasure\_scc1 when *highSpeedEnhMeasFlagSCell-r16* is not configured

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_scc1 (s) (DRX cycles) |
| ≤0.04 | 0.2 (Note1) |
| 0.04<DRX-cycle≤2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | |

Table 8.3.3.2.2-2a: Requirement for Tmeasure\_scc1 when *highSpeedEnhMeasFlagSCell-r16* is configured

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_scc1 (s) (DRX cycles) |
| ≤0.04 | 0.2 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2(4) |
| 0.08<DRX-cycle≤1.28 | Note2(3) |
| 1.28<DRX-cycle≤2.56 | Note2(5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

The measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.11 (Carrier aggregation measurement accuracy).

A UE may reconfigure receiver bandwidth taking into account the SCell activation/deactivation status, and when making measurements of cells on up to six SCCs with deactivated SCell. This may cause interruptions (packet drops) to a PCell or activated SCell(s) or both when the PCell and the SCell belong to the same frequency band. No interruptions while the On Duration timer is running shall be allowed when common DRX is used. The requirement considers only interruptions due to reconfiguration of the receiver bandwidth, and not due to other causes such as RF impairments or channel conditions.

8.3.3.2.2.1 Measurement Reporting Requirements

8.3.3.2.2.1.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the applicable requirements in clause 9.

8.3.3.2.2.1.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the applicable requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.3.3.2.2.1.3.

8.3.3.2.2.1.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the applicable requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which is caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_scc defined in Clause 8.3.3.2.2. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_scc defined in clause 8.3.3.2.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_scc provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

#### 8.3.3.3 Measurements on a secondary component carrier with FeMBMS/Unicast mixed cells and activated SCell

Requirements in this section apply for UE configured to operate on a secondary component carrier with activated SCell and one or more FeMBMS/Unicast mixed cells and capable of receiving at least one of *SystemInformationBlockType15* or *fembms-MixedCarrier-r14* indication and are provided with the information that one or more FeMBMS/Unicast mixed cells are present on the secondary component carrier to be measured.

The UE shall meet the requirements in Section 8.3.3.1, when performing measurements on a secondary component carrier with an active SCell and at least one FeMBMS/Unicast mixed cell which may or may not be the active SCell. The minimum number of cells that the UE shall be able to measure on includes also FeMBMS/Unicast mixed cells.

#### 8.3.3.4 Measurements on a secondary component carrier with FeMBMS/Unicast mixed cells and deactivated SCell

Requirements in this section apply for UE configured to operate on a secondary component carrier with deactivated SCell and one or more FeMBMS/Unicast mixed cells and which are capable of receiving at least one of *SystemInformationBlockType15* or *fembms-MixedCarrier-r14* indication and are provided with the information that one or more FeMBMS/Unicast mixed cells are present on the secondary component carrier to be measured.

The UE shall meet the requirements in Section 8.3.3.2, when performing measurements on a secondary component carrier with a deactivated SCell and at least one FeMBMS/Unicast mixed cell which may or may not be the deactiveted SCell. The minimum number of cells that the UE shall be able to measure on includes also FeMBMS/Unicast mixed cells.

## 8.4 OTDOA RSTD Measurements for E-UTRAN carrier aggregation

### 8.4.1 Introduction

This clause contains RSTD measurement requirements on UE capabilities for support of E-UTRA carrier aggregation. Requirements in this clause are applicable to all carrier aggregation capable UE which have been configured with one or two downlink Scell(s). Non-configured frequencies may be measured with measurement gaps according to the requirements in clause 8.1.2.6, i.e., E-UTRAN inter-frequency RSTD measurement period applies. Requirements in this clause are applicable for E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD carrier aggregation.

For UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 36.331 [2], and is compliant to the requirements for inter-band CA with uplink in one E-UTRA band and without simultaneous Rx/Tx specified in TS 36.101 [5], RSTD requirements in Section 8.4 shall apply also with different TDD UL/DL subframe configurations and/or different special subframe configurations used in CCs of different bands, under the following additional conditions:

- all positioning subframes indicated in the OTDOA assistance data and specified in Section 9.1.10 are available for RSTD measurements in the measured and reference cells; and

- UE is not simultaneously scheduled in UL and DL on the different CCs.

The UE capable of SRS carrier based switching when configured to perform SRS transmission and/or RACH transmission over one or more SCells without PUSCH shall meet the requirements defined in Section 8.4 provided the following condition is met:

all positioning subframes indicated in the OTDOA assistance data and specified in Section 9.1.10 are available for RSTD measurements at the UE in the measured and reference cells.

If network-based CRS interference mitigation is enabled in a cell for which the UE performs RSTD measurements, the UE capable of supporting network-based CRS interference mitigation shall perform RSTD measurements and meet all the requirements in this section, provided the CRS are available within at least the PRS bandwidth in the subframes with PRS, with N1= 0 and N2=0 subframes before and after the indicated PRS subframes respectively, during all positioning occasions within the RSTD measurement period.

### 8.4.2 Measurements on the primary component carrier

The RSTD measurements on cells belonging to the primary component carrier shall meet all applicable requirements (FDD or TDD) specified in clause 8.1.2.5, i.e., E-UTRAN intra-frequency RSTD measurement period applies.

The RSTD measurement accuracy for all the measurements on the primary component carrier shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.12.

If the PCell is changed, regardless whether the primary component carrier is changed or not while the RSTD measurements are being performed on cells belonging to the primary component carrier, then the UE shall complete the ongoing OTDOA measurement session. In case of change of the primary component carrier, the requirements shall apply only if the primary component carrier is swapped with any of the currently configured secondary component carrier(s). The UE shall also meet the OTDOA measurement and accuracy requirements for the primary component carrier. However in this case the total RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the PCell is changed during,

 is defined in clause 8.1.2.5,

 is the time during which the RSTD measurement may not be possible due to PCell change; it can be up to 25 ms,

corresponds to the E-UTRAN intra-frequency RSTD measurement period as specified in clause 8.1.2.5.

Furthermore, due to the PCell changing the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCell/SCell(s) on whose carriers RSTD measurement is performed during the RSTD measurement period.

### 8.4.3 Measurements on a secondary component carrier

The RSTD measurements when all cells are on a configured secondary component carrier shall meet all applicable requirements (FDD or TDD) specified in clause 8.1.2.5, i.e., E-UTRAN intra-frequency RSTD measurement period applies, regardless of whether the Scell on the corresponding frequency is activated or deactivated by the MAC-CE commands as specified in [17].

The RSTD measurement accuracy for all the measurements on the secondary component carrier shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.12.

A UE may reconfigure receiver bandwidth taking into account the SCell activation/deactivation status, RACH transmission over SCell without PUSCH if capable of SRS carrier based switching, and when making RSTD measurements on cells belonging to SCC with deactivated SCell. This may cause interruptions (packet drops) to a PCell when the PCell and the SCell belong to the adjacent or non-adjacent component carriers in the same frequency band or to different frequency bands. In this case, the UE shall follow the interruption requirements specified in Section 7.10. No interruption to the PCell shall be allowed during the PRS positioning occasion on the PCell.

If the PCell is changed, regardless whether the primary component carrier is changed or not while the RSTD measurements are being performed on cells belonging to the secondary component carrier, then the UE shall complete the ongoing OTDOA measurement session. In case of change of the primary component carrier, the requirements shall apply only if the primary component carrier is swapped with any of the currently configured secondary component carrier(s). The UE shall also meet the OTDOA measurement and accuracy requirements for the secondary component carrier. However in this case the total RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the PCell is changed during,

 is defined in clause 8.1.2.5,

 is the time during which the RSTD measurement may not be possible due to PCell change; it can be up to 25 ms,

 corresponds to the E-UTRAN intra-frequency RSTD measurement period as specified in clause 8.1.2.5.

Furthermore, due to the PCell changing the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCell/SCell(s) on whose carriers RSTD measurement is performed during the RSTD measurement period.

### 8.4.4 Measurements on both primary component carrier and a secondary component carrier

The RSTD measurements of cells on both primary component carrier and a configured secondary component carrier shall meet all applicable requirements (FDD-FDD, TDD-TDD, TDD-FDD or FDD-TDD inter-Frequency OTDOA) specified in clause 8.1.2.6, i.e., E-UTRAN inter-frequency RSTD measurement period applies regardless of whether the SCell on the corresponding frequency is activated or deactivated by the MAC-CE commands as specified in [17], with the following exceptions

- the number of PRS positioning occasions is as specified in Table 8.4.4-1 shall apply, and

- TDD uplink-downlink subframes configurations as specified in Clause 8.1.2.5.2, Table 8.1.2.5.2-2 shall apply.

Table 8.4.4-1: Number of PRS positioning occasions within measurement period

|  |  |
| --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions |
| 160 ms | 32 |
| >160 ms | 16 |

The RSTD measurement accuracy for all the measurements on both primary component carrier and the secondary component carrier shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.12.

A UE may reconfigure its receiver bandwidth taking into account the SCell activation/deactivation status, RACH transmission over SCell without PUSCH if capable of SRS carrier based switching, and when performing RSTD measurements on cells belonging to at least SCC with deactivated SCell. This may cause interruptions (packet drops) on a PCell when the PCell and the SCell belong to the adjacent or non-adjacent component carriers in the same frequency band or to different frequency bands. In this case, the UE shall follow the interruption requirements specified in Section 7.10. No interruption to the PCell shall be allowed during the PRS positioning occasion on the PCell.

If the PCell is changed regardless whether the primary component carrier is changed or not while the RSTD measurements are being performed on cells belonging to both the primary component carrier and the secondary component carrier then the UE shall complete the ongoing OTDOA measurement session. In case of change of the primary component carrier, the requirements shall apply only if the primary component carrier is swapped with any of the currently configured secondary component carrier(s). The UE shall also meet the OTDOA measurement and accuracy requirements for the primary and secondary component carrier. However in this case the total RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the PCell is changed during,

 is defined in clause 8.1.2.6,

 is the time during which the RSTD measurement may not be possible due to PCell change; it can be up to 25 ms,

 corresponds to the E-UTRAN inter-frequency RSTD measurement period as specified in clause 8.1.2.6 with the exception that the number of PRS positioning occasions is as specified in Table 8.4.4-1.

Furthermore, due to the PCell changing the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCell/SCell(s) on whose carriers RSTD measurement is performed during the RSTD measurement period.

### 8.4.5 Measurements on different secondary component carriers

The RSTD measurements of cells on a configured secondary component carrier and another configured secondary component carrier shall meet all applicable requirements (FDD-FDD, TDD-TDD, TDD-FDD or FDD-TDD inter-Frequency OTDOA) specified in clause 8.1.2.6, i.e., E-UTRAN inter-frequency RSTD measurement period applies regardless of whether the SCell on the corresponding frequency is activated or deactivated by the MAC-CE commands as specified in [17], with the following exceptions

- the number of PRS positioning occasions is as specified in Table 8.4.4-1 shall apply, and

- TDD uplink-downlink subframes configurations as specified in Clause 8.1.2.5.2, Table 8.1.2.5.2-2 shall apply.

Table 8.4.4-1: Number of PRS positioning occasions within measurement period

|  |  |
| --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions |
| 160 ms | 32 |
| >160 ms | 16 |

The RSTD measurement accuracy for all the measurements on the secondary component carriers shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.12.

A UE may reconfigure its receiver bandwidth taking into account the SCell activation/deactivation status, RACH transmission over SCell without PUSCH if capable of SRS carrier based switching, and when performing RSTD measurements on cells belonging to at least SCC with deactivated SCell. This may cause interruptions (packet drops) on a PCell when the PCell and the SCell belong to the adjacent or non-adjacent component carriers in the same frequency band or to different frequency bands. In this case, the UE shall follow the interruption requirements specified in Section 7.10. No interruption to the PCell shall be allowed during the PRS positioning occasion on the PCell. No interruption to the SCells shall be allowed during the PRS positioning occasion on the SCells.

If the PCell is changed regardless whether the primary component carrier is changed or not while the RSTD measurements are being performed on cells belonging to the secondary component carriers then the UE shall complete the ongoing OTDOA measurement session. In case of change of the primary component carrier, the requirements shall apply only if the primary component carrier is swapped with any of the currently configured secondary component carrier(s). The UE shall also meet the OTDOA measurement and accuracy requirements for the secondary component carriers. However in this case the total RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the PCell is changed during,

 is defined in clause 8.1.2.6,

 is the time during which the RSTD measurement may not be possible due to PCell change; it can be up to 25 ms,

 corresponds to the E-UTRAN inter-frequency RSTD measurement period as specified in clause 8.1.2.6 with the exception that the number of PRS positioning occasions is as specified in Table 8.4.4-1.

Furthermore, due to the PCell changing the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCell/SCell(s) on whose carriers RSTD measurement is performed during the RSTD measurement period.

## 8.5 Measurements for UE category 0

### 8.5.1 Introduction

The UE category 0 applicability of the requirements in subclause 8.5 is defined in Section 3.6.1.

This clause contains requirements on the UE regarding measurement reporting in RRC\_CONNECTED state. The requirements are specified for E-UTRA intra frequency measurements. These measurements may be used by the E-UTRAN, e.g. for handover decisions. The measurement quantities are defined in [4], the measurement model is defined in [22] and measurement accuracies are specified in clause 9. Control of measurement reporting is specified in TS 36.331 [2].

When the UE is provided with IDC solution, the UE shall also perform RRM measurements and meet the corresponding requirements in clause 8.

### 8.5.2 Requirements

#### 8.5.2.1 E-UTRAN intra frequency measurements

The UE shall be able to identify new intra-frequency cells and perform RSRP measurements of identified intra-frequency cells without an explicit intra-frequency neighbour cell list containing physical layer cell identities. During the RRC\_CONNECTED state the UE shall continuously measure identified intra frequency cells and additionally search for and identify new intra frequency cells.

##### 8.5.2.1.1 E-UTRAN FDD intra frequency measurements

8.5.2.1.1.1 E-UTRAN intra frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify a new detectable FDD intra frequency cell within



where

Tbasic\_identify\_E-UTRA\_FDD\_UE cat 0, intra is 1000 ms

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.13.1 and 9.1.13.2 and RSRQ related side conditions given in Clause 9.1.13.3 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band.

For category 1bis UE, a cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.2.7 and 9.1.2.8 and RSRQ related side conditions given in Clause 9.1.5.5 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band.

TIntra : This is the minimum time that is available for intra frequency measurements, during the measurement period with an arbitrarily chosen timing. Time is assumed to be available for performing intra frequency measurements whenever the receiver is guaranteed to be active on the intra frequency carrier.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period\_ UE cat 0 Intra. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is 400 ms. When no measurement gaps are activated, the low complexity UE shall be capable of performing RSRPand RSRQ measurements for 8 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of 400 ms. When measurement gaps are activated the UE shall be capable of performing measurements for at least Ymeasurement intra\_UE cat 0 cells , where Ymeasurement intra\_ UE cat 0 is defined in the following equation. If the UE has identified more than Ymeasurement intra\_UE cat 0 cells, the UE shall perform measurements of at least 8 identified intra- frequency cells but the reporting rate of RSRP and RSRQ measurements of cells from UE physical layer to higher layers may be decreased.



cells where

Xbasic measurement FDD\_UE cat 0 = 8 (cells)

TMeasurement\_Period\_UE cat 0, Intra = 400 ms. The measurement period for Intra frequency RSRP and RSRQ measurements.

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.13.1 and 9.1.13.2, and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.13.3.For category 1bis UE, the RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.2.7 and 9.1.2.8, and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.5.5.

8.5.2.1.1.1.1 Measurement Reporting Requirements

8.5.2.1.1.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

8.5.2.1.1.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.5.2.1.1.1.1.3.

8.5.2.1.1.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify intra\_UE cat 0 defined in Clause 8.5.2.1.1.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat 0 defined in clause 8.5.2.1.1.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_UE cat 0, Intra provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.5.2.1.1.2 E-UTRAN intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra\_UE cat 0 as shown in table 8.5.2.1.1.2-1. When eDRX\_CONN is in use the UE shall be able to identify a new detectable FDD intra-frequency cell within Tidentify\_intra\_UE cat 0 as shown in table 8.5.2.1.1.2-1A.

Table 8.5.2.1.1.2-1: Requirement to identify a newly detectable FDD intrafrequency cell

|  |  |
| --- | --- |
| DRX cycle length (s) | Tidentify\_intra\_UE cat 0 (s) (DRX cycles) |
| ≤0.04 | 1 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2 (40) |
| 0.128 | 3.2 (25) |
| 0.128<DRX-cycle≤2.56 | Note2(20) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | |

Table 8.5.2.1.1.2-1A: Requirement to identify a newly detectable FDD intra-frequency cell when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_intra\_UE cat 0 (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note(20) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.13.1 and 9.1.13.2 and RSRQ related side conditions given in Clause  9.1.13.3 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band

For category 1bis UE, a cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.2.7 and 9.1.2.8 and RSRQ related side conditions given in Clause 9.1.5.5 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra\_UE cat 0. When DRX is used, Tmeasure\_intra\_UE cat 0 is as defined in table 8.5.2.1.1.2-2, when eDRX\_CONN is used, Tmeasure\_intra\_UE cat 0 is as defined in table 8.5.2.1.1.2-3. The UE shall be capable of performing RSRP and RSRQ measurements for 8 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_UE cat 0.

Table 8.5.2.1.1.2-2: Requirement to measure FDD intrafrequency cells

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_intra\_UE cat 0 (s) (DRX cycles) |
| ≤0.08 | 0.4 (Note1) |
| 0.08<DRX-cycle≤2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | |

Table 8.5.2.1.1.2-3: Requirement to measure FDD intra-frequency cells when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_intra\_UE cat 0 (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.13.1 and 9.1.13.2, and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.13.3.

For category 1bis UE, the RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.2.7 and 9.1.2.8, and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.5.5.

8.5.2.1.1.2.1 Measurement Reporting Requirements

8.5.2.1.1.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

8.5.2.1.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.5.2.1.1.2.1.3.

8.5.2.1.1.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra, UE cat 0 defined in Clause 8.5.2.1.1.2When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat 0 defined in clause 8.5.2.1.1.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_UE cat 0 provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

##### 8.5.2.1.2 E-UTRAN intra frequency measurements for HD-FDD

8.5.2.1.2.1 E-UTRAN intra frequency measurements when no DRX is used

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.5.2.1.1.1 also apply for this section provided the following conditions are met:

- at least downlink subframe # 0 or downlink subframe # 5 per radio frame of an intra-frequency cell to be identified by the UE is available at the UE over Tidentify\_intra\_UE cat 0;

- at least one downlink subframe per radio frame of measured cell is available at the UE for RSRP and RSRQ measurements assuming measured cell is identified cell over Tmeasure\_intra\_UE cat 0.

8.5.2.1.2.2 E-UTRAN intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra\_UE cat 0 as shown in table 8.5.2.1.2.2-1. When eDRX\_CONN is in use the UE shall be able to identify a new detectable FDD intra-frequency cell within Tidentify\_intra\_UE cat 0 as shown in table 8.5.2.1.2.2-1A.

Table 8.5.2.1.2.2-1: Requirement to identify a newly detectable HD-FDD intrafrequency cell

|  |  |
| --- | --- |
| DRX cycle length (s) | Tidentify\_intra\_UE cat 0 (s) (DRX cycles) |
| ≤0.04 | 1 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2 (50) |
| 0.128 | 3.2 (32) |
| 0.128<DRX-cycle≤2.56 | Note2(25) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | |

Table 8.5.2.1.2.2-1A: Requirement to identify a newly detectable HD-FDD intra-frequency cell when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_intra\_UE cat 0 (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (25) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.13.1 and 9.1.13.2 and RSRQ related side conditions given in Clause 9.1.13.3 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band

When DRX is in use, in the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra\_UE cat 0 as shown in table 8.5.2.1.2.2-2. When eDRX\_CONN is in use in the RRC\_CONNECTED state, the measurement period for intra-frequency measurements is Tmeasure\_intra\_UE cat 0 as shown in table 8.5.2.1.2.2-3. The UE shall be capable of performing RSRP and RSRQ measurements for 8 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_UE cat 0.

Table 8.5.2.1.2.2-2: Requirement to measure HD-FDD intrafrequency cells

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_intra\_UE cat 0 (s) (DRX cycles) |
| ≤0.04 | 0.4 (Note1) |
| 0.04<DRX-cycle≤0.16 | Note2 (7) |
| 0.16<DRX-cycle≤2.56 | Note2(5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | |

Table 8.5.2.1.2.2-3: Requirement to measure HD-FDD intra-frequency cells when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_intra\_UE cat 0 (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.13.1 and 9.1.13.2, and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.13.3.

8.5.2.1.1.2.1 Measurement Reporting Requirements

8.5.2.1.1.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

8.5.2.1.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.5.2.1.1.2.1.3.

8.5.2.1.1.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra\_UE cat 0 defined in Clause 8.5.2.1.1.2When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat 0 defined in clause 8.5.2.1.1.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_UE cat 0 provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

##### 8.5.2.1.3 E-UTRAN TDD intra frequency measurements

8.5.2.1.3.1 E-UTRAN intra frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify a new detectable TDD intra frequency cell within



where

Tbasic\_identify\_E-UTRA\_TDD\_UE cat 0, intra is 1000 ms

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.13.1 and 9.1.13.2 and RSRQ related side conditions given in Clause 9.1.13.3 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band

For category 1bis UE, a cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.2.7 and 9.1.2.8 and RSRQ related side conditions given in Clause 9.1.5.5 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band.

TIntra : This is the minimum time that is available for intra frequency measurements, during the measurement period with an arbitrarily chosen timing. Time is assumed to be available for performing intra frequency measurements whenever the receiver is guaranteed to be active on the intra frequency carrier.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period\_UE cat 0 Intra. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is 400 ms. When no measurement gaps are activated, the UE shall be capable of performing RSRP and RSRQ measurements for 8 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of 400 ms. When measurement gaps are activated the UE shall be capable of performing measurements for at least Ymeasurement intra\_UE cat 0 cells , where Ymeasurement intra\_UE cat 0 is defined in the following equation. If the UE has identified more than Ymeasurement ,intra\_UE cat 0 cells, the UE shall perform measurements of at least 8 identified intra-frequency cells but the reporting rate of RSRP and RSRQ measurements of cells from UE physical layer to higher layers may be decreased.



cells where

Xbasic measurement TDD\_UE cat 0 = 8 (cells)

TMeasurement\_Period intra\_UE cat 0 = 400 ms. The measurement period for Intra frequency RSRP and RSRQ measurements.

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.13.1 and 9.1.13.2, and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.13.3.

For category 1bis UE, the RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.2.7 and 9.1.2.8, and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.5.5.

8.5.2.1.3.1.1 Measurement Reporting Requirements

8.5.2.1.3.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

8.5.2.1.3.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.5.2.1.3.1.1.3.

8.5.2.1.3.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify intra\_UE cat 0 defined in Clause 8.5.2.1.3.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat 0 defined in clause 8.5.2.1.3.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period Intra\_UE cat 0 provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.5.2.1.3.2 E-UTRAN intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable TDD intra frequency cell within Tidentify\_intra\_UE cat 0 as shown in table 8.5.2.1.3.2-1. When eDRX\_CONN is in use the UE shall be able to identify a new detectable TDD intra-frequency cell within Tidentify\_intra\_UE cat 0 as defined in table 8.5.2.1.3.2-1A.

Table 8.5.2.1.3.2-1: Requirement to identify a newly detectable TDD intrafrequency cell

|  |  |
| --- | --- |
| DRX cycle length (s) | Tidentify\_intra\_UE cat 0 (s) (DRX cycles) |
| ≤0.04 | 1 (Note1) |
| 0.04<DRX-cycle≤0.08 | Note2 (40) |
| 0.128 | 3.2 (25) |
| 0.128<DRX-cycle≤2.56 | Note2(20) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | |

Table 8.5.2.1.3.2-1A: Requirement to identify a newly detectable TDD intra-frequency cell when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_intra\_UE cat 0 (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (20) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Clause 9.1.13.1 and 9.1.13.2 and RSRQ related side conditions given in Clause 9.1.13.3 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band

For category 1bis UE, a cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.2.7 and 9.1.2.8 and RSRQ related side conditions given in Clause 9.1.5.5 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band.

When DRX is in use in the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra\_UE cat 0 as shown in table 8.5.2.1.3.2-2. When eDRX\_CONN in the RRC\_CONNECTED state is in use, the measurement period for intra-frequency measurements is Tmeasure\_intra\_UE cat 0 as defined in table 8.5.2.1.3.2-3. The UE shall be capable of performing RSRP and RSRQ measurements for 8 identified intra-frequency cells and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_UE cat 0.

Table 8.5.2.1.3.2-2: Requirement to measure TDD intra frequency cells

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_intra\_UE cat 0 (s) (DRX cycles) |
| ≤0.08 | 0.4 (Note1) |
| 0.08<DRX-cycle≤2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use.  Note2: Time depends upon the DRX cycle in use. | |

Table 8.5.2.1.3.2-3: Requirement to measure TDD intra-frequency cells when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_intra\_UE cat 0 (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5) |
| Note: Time depends upon the eDRX\_CONN cycle in use. | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.13.1 and 9.1.13.2, and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.13.3.

For category 1bis UE, the RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.2.7 and 9.1.2.8, and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.5.5.

8.5.2.1.3.2.1 Measurement Reporting Requirements

8.5.2.1.3.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

8.5.2.1.3.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.5.2.1.3.2.1.3.

8.5.2.1.3.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.13.1, 9.1.13.2 and 9.1.13.3, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra\_UE cat 0 defined in Clause 8.5.2.1.3.2.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat 0 defined in clause 8.5.2.1.3.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_UE cat 0 provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

##### 8.5.2.1.4 E-UTRAN FDD intra frequency measurements with autonomous gaps for UE category 0

The requirements defined in this subclause 8.5.2.1.4 apply provided the following condition is met:

- Tx diversity or transmission using multiple antennas are supported in the target cell to be detected.

8.5.2.1.4.1 Identification of a new CGI of E-UTRA cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose ‘reportCGI’. The UE may make autonomous gaps in downlink reception and uplink transmission for receiving MIB and SIB1 message according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI\_LC-UE, intra = 190 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of an E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.2 for a corresponding Band

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI\_LC-UE,.intra is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the UE shall transmit at least 92 ACK/NACKs on PCell provided that:

- there is continuous DL data allocation,

- no DRX and no eDRX\_CONN cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each subframe,

- no MBSFN subframes are configured in the PCell or each of activated SCell(s).

8.5.2.1.4.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

##### 8.5.2.1.5 E-UTRAN intra frequency measurements with autonomous gaps for HD-FDD UE category 0

The requirements in this section are applicable for the UE which supports half duplex FDD operation on one or more supported frequency bands [2].

The requirements defined in this subclause 8.5.2.1.5 apply provided the following condition is met:

- Tx diversity or transmission using multiple antennas are supported in the target cell to be detected.

8.5.2.1.5.1 Identification of a new CGI of E-UTRA cell with autonomous gaps

All the CGI requirements with the exception of requirement on the number of ACK/NACK transmission on PCell defined in clause 8.5.2.1.4.1 also apply for this section.

For the UE supporting half duplex FDD operation there is no requirement in terms of number of ACK/NACK transmission on PCell.

8.5.2.1.5.2 ECGI Reporting Delay

The ECGI reporting delay defined in clause 8.5.2.1.4.2 also apply for this section.

##### 8.5.2.1.6 E-UTRAN TDD intra frequency measurements with autonomous gaps for UE category 0

The requirements defined in this subclause 8.5.2.1.6 apply provided the following condition is met:

- Tx diversity or transmission using multiple antennas are supported in the target cell to be detected.

8.5.2.1.6.1 Identification of a new CGI of E-UTRA cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose ‘reportCGI’. The UE may make autonomous gaps in downlink reception and uplink transmission for receiving MIB and SIB1 messages according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI\_LC-UE, intra = 190 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of an E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable when the following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.2 for a corresponding Band

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI\_LC-UE, intra is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the UE shall be able to transmit at least the number of ACK/NACKs stated in Table 8.5.2.1.6.1-1 on PCell provided that:

- there is continuous DL data allocation,

- no DRX and no eDRX\_CONN cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each subframe,

- no MBSFN subframes are configured in the PCell or each of activated SCell(s).

Table 8.5.2.1.6.1-1: Requirement on minimum number of ACK/NACKs to transmit during Tbasic\_identify\_CGI\_LC-UE, intra.

|  |  |
| --- | --- |
| UL/DL configuration | Minimum number of transmitted ACK/NACKs |
| 0 | 30 |
| 1 | 54 |
| 2 | 68 |
| 3 | 56 |
| 4 | 61 |
| 5 | 66 |
| 6 | 46 |

8.5.2.1.6.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

## 8.6 Discovery signal measurements

### 8.6.1 Introduction

This clause contains requirements on the UE for measurement reporting in RRC\_CONNECTED state when discovery signal [16] is configured. The requirements are specified for E-UTRA CRS based discovery signal measurements and CSI-RS based discovery signal measurements. These measurements may be used by the E-UTRAN, e.g. for handover decisions. The measurement quantities are defined in [4], the measurement model is defined in [22] and measurement accuracy requirements are specified in clause 9. Control of measurement reporting is specified in TS 36.331 [2].

The requirements in Section 9 are applicable for a UE performing measurements according to Section 8.6.

### 8.6.2 Requirements for CRS based discovery signal measurements

#### 8.6.2.1 E-UTRAN intra frequency measurements

The UE shall be able to identify new intra-frequency cells and perform measurements of identified intra-frequency cells without an explicit intra-frequency neighbour cell list containing physical layer cell identities. During the RRC\_CONNECTED state the UE shall continuously measure identified intra frequency cells and additionally search for and identify new intra frequency cells.

The UE capable of SRS carrier based switching when configured to perform SRS transmission and/or PRACH transmission over one or more SCells without PUSCH shall meet the requirements defined in Section 8.6.2.1 provided the following condition is met:

- minimum number of configured discovery signal occasions containing CRS based discovery signal as specified in section 8.6.2.1 are available for measurements at the UE in the measurement cell.

##### 8.6.2.1.1 E-UTRAN FDD intra frequency measurements

8.6.2.1.1.1 E-UTRAN FDD intra frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra\_SCE,

Tidentify\_intra\_SCE = 12\* TDMTC\_periodicity + TMeasurement\_Period \_intra\_FDD\_CRS

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.14.2 and RSRQ related side conditions given in Clause  9.1.14.4 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.10 for a corresponding Band

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer.

TMeasurement\_Period \_intra\_FDD\_CRS is the intra-frequency period for measurements as shown in table 8.6.2.1.1.1-1

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period intra\_FDD\_CRS when no DRX is used. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is TMeasurement\_Period \_intra\_FDD\_CRS as shown in table 8.6.2.1.1.1-1, when no DRX is in use. The UE shall be capable of performing RSRP and RSRQ measurements for 3 identified intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of TMeasurement\_Period \_intra\_FDD\_ CRS

Table 8.6.2.1.1.1-1: Requirement to measure FDD intra frequency cell

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth [RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | TMeasurement\_Period intra\_FDD\_CRS[ms] |
| 6 | ≥1 | 5 \* TDMTC\_periodicity |
| 25 | ≥1 | 3 \* TDMTC\_periodicity |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.14.2, and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.14.4.

8.6.2.1.1.1.1 Measurement Reporting Requirements

8.6.2.1.1.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.14.2 and 9.1.14.4 respectively.

8.6.2.1.1.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.14.2 and 9.1.14.4 respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.6.2.1.1.1.1.3.

8.6.2.1.1.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.14.2 and 9.1.14.4 respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_intra\_SCE defined in Clause 8.6.2.1.1.1.When L3 filtering is used or IDC autonomous denial is configured or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_SCE defined in clause 8.6.2.1.1.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period \_intra\_FDD\_CRS provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.6.2.1.1.2 E-UTRAN FDD intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra\_SCE\_DRX.

Tidentify\_intra\_SCE\_DRX = 16*\* Max* { TDMTC\_periodicity, DRX cycle length}+ TMeasurement\_Period \_intra\_FDD\_CRS\_DRX

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.14.2 and RSRQ related side conditions given in Clause 9.1.14.4 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.10 for a corresponding Band

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer.

TMeasurement\_Period \_intra\_FDD\_CRS\_DRX is the intra-frequency period for measurements as shown in table 8.6.2.1.1.2-1

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period intra\_FDD\_ CRS\_DRX when DRX is used. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is TMeasurement\_Period \_intra\_FDD\_CRS\_DRX as shown in table 8.6.2.1.1.2-1, when DRX is in use. The UE shall be capable of performing RSRP and RSRQ measurements for 3 identified intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of TMeasurement\_Period \_intra\_FDD\_ CRS\_DRX.

Table 8.6.2.1.1.2-1: Requirement to measure FDD intra frequency cell

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth [RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | TMeasurement\_Period intra\_FDD\_CRS\_DRX [ms] |
| 6 | ≥1 | 5 \* *Max*{ TDMTC\_periodicity, DRX cycle length } |
| 25 | ≥1 | 3 \*  *Max*{ TDMTC\_periodicity, DRX cycle length } |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.14.2, and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.14.4.

8.6.2.1.1.2.1 Measurement Reporting Requirements

8.6.2.1.1.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.14.2 and 9.1.14.4 respectively.

8.6.2.1.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.14.2 and 9.1.14.4 respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.6.2.1.1.2.1.3.

8.6.2.1.1.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.14.2 and 9.1.14.4 respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_intra\_SCE\_DRX defined in Clause 8.6.2.1.1.2.When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_SCE\_DRX defined in clause 8.6.2.1.1.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period \_intra\_FDD\_CRS\_DRX provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.6.2.1.2 E-UTRAN TDD intra frequency measurements

8.6.2.1.2.1 E-UTRAN TDD intra frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify a new detectable TDD intra frequency cell within Tidentify\_intra\_SCE,

Tidentify\_intra\_SCE = 12\* TDMTC\_periodicity + TMeasurement\_Period \_intra\_TDD\_CRS

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.14.2 and RSRQ related side conditions given in Clause 9.1.14.4 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.10 for a corresponding Band

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer.

TMeasurement\_Period \_intra\_TDD\_CRS is the intra-frequency period for measurements

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period \_intra\_TDD\_CRS when no DRX is used. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is TMeasurement\_Period \_intra\_TDD\_CRS as shown in table 8.6.2.1.2.1-1, when no DRX is in use. The UE shall be capable of performing RSRP and RSRQ measurements for 3 identified intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of TMeasurement\_Period \_intra\_TDD\_ CRS

Table 8.6.2.1.2.1-1: Requirement to measure TDD intra frequency cell

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth[RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | TMeasurement\_Period intra\_TDD\_CRS[ms] |
| 6 | ≥2 | 5 \* TDMTC\_periodicity |
| 25 | ≥2 | 3 \* TDMTC\_periodicity |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.14.2, and RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.14.4.

8.6.2.1.2.1.1 Measurement Reporting Requirements

8.6.2.1.2.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.14.2 and 9.1.14.4 respectively.

8.6.2.1.2.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.14.2 and 9.1.14.4 respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.6.2.1.2.1.1.3.

8.6.2.1.2.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.14.2 and 9.1.14.4 respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_intra\_SCE defined in Clause 8.6.2.1.2.1.When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_SCE defined in clause  8.6.2.1.2.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period \_intra\_TDD\_CRS provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.6.2.1.2.2 E-UTRAN TDD intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable TDD intra frequency cell within Tidentify\_intra\_SCE\_DRX.

Tidentify\_intra\_SCE\_DRX = 16\* max { TDMTC\_periodicity, DRX cycle length}+ TMeasurement\_Period \_intra\_TDD\_CRS\_DRX

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.14.2 and RSRQ related side conditions given in Clause 9.1.14.4 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.10 for a corresponding Band

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period intra\_TDD\_ CRS\_DRX when DRX is used. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is TMeasurement\_Period \_intra\_TDD\_CRS\_DRX as shown in table 8.6.2.1.2.2-1, when DRX is in use. The UE shall be capable of performing RSRP and RSRQ measurements for 3 identified intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of TMeasurement\_Period \_intra\_TDD\_ CRS\_DRX

Table 8.6.2.1.2.2-1: Requirement to measure TDD intra frequency cell

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth[RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | TMeasurement\_Period intra\_TDD\_CRS\_DRX [ms] |
| 6 | ≥2 | 5 \* *Max*{ TDMTC\_periodicity, DRX cycle length } |
| 25 | ≥2 | 3 \* *Max*{ TDMTC\_periodicity, DRX cycle length } |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.14.2, and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.14.4.

8.6.2.1.2.2.1 Measurement Reporting Requirements

8.6.2.1.2.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.14.2 and 9.1.14.4 respectively.

8.6.2.1.2.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.14.2 and 9.1.14.4 respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.6.2.1.2.2.1.3.

8.6.2.1.2.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.14.2 and 9.1.14.4 respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report. When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_intra\_SCE\_DRX defined in Clause 8.6.2.1.2.2.When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_SCE\_DRX defined in clause 8.6.2.1.2.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period \_intra\_TDD\_CRS\_DRX provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

#### 8.6.2.2 E-UTRAN inter frequency measurements

The UE shall be able to identify new inter-frequency cells and perform RSRP and RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the PCell, even if no explicit neighbour list with physical layer cell identities is provided. The discovery signal occasion and the measurement gap should be aligned, provided that also the following additional conditions are fulfilled:

Entire discovery signal occasion should be contained in the measurement gap.

The subframe contained discovery signal for the measurement is not overlapped with the first 0.5ms period and the last 0.5ms period in every gap.

The UE capable of SRS carrier based switching when configured to perform SRS transmission and/or PRACH transmission over one or more SCells without PUSCH shall meet the requirements defined in Section 8.6.2.2 provided the following condition is met:

- minimum number of configured discovery signal occasions containing CRS based discovery signal as specified in section 8.6.2.2 are available for measurements at the UE in the measurement cell.

##### 8.6.2.2.1 E-UTRAN FDD – FDD inter-frequency measurements

8.6.2.2.1.1 E-UTRAN FDD – FDD inter frequency measurements when no DRX is used

When measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new FDD inter-frequency within TIdentify\_Inter\_SCE according to the following expression:

TIdentify\_Inter\_SCE =13 \* *Max* {TDMTC\_periodicity, MGRP}\**Nfreq* + TMeasurement\_Period\_inter\_FDD\_CRS

A cell shall be considered detectable provided following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1.14.2 and RSRQ related side conditions given in Sections 9.1.14.4 are fulfilled,

- SCH\_RP|dBm SCH Ês/Iot according to Annex B.2.11 for a corresponding Band,

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer.

TMeasurement\_Period \_intra\_FDD\_CRS is the inter-frequency period for measurements as shown in table 8.6.2.2.1.1-1. *Nfreq* is defined in clause 8.1.2.1.1.

When measurement gaps are scheduled for FDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.14.2 and 9.1.14.4, respectively, with measurement period given by table 8.6.2.2.1.1-1.

The UE shall be capable of performing RSRP and RSRQ measurements of at least 3 identified inter-frequency cells per FDD inter-frequency for up to 3 FDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period defined in table 8.6.2.2.1.1-1 when no DRX is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps.

Table 8.6.2.2.1.1-1: Requirement to measure FDD inter frequency cell

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth[RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | TMeasurement\_Period inter\_FDD\_CRS [ms] |
| 6 | ≥1 | 5 \* *Max*{ TDMTC\_periodicity, MGRP}\**Nfreq* |
| 25 | ≥1 | 3 \* *Max*{ TDMTC\_periodicity, MGRP}\**Nfreq* |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.14.2, and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.14.4.

8.6.2.2.1.1.1 Measurement Reporting Requirements

8.6.2.2.1.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.14.2 and 9.1.14.4,respectively.

8.6.2.2.1.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.14.2, and 9.1.14.4, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.6.2.2.1.1.1.3.

8.6.2.2.1.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.14.2 and 9.1.14.4, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than TIdentify\_Inter\_SCE defined in Clause 8.6.2.2.1.1.When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period TIdentify\_Inter\_SCE defined in clause 8.6.2.2.1.1 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_inter\_FDD\_CRS provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.6.2.2.1.2 E-UTRAN FDD – FDD inter frequency measurements when DRX is used

When DRX is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable E-UTRAN FDD inter frequency cell within Tidentify\_inter\_SCE\_DRX.

Tidentify\_inter\_SCE DRX = 17 \* *Max* { TDMTC\_periodicity, DRX cycle length, MGRP} \*Nfreq +TMeasurement\_Period\_inter\_FDD\_CRS\_DRX

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.14.2 and RSRQ related side conditions given in Clause 9.1.14.4 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.11 for a corresponding Band

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer.

TMeasurement\_Period\_inter\_FDD\_CRS\_DRX is the inter-frequency period for measurements as shown in Table 8.6.2.2.1.2-1. *Nfreq* is defined in clause 8.1.2.1.1.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period\_inter\_FDD\_CRS\_DRX when DRX is used. If higher layer filtering is used, an additional cell identification delay can be expected.

The UE shall be capable of performing RSRP and RSRQ measurements of at least 3 identified inter-frequency cells per FDD inter-frequency for up to 3 FDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period defined in table 8.6.2.2.1.2-1 when DRX is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps.

Table 8.6.2.2.1.2-1: Requirement to measure FDD interfrequency cell

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth[RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | TMeasurement\_Period inter\_FDD\_CRS\_DRX [ms] |
| 6 | ≥1 | 5 \* *Max*{ TDMTC\_periodicity, DRX cycle length,MGRP}\**Nfreq* |
| 25 | ≥1 | 3 \* *Max*{ TDMTC\_periodicity, DRX cycle length,MGRP}\**Nfreq* |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.14.2, and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.14.4.

8.6.2.2.1.2.1 Measurement Reporting Requirements

8.6.2.2.1.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.14.2, and 9.1.14.4 respectively.

8.6.2.2.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.14.2 and 9.1.14.4 respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.6.2.2.1.2.1.3.

8.6.2.2.1.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.14.2, and 9.1.14.4 respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_inter\_SCE DRX defined in Clause 8.6.2.2.1.2.When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_SCE DRX defined in clause 8.6.2.2.1.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_inter\_FDD\_CRS\_DRX provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.6.2.2.2 E-UTRAN TDD – TDD inter frequency measurements

8.6.2.2.2.1 E-UTRAN TDD – TDD inter frequency measurements when no DRX is used

When measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new TDD inter-frequency within TIdentify\_Inter\_SCE according to the following expression:

Tidentify\_inter\_SCE =13 \* *Max* { TDMTC\_periodicity, MGRP}\**Nfreq* +TMeasurement\_Period\_inter\_TDD\_CRS

A cell shall be considered detectable provided following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1.14.2 and RSRQ related side conditions given in Sections 9.1.14.4 are fulfilled,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.11 for a corresponding Band

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer.

TMeasurement\_Period\_inter\_TDD\_CRS is the inter-frequency period for measurements as shown in Table 8.6.2.2.2.1-1. *Nfreq* is defined in clause 8.1.2.1.1.

When measurement gaps are scheduled for TDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.14.2, and 9.1.14.4, respectively, with measurement period TMeasurement\_Period inter\_TDD\_CRS given by table 8.6.2.2.2.1-1:

Table 8.6.2.2.2.1-1: Requirement to measure TDD interfrequency cell

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth[RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | TMeasurement\_Period inter\_TDD\_CRS [ms] |
| 6 | ≥2 | 5 \* *Max*{ TDMTC\_periodicity, MGRP}\**Nfreq* |
| 25 | ≥2 | 3 \* *Max*{ TDMTC\_periodicity, MGRP}\**Nfreq* |

The UE shall be capable of performing RSRP and RSRQ measurements of at least 3 identified inter-frequency cells per TDD inter-frequency for up to 3TDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period defined in table 8.6.2.2.2.1-1 when no DRX is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps.

8.6.2.2.2.1.1 Measurement Reporting Requirements

8.6.2.2.2.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.14.2, and 9.1.14.4, respectively.

8.6.2.2.2.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.14.2, and 9.1.14.4, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.6.2.2.2.1.1.3.

8.6.2.2.2.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.14.2, and 9.1.14.4, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than TIdentify\_Inter defined in clause 8.6.2.2.2.1.When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period TIdentify\_Inter\_SCE defined in clause 8.6.2.2.2.1 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TMeasurement\_Period inter\_TDD\_CRS defined in clause 8.6.2.2.2.1 provided the timing to that cell has not changed more than ± 50 Ts while measurementgap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.6.2.2.2.2 E-UTRAN TDD – TDD inter frequency measurements when DRX is used

When DRX is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable E-UTRAN TDD inter frequency cell within Tidentify\_inter\_SCE\_DRX

Tidentify\_inter\_SCE\_DRX = 17 \* *Max* { TDMTC\_periodicity, DRX cycle length, MGRP} \*Nfreq +TMeasurement\_Period\_inter\_TDD\_CRS\_DRX

A cell shall be considered detectable when

- RSRP related side conditions given in Clause 9.1.14.2 and RSRQ related side conditions given in Sections 9.1.14.4 are fulfilled,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.11 for a corresponding Band

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer.

TMeasurement\_Period\_inter\_TDD\_CRS\_DRX is the inter-frequency period for measurements as shown in Table 8.6.2.2.2.2-1. *Nfreq* is defined in clause 8.1.2.1.1.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period intra\_TDD\_CRS\_DRX when DRX is used. If higher layer filtering is used, an additional cell identification delay can be expected.

The UE shall be capable of performing RSRP and RSRQ measurements of at least 3 identified inter-frequency cells per TDD inter-frequency for up to 3 TDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period defined in table 8.6.2.2.2.2-1 when DRX is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps.

Table 8.6.2.2.2.2-1: Requirement to measure TDD interfrequency cell

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth[RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | TMeasurement\_Period inter\_TDD\_CRS\_DRX [ms] |
| 6 | ≥2 | 5 \* *Max*{ TDMTC\_periodicity, DRX cycle length,MGRP}\**Nfreq* |
| 25 | ≥2 | 3 \* *Max*{ TDMTC\_periodicity, DRX cycle length,MGRP}\**Nfreq* |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.14.2, and the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.14.4.

8.6.2.2.2.2.1 Measurement Reporting Requirements

8.6.2.2.2.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.14.2, and 9.1.14.4, respectively.

8.6.2.2.2.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.14.2, and 9.1.14.4, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.6.2.2.2.2.1.3.

8.6.2.2.2.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.14.2, and 9.1.14.4, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than TIdentify\_Inter defined in clause 8.6.2.2.2.2.When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_SCE\_DRX defined in clause 8.6.2.2.2.2 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_inter\_TDD\_CRS\_DRX defined in clause 8.6.2.2.2.2 provided the timing to that cell has not changed more than ± 50 Ts while measurementgap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.6.2.2.3 E-UTRAN TDD – FDD inter frequency measurements

8.6.2.2.3.1 E-UTRAN TDD – FDD inter frequency measurements when no DRX is used

The requirements in this clause shall apply to UE supporting FDD and TDD.

The requirements in clause 8.6.2.2.1.1 also apply for this section.

8.6.2.2.3.2 E-UTRAN TDD – FDD inter frequency measurements when DRX is used

The requirements in this clause shall apply to UE supporting FDD and TDD.

The requirements in clause 8.6.2.2.1.2 also apply for this section.

##### 8.6.2.2.4 E-UTRAN FDD – TDD inter frequency measurements

8.6.2.2.4.1 E-UTRAN FDD – TDD inter frequency measurements when no DRX is used

The requirements in this clause shall apply to UE supporting FDD and TDD.

The requirements in clause 8.6.2.2.2.1 also apply for this section.

8.6.2.2.4.2 E-UTRAN FDD – TDD inter frequency measurements when DRX is used

The requirements in this clause shall apply to UE supporting FDD and TDD.

The requirements in clause 8.6.2.2.2.2 also apply for this section.

### 8.6.3 Requirements for CSI-RS based discovery signal measurements

#### 8.6.3.1 E-UTRAN intra frequency measurements

The UE shall be able to identify new intra-frequency TPs and perform CSI-RSRP measurements of intra-frequency TPs with an explicit intra-frequency TP list containing physical layer cell identities. During the RRC\_CONNECTED state the UE shall continuously measure identified intra frequency TPs and additionally search for and identify new intra frequency TPs.

The UE capable of SRS carrier based switching when configured to perform SRS transmission and/or RACH transmission over one or more SCells without PUSCH shall meet the requirements defined in Section 8.6.3.1 provided the following condition is met:

- minimum number of configured discovery signal occasions containing CSI-RS based discovery signal as specified in section 8.6.3.1 is available for measurements at the UE in the measurement cell.

##### 8.6.3.1.1 E-UTRAN FDD intra frequency measurements

8.6.3.1.1.1 E-UTRAN FDD intra frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify a new detectable FDD intra frequency TP within Tidentify\_intra\_TP\_SCE,

Tidentify\_intra\_TP\_SCE = Tidentify\_intra\_SCE + TMeasurement\_Period \_intra\_FDD\_CSI-RS

A TP shall be considered detectable when

- CSI-RSRP related side conditions given in Sections 9.1.14.3 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.10 for a corresponding Band

Tidentify\_intra\_SCE is the intra-frequency period for cell identification in section 8.6.2.1.1.1. TMeasurement\_Period \_intra\_FDD\_CSI-RS is the intra-frequency period for TP measurement as shown in table 8.6.3.1.1.1-1.

Identification of a TP shall include identification of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period\_intra\_FDD\_CSI-RS when no DRX is used. If higher layer filtering is used, an additional TP identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is TMeasurement\_Period\_intra\_FDD\_CSI-RS as shown in table 8.6.3.1.1.1-1, when no DRX is in use. The UE shall be capable of performing CSI-RSRP measurements for 3 identified intra-frequency TPs, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of TMeasurement\_Period\_intra\_FDD\_CSI-RS

Table 8.6.3.1.1.1-1: Requirement to measure FDD intra frequency TP

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth [RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | TMeasurement\_Period \_intra\_FDD\_CSI-RS [ms] |
| ≥ 6 | ≥1 | 5\* TDMTC\_periodicity |
| ≥ 25 | ≥1 | 3\* TDMTC\_periodicity |

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer.

The CSI-RSRP measurement accuracy for all measured TPs shall be as specified in the sub-clauses 9.1.14.3.

8.6.3.1.1.1.1 Measurement Reporting Requirements

8.6.3.1.1.1.1.1 Periodic Reporting

Reported CSI-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.14.3.

8.6.3.1.1.1.1.2 Event-triggered Periodic Reporting

Reported CSI-RSRP measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.14.3.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.6.3.1.1.1.1.3.

8.6.3.1.1.1.1.3 Event Triggered Reporting

Reported CSI-RSRP measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.14.3.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_intra\_TP\_SCE defined in Clause 8.6.3.1.1.1.When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a TP which has been detectable at least for the time period Tidentify\_intra\_TP\_SCE defined in clause 8.6.3.1.1.1 becomes undetectable for a period ≤ 5 seconds and then the TP becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period \_intra\_FDD\_CSI-RS provided the timing to that TP has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.6.3.1.1.2 E-UTRAN FDD intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable FDD intra frequency TP within Tidentify\_intra\_TP\_SCE\_DRX.

Tidentify\_intra\_TP\_SCE\_DRX = Tidentify\_intra\_SCE\_DRX + TMeasurement\_Period \_intra\_FDD\_CSI-RS\_DRX

A TP shall be considered detectable when

- CSI-RSRP related side conditions given in Sections 9.1.14.3 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.10 for a corresponding Band

Tidentify\_intra\_SCE\_DRX is the intra-frequency period for cell identification in section 8.6.2.1.1.2. TMeasurement\_Period \_intra\_FDD\_CSI-RS\_DRX is the intra-frequency period for TP measurement as shown in table 8.6.3.1.1.2-1.

Identification of a TP shall include identification of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period\_intra\_FDD\_CSI-RS\_DRX when DRX is used. If higher layer filtering is used, an additional TP identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is TMeasurement\_Period \_intra\_FDD\_CSI-RS\_DRX as shown in table 8.6.3.1.1.2-1, when DRX is in use. The UE shall be capable of performing CSI-RSRP measurements for 3 identified intra-frequency TPs, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of TMeasurement\_Period \_intra\_FDD\_ CSI-RS\_DRX.

Table 8.6.3.1.1.2-1: Requirement to measure FDD intra frequency TP

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth [RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | TMeasurement\_Period intra\_FDD\_ CSI-RS\_DRX [ms] |
| ≥ 6 | ≥1 | 5\**Max*{TDMTC\_periodicity, DRX cycle length} |
| ≥ 25 | ≥1 | 3\**Max*{TDMTC\_periodicity, DRX cycle length} |

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer.

The CSI-RSRP measurement accuracy for all measured TPs shall be as specified in the sub-clauses 9.1.14.3.

8.6.3.1.1.2.1 Measurement Reporting Requirements

8.6.3.1.1.2.1.1 Periodic Reporting

Reported CSI-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.14.3.

8.6.3.1.1.2.1.2 Event-triggered Periodic Reporting

Reported CSI-RSRP measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.14.3.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.6.3.1.1.2.1.3.

8.6.3.1.1.2.1.3 Event Triggered Reporting

Reported CSI-RSRP measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.14.3.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_intra\_TP\_SCE\_DRX defined in Clause 8.6.3.1.1.2.When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a TP which has been detectable at least for the time period Tidentify\_intra\_TP\_SCE\_DRX defined in clause 8.6.3.1.1.2 becomes undetectable for a period ≤ 5 seconds and then the TP becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period \_intra\_FDD\_CSI-RS\_DRX provided the timing to that TP has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.6.3.1.2 E-UTRAN TDD intra frequency measurements

8.6.3.1.2.1 E-UTRAN TDD intra frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify a new detectable TDD intra frequency TP within Tidentify\_intra\_TP\_SCE,

Tidentify\_intra\_TP\_SCE = Tidentify\_intra\_SCE + TMeasurement\_Period \_intra\_TDD\_CSI-RS

A TP shall be considered detectable when

- CSI-RSRP related side conditions given in Sections 9.1.14.3 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.10 for a corresponding Band

Tidentify\_intra\_SCE is the intra-frequency period for cell identification in section 8.6.2.1.2.1. TMeasurement\_Period \_intra\_TDD\_CSI-RS is the intra-frequency period for TP measurement as shown in table 8.6.3.1.2.1-1.

Identification of a TP shall include identification of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period\_intra\_TDD\_CSI-RS when no DRX is used. If higher layer filtering is used, an additional TP identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is TMeasurement\_Period \_intra\_TDD\_CSI-RS as shown in table 8.6.3.1.2.1-1, when no DRX is in use. The UE shall be capable of performing measurements for 3 identified intra-frequency TPs, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of TMeasurement\_Period \_intra\_TDD\_ CSI-RS

Table 8.6.3.1.2.1-1: Requirement to measure TDD intra frequency TP

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth [RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | TMeasurement\_Period \_intra\_TDD\_CSI-RS [ms] |
| ≥ 6 | ≥2 | 5\* TDMTC\_periodicity |
| ≥ 25 | ≥2 | 3\* TDMTC\_periodicity |

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer.

The CSI-RSRP measurement accuracy for all measured TPs shall be as specified in the sub-clauses 9.1.14.3.

8.6.3.1.2.1.1 Measurement Reporting Requirements

8.6.3.1.2.1.1.1 Periodic Reporting

Reported CSI-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.14.3.

8.6.3.1.2.1.1.2 Event-triggered Periodic Reporting

Reported CSI-RSRP measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.14.3.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.6.3.1.2.1.1.3.

8.6.3.1.2.1.1.3 Event Triggered Reporting

Reported CSI-RSRP measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.14.3.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report. When L3 filtering is used or IDC autonomous denial is configured or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_intra\_TP\_SCE defined in Clause 8.6.3.1.2.1.When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a TP which has been detectable at least for the time period Tidentify\_intra\_TP\_SCE defined in clause 8.6.3.1.2.1 becomes undetectable for a period ≤ 5 seconds and then the TP becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period \_intra\_TDD\_CSI-RS provided the timing to that TP has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.6.3.1.2.2 E-UTRAN TDD intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable TDD intra frequency TP within Tidentify\_intra\_TP\_SCE\_DRX.

Tidentify\_intra\_TP\_SCE\_DRX = Tidentify\_intra\_SCE\_DRX + TMeasurement\_Period \_intra\_TDD\_CSI-RS\_DRX

A TP shall be considered detectable when

- CSI-RSRP related side conditions given in Sections 9.1.14.3 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.10 for a corresponding Band

Tidentify\_intra\_SCE\_DRX is the intra-frequency period for cell identification as shown in section 8.6.2.1.2.2. TMeasurement\_Period\_intra\_TDD\_CSI-RS\_DRX is the intra-frequency period for TP measurement as shown in table 8.6.3.1.2.2-1.

Identification of a TP shall include identification of the cell and additionally performing a single measurement with measurement period of TMeasurement\_Period\_intra\_TDD\_CSI-RS\_DRX when DRX is used. If higher layer filtering is used, an additional TP identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is TMeasurement\_Period \_intra\_TDD\_CSI-RS\_DRX as shown in table 8.6.3.1.2.2-1, when DRX is in use. The UE shall be capable of performing CSI-RSRP measurements for 3 identified intra-frequency TPs, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of TMeasurement\_Period \_intra\_TDD\_ CSI-RS\_DRX

Table 8.6.3.1.2.2-1: Requirement to measure TDD intrafrequency TP

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth [RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | TMeasurement\_Period intra\_TDD\_ CSI-RS\_DRX [ms] |
| ≥ 6 | ≥2 | 5\**Max*{TDMTC\_periodicity, DRX cycle length} |
| ≥ 25 | ≥2 | 3\**Max*{TDMTC\_periodicity, DRX cycle length} |

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer.

The CSI-RSRP measurement accuracy for all measured TPs shall be as specified in the sub-clauses 9.1.14.3.

8.6.3.1.2.2.1 Measurement Reporting Requirements

8.6.3.1.2.2.1.1 Periodic Reporting

Reported CSI-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.14.3.

8.6.3.1.2.2.1.2 Event-triggered Periodic Reporting

Reported CSI-RSRP measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.14.3.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.6.3.1.2.2.1.3.

8.6.3.1.2.2.1.3 Event Triggered Reporting

Reported CSI-RSRP measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.14.3.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_intra\_TP\_SCE\_DRX defined in Clause 8.6.3.1.2.2.When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a TP which has been detectable at least for the time period Tidentify\_intra\_TP\_SCE\_DRX defined in clause 8.6.3.1.2.2 becomes undetectable for a period ≤ 5 seconds and then the TP becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period \_intra\_TDD\_CSI-RS\_DRX provided the timing to that TP has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

#### 8.6.3.2 E-UTRAN inter frequency measurements

The UE shall be able to identify new inter-frequency TPs and perform CSI-RSRP measurements of inter-frequency TP with an explicit inter-frequency TP list containing physical layer cell identities. The discovery signal occasion and the measurement gap should be aligned, provided that also the following additional conditions are fulfilled:

Entire discovery signal occasion should be contained in the measurement gap.

The subframe contained discovery signal for the measurement is not overlapped with the first 0.5ms period and the last 0.5ms period in every gap.

The UE capable of SRS carrier based switching when configured to perform SRS transmission and/or RACH transmission over one or more SCells without PUSCH shall meet the requirements defined in Section 8.6.3.2 provided the following condition is met:

- minimum number of configured discovery signal occasions containing CSI-RS based discovery signal as specified in section 8.6.3.2 is available for measurements at the UE in the measurement cell.

##### 8.6.3.2.1 E-UTRAN FDD – FDD inter frequency measurements

8.6.3.2.1.1 E-UTRAN FDD – FDD inter frequency measurements when no DRX is used

When measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new FDD inter-frequency TP within Tidentify\_inter\_TP\_SCE according to the following expression:

Tidentify\_inter\_TP\_SCE = Tidentify\_Inter\_SCE + TMeasurement\_Period \_inter\_FDD\_CSI-RS

A TP shall be considered detectable when

- CSI-RSRP related side conditions given in Sections 9.1.14.3 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.11 for a corresponding Band

Tidentify\_inter\_SCE is the inter-frequency period for cell identification as shown in section 8.6.2.2.1.1. *Nfreq* is defined in clause 8.1.2.1.1. TMeasurement\_Period \_inter\_FDD\_CSI-RS is the inter-frequency period for TP measurement as shown in table 8.6.3.2.1.1-1.

When measurement gaps are scheduled for FDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting CSI-RSRP measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.14.3, with measurement period given by table 8.6.3.2.1.1-1.

The UE shall be capable of performing CSI-RSRP measurements of at least 3 identified inter-frequency TPs per FDD inter-frequency for up to 3 FDD inter-frequencies and the UE physical layer shall be capable of reporting CSI-RSRP measurements to higher layers with the measurement period defined in table 8.6.3.2.1.1-1 when no DRX is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps.

Table 8.6.3.2.1.1-1: Requirement to measure FDD inter frequency TP

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth [RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | TMeasurement\_Period inter\_FDD\_ CSI-RS [ms] |
| ≥ 6 | ≥1 | 5\**Max*{TDMTC\_periodicity, MGRP }\**Nfreq* |
| ≥ 25 | ≥1 | 3\**Max*{TDMTC\_periodicity, MGRP }\**Nfreq* |

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer.

The CSI-RSRP measurement accuracy for all measured TPs shall be as specified in the sub-clauses 9.1.14.3.

8.6.3.2.1.1.1 Measurement Reporting Requirements

8.6.3.2.1.1.1.1 Periodic Reporting

Reported CSI-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.14.3.

8.6.3.2.1.1.1.2 Event-triggered Periodic Reporting

Reported CSI-RSRP measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.14.3.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.6.3.2.1.1.1.3.

8.6.3.2.1.1.1.3 Event Triggered Reporting

Reported CSI-RSRP measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.14.3.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_inter\_TP\_SCE defined in Clause 8.6.3.2.1.1.When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a TP which has been detectable at least for the time period Tidentify\_inter\_TP\_SCEdefined in clause  8.6.3.2.1.1 becomes undetectable for a period ≤ 5 seconds and then the TP becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period \_inter\_FDD\_CSI-RS provided the timing to that TP has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.6.3.2.1.2 E-UTRAN FDD – FDD inter frequency measurements when DRX is used

When DRX is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable E-UTRAN FDD inter frequency TP within Tidentify\_inter\_TP\_SCE\_DRX according to the following expression:

Tidentify\_inter\_TP\_SCE\_DRX = Tidentify\_inter\_SCE\_DRX + TMeasurement\_Period\_inter\_FDD\_CSI-RS\_DRX

A TP shall be considered detectable when

- CSI-RSRP related side conditions given in Sections 9.1.14.3 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.11 for a corresponding Band

Tidentify\_inter\_SCE\_DRX is the inter-frequency period for cell identification as shown in section 8.6.2.2.1.2. *Nfreq* is defined in clause 8.1.2.1.1. TMeasurement\_Period\_inter\_FDD\_CSI-RS\_DRX is the inter-frequency period for TP measurement as shown in table 8.6.3.2.1.2-1.

When measurement gaps are scheduled for FDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting CSI-RSRP measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.14.3, with measurement period given by table 8.6.3.2.1.2-1.

The UE shall be capable of performing CSI-RSRP measurements of at least 3 identified inter-frequency TPs per FDD inter-frequency for up to 3 FDD inter-frequencies and the UE physical layer shall be capable of reporting CSI-RSRP measurements to higher layers with the measurement period defined in table 8.6.3.2.1.2-1 when DRX is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps.

Table 8.6.3.2.1.2-1: Requirement to measure FDD inter frequency TP

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth [RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | TMeasurement\_Period inter\_FDD\_ CSI-RS\_DRX [ms] |
| ≥ 6 | ≥1 | 5\**Max*{TDMTC\_periodicity, DRX cycle length, MGRP}\**Nfreq* |
| ≥ 25 | ≥1 | 3\**Max*{TDMTC\_periodicity, DRX cycle length, MGRP}\**Nfreq* |

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer.

The CSI-RSRP measurement accuracy for all measured TPs shall be as specified in the sub-clauses 9.1.14.3.

8.6.3.2.1.2.1 Measurement Reporting Requirements

8.6.3.2.1.2.1.1 Periodic Reporting

Reported CSI-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.14.3 respectively.

8.6.3.2.1.2.1.2 Event-triggered Periodic Reporting

Reported CSI-RSRP measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.14.3.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.6.3.2.1.2.1.3.

8.6.3.2.1.2.1.3 Event Triggered Reporting

Reported CSI-RSRP measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.14.3.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_inter\_TP\_SCE\_DRX defined in clause 8.6.3.2.1.2.When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a TP which has been detectable at least for the time period Tidentify\_inter\_TP\_SCE\_DRX defined in clause 8.6.3.2.1.2 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_inter\_FDD\_CSI-RS\_DRX provided the timing to that TP has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.6.3.2.2 E-UTRAN TDD – TDD inter frequency measurements

8.6.3.2.2.1 E-UTRAN TDD – TDD inter frequency measurements when no DRX is used

When measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new TDD inter-frequency TP within Tidentify\_inter\_TP\_SCE according to the following expression:

Tidentify\_inter\_TP\_SCE = Tidentify\_inter\_SCE + TMeasurement\_Period \_inter\_TDD\_CSI-RS

A TP shall be considered detectable when

- CSI-RSRP related side conditions given in Sections 9.1.14.3 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.11 for a corresponding Band

Tidentify\_inter\_SCE is the inter-frequency period for cell identification as shown in section 8.6.2.2.2.1. *Nfreq* is defined in clause 8.1.2.1.1. TMeasurement\_Period \_inter\_TDD\_CSI-RS is the inter-frequency period for TP measurement as shown in table 8.6.3.2.2.1-1.

When measurement gaps are scheduled for TDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.14.3, with measurement period given by table 8.6.3.2.2.1-1.

The UE shall be capable of performing CSI-RSRP measurements of at least 3 identified inter-frequency TP per TDD inter-frequency for up to 3TDD inter-frequencies and the UE physical layer shall be capable of reporting CSI-RSRP measurements to higher layers with the measurement period defined in table 8.6.3.2.2.1-1 when no DRX is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps.

Table 8.6.3.2.2.1-1: Requirement to measure TDD inter frequency TP

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth [RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | TMeasurement\_Period inter\_TDD\_ CSI-RS [ms] |
| ≥ 6 | ≥2 | 5\**Max*{TDMTC\_periodicity, MGRP}\**Nfreq* |
| ≥ 25 | ≥2 | 3\**Max*{TDMTC\_periodicity, MGRP }\**Nfreq* |

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer.

The CSI-RSRP measurement accuracy for all measured TPs shall be as specified in the sub-clauses 9.1.14.3.

8.6.3.2.2.1.1 Measurement Reporting Requirements

8.6.3.2.2.1.1.1 Periodic Reporting

Reported CSI-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.14.3.

8.6.3.2.2.1.1.2 Event-triggered Periodic Reporting

Reported CSI-RSRP measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.14.3.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.6.3.2.2.1.1.3.

8.6.3.2.2.1.1.3 Event Triggered Reporting

Reported CSI-RSRP measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.14.3.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_inter\_TP\_SCE defined in clause 8.6.3.2.2.1.When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a TP which has been detectable at least for the time period Tidentify\_inter\_TP\_SCE defined in clause 8.6.3.2.2.1 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TMeasurement\_Period \_inter\_TDD\_CSI-RS provided the timing to that TP has not changed more than ± 50 Ts while measurementgap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.6.3.2.2.2 E-UTRAN CSI-RS based TDD – TDD inter frequency measurements when DRX is used

When DRX is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable E-UTRAN TDD inter frequency TP within Tidentify\_inter\_TP\_SCE\_DRX according to the following expression:

Tidentify\_inter\_TP\_SCE\_DRX = Tidentify\_inter\_SCE\_DRX + TMeasurement\_Period \_inter\_TDD\_CSI-RS\_DRX

A TP shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.14.3 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.11 for a corresponding Band

Tidentify\_inter\_SCE\_DRX is the inter-frequency period for cell identification as shown in section 8.6.2.2.2.2. *Nfreq* is defined in clause 8.1.2.1.1. TMeasurement\_Period \_inter\_TDD\_CSI-RS\_DRX is the inter-frequency period for TP measurement as shown in table 8.6.3.2.2.2-1.

When measurement gaps are scheduled for TDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting CSI-RSRP measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.14.3, with measurement period given by table 8.6.3.2.2.2-1.

The UE shall be capable of performing CSI-RSRP measurements of at least 3 identified inter-frequency TPs per TDD inter-frequency for up to 3 TDD inter-frequencies and the UE physical layer shall be capable of reporting CSI-RSRP measurements to higher layers with the measurement period defined in table 8.6.3.2.2.2-1 when DRX is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps.

Table 8.6.3.2.2.2-1: Requirement to measure TDD inter frequency TP

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth [RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | TMeasurement\_Period inter\_TDD\_ CSI-RS\_DRX [ms] |
| ≥ 6 | ≥2 | 5\**Max*{TDMTC\_periodicity, DRX cycle length, MGRP}\**Nfreq* |
| ≥ 25 | ≥2 | 3\**Max*{TDMTC\_periodicity, DRX cycle length, MGRP}\**Nfreq* |

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer.

The CSI-RSRP measurement accuracy for all measured TPs shall be as specified in the sub-clauses 9.1.14.3.

8.6.3.2.2.2.1 Measurement Reporting Requirements

8.6.3.2.2.2.1.1 Periodic Reporting

Reported CSI-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.14.3.

8.6.3.2.2.2.1.2 Event-triggered Periodic Reporting

Reported CSI-RSRP measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.14.3.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.6.3.2.2.2.1.3.

8.6.3.2.2.2.1.3 Event Triggered Reporting

Reported CSI-RSRP measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.14.3.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_inter\_TP\_SCE\_DRX defined in Clause 8.6.3.2.2.2.When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a TP which has been detectable at least for the time period Tidentify\_inter\_TP\_SCE\_DRX in clause 8.6.3.2.2.2 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TMeasurement\_Period \_inter\_TDD\_CSI-RS\_DRX provided the timing to that TP has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.6.3.2.3 E-UTRAN TDD – FDD inter frequency measurements

8.6.3.2.3.1 E-UTRAN TDD – FDD inter frequency measurements when no DRX is used

The requirements in this clause shall apply to UE supporting FDD and TDD.

The requirements in clause 8.6.3.2.1.1 also apply for this section.

8.6.3.2.3.2 E-UTRAN TDD – FDD inter frequency measurements when DRX is used

The requirements in this clause shall apply to UE supporting FDD and TDD.

The requirements in clause 8.6.3.2.1.2 also apply for this section.

##### 8.6.3.2.4 E-UTRAN FDD – TDD inter frequency measurements

8.6.3.2.4.1 E-UTRAN FDD – TDD inter frequency measurements when no DRX is used

The requirements in this clause shall apply to UE supporting FDD and TDD.

The requirements in clause 8.6.3.2.2.1 also apply for this section.

8.6.3.2.4.2 E-UTRAN FDD – TDD inter frequency measurements when DRX is used

The requirements in this clause shall apply to UE supporting FDD and TDD.

The requirements in clause 8.6.3.2.2.2 also apply for this section.

## 8.7 Discovery signal measurements for E-UTRA carrier aggregation

### 8.7.1 Introduction

Requirements in this clause are applicable to UE supporting E-UTRA FDD, E-UTRA TDD and/or E-UTRA TDD-FDD carrier aggregation.

Non configured frequencies may be measured with measurement gaps according to the requirements in clause 8.6.2.2 and clause 8.6.3.2 (E-UTRAN CRS based inter frequency measurements and E-UTRAN CSI-RS based inter frequency measurements).

### 8.7.2 Requirements for CRS based discovery signal measurements for E-UTRA carrier aggregation

#### 8.7.2.1 Measurements of the primary component carrier

CRS based measurements of cells on the primary component carrier shall meet all applicable requirements (FDD or TDD) in clause 8.6.2.1.

#### 8.7.2.2 Measurements of a secondary component carrier

A Secondary component carrier may be activated and deactivated by MAC-CE commands as specified in [17]. The applicable performance requirements depend on whether the SCell on the corresponding frequency is actived or deactivated.

#### 8.7.2.3 Measurements of a secondary component carrier with active SCell

When the SCell is activated, measurement performance requirements for the frequency are those given in clause 8.6.2.1. If common DRX is in use, then the requirements for that secondary component carrier are given by the applicable DRX requirements (FDD or TDD) in clause 8.6.2.1 , otherwise the non DRX requirements are applicable. The applicable measurement accuracy requirements are in clause 9.1.15.

#### 8.7.2.4 Measurements of a secondary component carrier with deactivated SCell

This clause defines the measurement requirements of a secondary component carrier with deactivated SCell based on the parameter *measCycleSCell* defined in TS 36.331 [2].

##### 8.7.2.4.1 E-UTRAN secondary component carrier measurements when no common DRX is used

When no DRX is in use the UE shall be able to identify a new detectable FDD or TDD cell on a secondary component carrier within Tidentify\_scc\_SCE, according to the parameter *measCycleSCell* where Tidentify\_scc\_CRS = 13 \**measCycleSCell*+ Tmeasure\_scc\_CRS

A cell shall be considered detectable when

- RSRP related side condition given in Clause 9.1.15 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.10 for a corresponding Band

The measurement period for deactivated scell measurements is Tmeasure\_scc\_CRS according to the parameter *measCycleSCell* shown in Tables 8.7.2.4.1-1 and 8.7.2.4.1-2.

The UE capable of SRS carrier based switching when configured to perform SRS transmission and/or PRACH transmission over one or more SCells without PUSCH shall meet the requirements defined in Section 8.7.2.4.1 provided the following condition is met:

- minimum number of configured discovery signal occasions containing CRS based discovery signal as specified in section 8.7.2.4.1 are available for measurements at the UE in the measurement cell.

Table 8.7.2.4.1-1: Requirement to measure intra frequency cell on FDD SCC with deactivated SCell

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth[RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | Tmeasure\_scc\_CRS [ms] |
| 6 | ≥1 | 5\* *measCycleSCell* |
| 25 | ≥1 | 3 \* *measCycleSCell* |

Table 8.7.2.4.1-2: Requirement to measure intra frequency cell on TDD SCC with deactivated SCell

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth [RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | Tmeasure\_scc\_CRS [ms] |
| 6 | ≥2 | 5\* *measCycleSCell* |
| 25 | ≥2 | 3 \* *measCycleSCell* |

The UE shall be capable of performing RSRP and RSRQ measurements for 3 identified cells on a secondary component carrier, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_scc\_CRS.

The measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.15.

A UE may reconfigure the receiver bandwidth or turn on/off one of the RF chains when performing measurements on up to six SCCs with deactivated SCell. This may cause interruptions on PCell or activated SCell(s) or both that are specified in Section 7.8.

8.7.2.4.1.1 Measurement Reporting Requirements

8.7.2.4.1.1.1 Periodic Reporting

Reported measurements contained in periodically triggered measurement reports shall meet the requirements in clause 9.

8.7.2.4.1.1.2 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic CRS based measurement reporting shall meet the requirements specified in clause 8.7.2.4.1.1.3.

8.7.2.4.1.1.3 Event Triggered Reporting

Reported measurements contained in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which is caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_scc\_CRS defined in Clause 8.7.2.4.1. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_scc\_SCE defined in clause 8.7.2.4.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_scc\_CRS provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.7.2.4.2 E-UTRAN secondary component carrier measurements when common DRX is used

When DRX is in use the UE shall be able to identify a new detectable FDD or TDD cell on a secondary component carrier within Tidentify\_scc, according to the parameter *measCycleSCell* where Tidentify\_scc\_SCE\_DRX = 17\**Max*(*measCycleSCell*, DRX cycle length)+Tmeasure\_scc\_CRS\_DRX.

A cell shall be considered detectable when

- RSRP related side condition given in Clause 9.1.15 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.10 for a corresponding Band

The measurement period for deactivated scell measurements is Tmeasure\_scc\_CRS\_DRX according to the parameter *measCycleSCell* shown in Tables 8.7.2.4.2-1 and 8.7.2.4.2-2.

The UE capable of SRS carrier based switching when configured to perform SRS transmission and/or PRACH transmission over one or more SCells without PUSCH shall meet the requirements defined in Section 8.7.2.4.2 provided the following condition is met:

- -minimum number of configured discovery signal occasions containing CRS based discovery signal as specified in section 8.7.2.4.2 are available for measurements at the UE in the measurement cell.

Table 8.7.2.4.2-1: Requirement to measure intrafrequency cell on FDD SCC with deactivated SCell

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth[RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | Tmeasure\_scc\_CRS\_DRX [ms] |
| 6 | ≥1 | 5\* *Max*{ *measCycleSCell*, DRX cycle length } |
| 25 | ≥1 | 3 \* *Max*{ *measCycleSCell*, DRX cycle length } |

Table 8.7.2.4.2-2: Requirement to measure intrafrequency cell on TDD SCC with deactivated SCell

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth[RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | Tmeasure\_scc\_CRS\_DRX [ms] |
| 6 | ≥2 | 5\* *Max*{ *measCycleSCell*, DRX cycle length } |
| 25 | ≥2 | 3 \* *Max*{ *measCycleSCell*, DRX cycle length } |

The UE shall be capable of performing RSRP and RSRQ measurements for 3 identified cells on a secondary component carrier, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_scc\_CRS\_DRX.

The measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.15.

A UE may reconfigure receiver bandwidth taking into account the SCell activation/deactivation status, and when making measurements of cells on up to six SCCs with deactivated SCell. This may cause interruptions (packet drops) to a PCell or activated SCell(s) or both when the PCell and the SCell belong to the same frequency band. No interruptions while the On Duration timer is running shall be allowed when common DRX is used. The requirement considers only interruptions due to reconfiguration of the receiver bandwidth, and not due to other causes such as RF impairments or channel conditions.

8.7.2.4.2.1 Measurement Reporting Requirements

8.7.2.4.2.1.1 Periodic Reporting

Reported measurements contained in periodically triggered measurement reports shall meet the requirements in clause 9.

8.7.2.4.2.1.2 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.7.2.4.2.1.3.

8.7.2.4.2.1.3 Event Triggered Reporting

Reported measurements contained in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered CRS based measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which is caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_scc\_CRS defined in Clause 8.7.2.4.2. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_scc\_SCE\_DRX defined in clause 8.7.2.4.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_scc\_CRS\_DRX provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

### 8.7.3 Requirements for CSI-RS based discovery signal measurements for E-UTRA carrier aggregation

#### 8.7.3.1 Measurements of the primary component carrier

Measurements of cells on the primary component carrier shall meet all applicable requirements (FDD or TDD) in clause 8.6.3.1.

#### 8.7.3.2 Measurements of a secondary component carrier

A Secondary component carrier may be activated and deactivated by MAC-CE commands as specified in [17]. The applicable performance requirements depend on whether the SCell on the corresponding frequency is actived or deactivated.

#### 8.7.3.3 Measurements of a secondary component carrier with active SCell

When the SCell is activated, measurement performance requirements for the frequency are those given in clause 8.6.3.1. If common DRX is in use, then the requirements for that secondary component carrier are given by the applicable DRX requirements (FDD or TDD) in clause 8.6.3.1 , otherwise the non DRX requirements are applicable. The applicable measurement accuracy requirements are in clause 9.1.15.

#### 8.7.3.4 Measurements of a secondary component carrier with deactivated SCell

This clause defines the measurement requirements of a secondary component carrier with deactivated SCell based on the parameter *measCycleSCell* defined in TS 36.331 [2].

##### 8.7.3.4.1 E-UTRAN secondary component carrier measurements when no common DRX is used

When no DRX is in use the UE shall be able to identify a new detectable FDD or TDD TP on a secondary component carrier within Tidentify\_scc\_TP\_SCE, according to the parameter *measCycleSCell*, where Tidentify\_scc\_TP\_SCE = Tidentify\_scc\_SCE + Tmeasure\_scc\_CSI-RS,

A cell shall be considered detectable when

- CSI-RSRP related side condition given in Clause 9.1.15 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.10 for a corresponding Band

Tidentify\_scc\_SCE is the intra-frequency period for cell identification in section 8.7.2.4.1. Tmeasure\_scc\_CSI-RS is the intra-frequency period for TP measurement in table 8.7.3.4.1-1.

The measurement period for deactivated scell measurements is Tmeasure\_scc\_CSI-RS according to the parameter *measCycleSCell* as shown in tables 8.7.3.4.1-1 and 8.7.3.4.1-2.

The UE capable of SRS carrier based switching when configured to perform SRS transmission and/or RACH transmission over one or more SCells without PUSCH shall meet the requirements defined in Section 8.7.3.4.1 provided the following condition is met:

- minimum number of configured discovery signal occasions containing CSI-RS based discovery signal as specified in section 8.7.3.4.1 is available for measurements at the UE in the measurement cell.

Table 8.7.3.4.1-1: Requirement to measure intra frequency TP on FDD SCC with deactivated SCell

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth [RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | Tmeasure\_scc\_CSI-RS [ms] |
| ≥ 6 | ≥1 | 5\* *measCycleSCell* |
| ≥ 25 | ≥1 | 3\* *measCycleSCell* |

Table 8.7.3.4.1-2: Requirement to measure intra frequency TP on TDD SCC with deactivated SCell

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth [RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | Tmeasure\_scc\_CSI-RS [ms] |
| ≥ 6 | ≥2 | 5\* *measCycleSCell* |
| ≥ 25 | ≥2 | 3\* *measCycleSCell* |

The UE shall be capable of performing RSRP measurements for 3 identified TPs on a secondary component carrier, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_scc\_CSI-RS.

The measurement accuracy for all measured TPs shall be as specified in the sub-clause 9.1.15.

A UE may reconfigure the receiver bandwidth or turn on/off one of the RF chains when performing measurements on up to six SCCs with deactivated SCell. This may cause interruptions on PCell or activated SCell(s) or both that are specified in Section 7.8.

8.7.3.4.1.1 Measurement Reporting Requirements

8.7.3.4.1.1.1 Periodic Reporting

Reported measurements contained in periodically triggered measurement reports shall meet the requirements in clause 9.

8.7.3.4.1.1.2 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.7.3.4.1.1.3.

8.7.3.4.1.1.3 Event Triggered Reporting

Reported measurements contained in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which is caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_scc\_TP\_SCE defined in Clause 8.7.3.4.1. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a TP which has been detectable at least for the time period Tidentify\_scc\_TP\_SCE defined in clause 8.7.3.4.1 becomes undetectable for a period ≤ 5 seconds and then the TP becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_scc\_CSI-RS provided the timing to that TP has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

##### 8.7.3.4.2 E-UTRAN secondary component carrier measurements when common DRX is used

When DRX is in use the UE shall be able to identify a new detectable FDD or TDD TP on a secondary component carrier within Tidentify\_scc\_TP\_SCE\_DRX, according to the parameter *measCycleSCell*, where Tidentify\_scc\_TP\_SC E\_DRX = Tidentify\_scc\_SCE\_DRX + Tmeasure\_scc\_CSI-RS\_DRX,

A cell shall be considered detectable when

- CSI-RSRP related side condition given in Clause 9.1.15 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.10 for a corresponding Band

Tidentify\_scc\_SCE\_DRX is the intra-frequency period for cell identification in section 8.7.2.4.2. Tmeasure\_scc\_CSI-RS\_DRX is the intra-frequency period for TP measurement in table 8.7.3.4.2-1.

The measurement period for deactivated scell measurements is Tmeasure\_scc\_CSI-RS\_DRX according to the parameter *measCycleSCell* as shown in tables 8.7.3.4.2-1 and 8.7.3.4.2-2.

The UE capable of SRS carrier based switching when configured to perform SRS transmission and/or RACH transmission over one or more SCells without PUSCH shall meet the requirements defined in Section 8.7.3.4.2 provided the following condition is met:

- minimum number of configured discovery signal occasions containing CSI-RS based discovery signal as specified in section 8.7.3.4.2 is available for measurements at the UE in the measurement cell.

Table 8.7.3.4.2-1: Requirement to measure intrafrequency TP on FDD SCC with deactivated SCell

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth [RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | Tmeasure\_scc\_CSI-RS\_DRX [ms] |
| ≥ 6 | ≥1 | 5\* max {*measCycleSCell*, DRX cycle length } |
| ≥ 25 | ≥1 | 3\* max {*measCycleSCell*, DRX cycle length } |

Table 8.7.3.4.2-2: Requirement to measure intrafrequency TP on TDD SCC with deactivated SCell

|  |  |  |
| --- | --- | --- |
| Measurement bandwidth [RB] | Discovery signal occasion duration (*ds-OccasionDuration*) [ms] | Tmeasure\_scc\_CSI-RS\_DRX [ms] |
| ≥ 6 | ≥2 | 5\* max {*measCycleSCell*, DRX cycle length } |
| ≥ 25 | ≥2 | 3\* max {*measCycleSCell*, DRX cycle length } |

The UE shall be capable of performing CSI-RSRP measurements for 3 identified TPs on a secondary component carrier, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_scc\_CSI-RS\_DRX.

The measurement accuracy for all measured TPs shall be as specified in the sub-clause 9.1.15.

A UE may reconfigure receiver bandwidth taking into account the SCell activation/deactivation status, and when making measurements of TPs on up to six SCCs with deactivated SCell. This may cause interruptions (packet drops) to a PCell or activated SCell(s) or both when the PCell and the SCell belong to the same frequency band. No interruptions while the On Duration timer is running shall be allowed when common DRX is used. The requirement considers only interruptions due to reconfiguration of the receiver bandwidth, and not due to other causes such as RF impairments or channel conditions.

8.7.3.4.2.1 Measurement Reporting Requirements

8.7.3.4.2.1.1 Periodic Reporting

Reported measurements contained in periodically triggered measurement reports shall meet the requirements in clause 9.

8.7.3.4.2.1.2 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.7.3.4.2.1.3.

8.7.3.4.2.1.3 Event Triggered Reporting

Reported measurements contained in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which is caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_scc\_TP\_SCE\_DRX defined in Clause 8.7.3.4.2. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a TP which has been detectable at least for the time period Tidentify\_scc\_TP\_SCE\_DRX defined in clause 8.7.3.4.2 becomes undetectable for a period ≤ 5 seconds and then the TP becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_scc\_CSI-RS\_DRX provided the timing to that TP has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

## 8.8 Measurements for E-UTRA dual connectivity

### 8.8.1 Introduction

This clause contains requirements for UE supporting E-UTRA dual connectivity. Requirements in this clause are applicable to UEs which have been configured with one SCell in either MCG or SCG and one PSCell for inter-band dual connectivity. Requirements in this clause are applicable to E-UTRA FDD, E-UTRA TDD and E-UTRA TDD-FDD dual connectivity.

The UE capable of SRS carrier based switching when configured to perform SRS transmission and/or RACH transmission over one or more SCells without PUSCH shall meet the requirements defined in Section 8.8 provided the following condition is met:

- at least DL subframe #0 or DL subframe #5 per radio frame is available for measurements at the UE in the measurement cell.

### 8.8.2 Intra-frequency measurements requirements on PCell

PCell intra-frequency measurements shall meet all applicable requirements in clause 8.1.2.2. If MCG DRX is in use, then the PCell intra-frequency requirements for when DRX is in use in clause 8.1.2.2 shall apply and shall depend on the MCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply. The applicable measurement accuracy requirements are in clause 9.1.

### 8.8.3 Intra-frequency measurements requirements on PSCell

PSCell starts with activated state upon configuration and cannot be deactivated. PSCell intra-frequency measurements shall meet all applicable requirements in clause 8.1.2.2. If SCG DRX is in use, then the PSCell intra-frequency requirements for when DRX is in use in clause 8.1.2.2 shall apply and shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply. The applicable measurement accuracy requirements are in clause 9.1.

### 8.8.4 Inter-frequency and inter-RAT measurement requirements

Inter-frequency measurements shall meet all applicable requirements in clause 8.1.2.3. If MCG DRX is in use, then the inter-frequency requirements for when DRX is in use in clause 8.1.2.3 shall apply and shall depend on the MCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply. The applicable measurement accuracy requirements are in clause 9.1.

Inter-RAT measurements shall meet all applicable requirements in clause 8.1.2.4. If MCG DRX is in use, then the inter-RAT requirements for when DRX is in use in clause 8.1.2.4 shall apply and shall depend on the MCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply. The applicable measurement accuracy requirements are in clause 9.2, 9.3, 9.4 and 9.5.

### 8.8.5 Intra-frequency measurements with autonomous gaps

#### 8.8.5.1 Identification of a new CGI of E-UTRA cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose ‘reportCGI’. The UE may make autonomous gaps in both MCG and SCG in downlink reception and uplink transmission for receiving MIB and SIB1 messages according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX is used or whether the SCell is configured, the UE shall be able to identify a new CGI of E-UTRA cell within:

ms

where

Tbasic\_identify\_CGI, intra = 150 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of an E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.2 for a corresponding Band

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided that the PBCH demodulation requirements in [5] are met.

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI,.intra is applicable when no DRX is used as well as when any of the DRX cycles specified in TS 36.331 [2] is used.

Within the time ms, over which the UE identifies the CGI of a new E-UTRA cell, the UE shall transmit at least a minimum number of ACK/NACKs on cells in MCG and SCG, respectively, as specified in Table 8.8.5.1-1. The requirement depends on duplex mode, dual connectivity mode of operation, and whether a cell belongs to MCG or SCG, and is further conditioned on:

- there is continuous DL data allocation,

- no DRX cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each subframe,

- no MBSFN subframes are configured.

Table 8.8.5.1-1: Requirement on minimum number of ACK/NACKs to transmit during Tidentify\_CGI, intra.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Serving cell configuration | Minimum number of transmitted ACK/NACKs | | | |
| Synchronous operation | | Asynchronous operation | |
| MCG | SCG | MCG | SCG |
| FDD | 60 | | 60 | 49 |
| TDD UL/DL configuration 0 | 18 | | N/A | N/A |
| TDD UL/DL configuration 1 | 35 | | N/A | N/A |
| TDD UL/DL configuration 2 | 43 | | N/A | N/A |
| TDD UL/DL configuration 3 | 36 | | N/A | N/A |
| TDD UL/DL configuration 4 | 39 | | N/A | N/A |
| TDD UL/DL configuration 5 | 42 | | N/A | N/A |
| TDD UL/DL configuration 6 | 30 | | N/A | N/A |

#### 8.8.5.2 ECGI reporting delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. If IDC autonomous denial is configured, an additional delay can be expected.

### 8.8.6 Inter-frequency measurements with autonomous gaps

#### 8.8.6.1 Identification of a new CGI of E-UTRA cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose ‘reportCGI’. The UE may make autonomous gaps in both MCG and SCG in downlink reception and uplink transmission for receiving MIB and SIB1 messages according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX is used or whether the SCell is configured, the UE shall be able to identify a new CGI of E-UTRA cell within:

ms

where

Tbasic\_identify\_CGI, inter = 150 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of an E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.2 for a corresponding Band

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided that the PBCH demodulation requirements in [5] are met.

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI,.inter is applicable when no DRX is used as well as when any of the DRX cycles specified in TS 36.331 [2] is used.

Within the time Tidentify\_CGI,inter ms, over which the UE identifies the CGI of a new E-UTRA cell, the UE shall transmit at least a minimum number of ACK/NACKs on cells in MCG and SCG, respectively, as specified in Table 8.8.6.1-1. The requirement depends on duplex mode, dual connectivity mode of operation, and whether a cell belongs to MCG or SCG, and is further conditioned on:

- there is continuous DL data allocation,

- no DRX cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each subframe,

- no MBSFN subframes are configured.

Table 8.8.6.1-1: Requirement on minimum number of ACK/NACKs to transmit during Tidentify\_CGI, inter.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Serving cell configuration | Minimum number of transmitted ACK/NACKs | | | |
| Synchronous operation | | Asynchronous operation | |
| MCG | SCG | MCG | SCG |
| FDD | 60 | | 60 | 49 |
| TDD UL/DL configuration 0 | 18 | | N/A | N/A |
| TDD UL/DL configuration 1 | 30 | | N/A | N/A |

#### 8.8.6.2 ECGI reporting delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. If IDC autonomous denial is configured, an additional delay can be expected.

### 8.8.7 SSTD Measurements

#### 8.8.7.1 Introduction

This clause contains SSTD measurement requirements on UE capabilities for support of E-UTRA dual connectivity.

#### 8.8.7.2 SSTD Measurement requirements

When no DRX is used the physical layer measurement period of the SSTD measurement shall be Tmeasure\_SSTD1 = 200 ms.

When either MCG DRX or SCG DRX is used, or both MCG DRX and SCG DRX are used in RRC\_CONNECTED state the physical layer measurement period (Tmeasure\_SSTD1) of the SSTD measurement shall be as specified in table 8.8.7.2-1.

Table 8.8.7.2-1: SSTD measurement requirement when DRX is used

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_SSTD1 (s) (DRX cycles) |
| ≤0.04 | 0.2 (Note1) |
| 0.04<DRX-cycle≤2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use  Note3: DRX cycle length in this table refers to the DRX cycle length configured on the CG in which DRX is used. When DRX is used in both MCG and SCG, DRX cycle length in this table refers to the longer DRX cycle length between MCG DRX and SCG DRX. | |

If PCell is changed without changing PCC, and/or if PSCell is changed without changing a frequency of PSCell or if both PCell and PSCell are change by swapping the PCC with the frequency of PSCell while the UE is performing SSTD measurements, then the UE shall also meet the SSTD measurement and accuracy requirements corresponding to the new PCell and/or PSCell. However in this case the UE shall restart the SSTD measurement. In this case the total physical layer measurement period of the SSTD measurement shall not exceed Tmeasure\_SSTD2 as defined in the following expression:

Tmeasure\_SSTD2 = (N+M+1)\*(Tmeasure\_SSTD1) + N\*TPCell\_change\_DC + M\*TPSCell\_change\_DC

Where:

N is the number of times the PCell is changed over the measurement period (Tmeasure\_SSTD2),

M is the number of times the PSCell is changed over the measurement period (Tmeasure\_SSTD2),

TPCell\_change\_DC is the time necessary to change the PCell; it can be up to 25 ms,

TPSCell\_change\_DC is the time necessary to change the PSCell; it can be up to 25 ms.

The measurement accuracy for the SSTD measurement when DRX is used as well as when no DRX is used shall be as specified in the sub-clause 9.1.20.

#### 8.8.7.3 SSTD Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

Reported measurements contained in periodically triggered measurement reports shall meet the requirements in sub-clause 9.1.20.

### 8.8.8 Intra-frequency measurements requirements on SCell

SCell intra-frequency measurements shall meet all applicable requirements in clause 8.3.3. In case where the SCell belongs to MCG, the term “common DRX” in clause 8.3.3 shall be deemed to be replaced with “MCG DRX”. In case where the SCell belongs to SCG, the term “common DRX” and PCell in clause 8.3.3 shall be replaced with “SCG DRX” and PSCell, respectively.

## 8.9 MBSFN Measurements

### 8.9.1 Introduction

The requirements specified in Section 8.9 apply for MBSFN measurements (MBSFN RSRP, MBSFN RSRQ, and MCH BLER defined in [4]), which are performed in RRC\_CONNECTED and logged for MDT by UEs which are MBMS-capable and also indicate their MBSFN measurement logging capability [2].

UE shall measure MBSFN RSRP, MBSFN RSRQ and MCH BLER only in subframes and on carriers where UE is decoding PMCH. The requirements are specified for any carrier where PMCH is received by UE. The requirements specified in this section apply for any carrier frequency with configured MBSFN subframes with PMCH, which may be the same as or different from any serving unicast carrier.

The UE receiving PMCH on any non-serving carrier and performing MBSFN measurements shall not cause interruptions on any serving carrier in unicast subframes and in the subframes with non-MBSFN multicast transmissions such as system information.

The requirements in section 8.9 shall also appy, when the UE is configured to perform SRS carrier based switching.

The requirements in Section 8.9 apply for 15 kHz subcarrier spacing configured in MBSFN subframes. The same requirements apply also for 370.73 Hz, 2.5 kHz, 1.25 kHz and 7.5 kHz subcarrier spacing, provided that MBSFN RSRP|dBm/(L) kHz = MBSFN RSRP|dBm/15kHz + 10∙log10(L/15), where L is 370.73 Hz, 2.5 kHz, 1.25 kHz or 7.5 kHz.

### 8.9.2 MBSFN RSRP Measurements

The UE physical layer shall be capable of performing the MBSFN RSRP measurement [4] within the MBSFN RSRP measurement period and report the measurement, while meeting the MBSFN RSRP measurement accuracy requirements specified in section 9.8.2.

The MBSFN RSRP measurement period is defined as the maximum between 640ms and the period during which the UE decodes [5, Section 10] 5 subframes containing PMCH transmissions except SCS = 370.37 Hz numerology. For SCS = 370.37 Hz numerology, the MBSFN RSRP measurement period is defined as MAX(640 ms, period during which the UE decodes [5, Section 10] 5 symbols containing PMCH transmissions).

The MBSFN RSRP measurement period is the same for UE using any DRX cycle, any eDRX\_CONN cycle, or no DRX.

### 8.9.3 MBSFN RSRQ Measurements

The UE physical layer shall be capable of performing the MBSFN RSRQ measurement [4] within the MBSFN RSRP measurement period and report the measurement, while meeting the MBSFN RSRQ measurement accuracy requirements specified in section 9.8.3.

The MBSFN RSRQ measurement period is defined as the maximum between 640ms and the period during which the UE decodes [5, Section 10] 5 subframes containing PMCH transmissions except SCS = 370.37 Hz numerology. For SCS = 370.37 Hz numerology, the MBSFN RSRP measurement period is defined as MAX(640 ms, period during which the UE decodes [5, Section 10] 5 symbols containing PMCH transmissions).

The MBSFN RSRQ measurement period is the same for UE using any DRX cycle, any eDRX\_CONN cycle, and no DRX.

### 8.9.4 MCH BLER Measurements

The UE physical layer shall be capable of performing and reporting the MCH BLER measurement [4] to higher layers within the MCH BLER measurement period. The MCH BLER measurement reporting is according to section 9.8.4.

The MCH BLER measurement period is equal to the MBSFN logging interval configured by higher layers [2].

## 8.10 Proximity-based Services

### 8.10.1 Introduction

This section contains the requirements for the UE capable of ProSe Direct Communication and/or ProSe Direct Discovery in RRC\_CONNECTED state.

### 8.10.2 Requirements

When a UE in RRC\_CONNECTED state is performing transmissions and/or reception for ProSe Direct Discovery and/or ProSe Direct Communication, the UE shall meet all the requirements specified in Section 8.

Note: The UE may need to interrupt ProSe operation in order to meet the measurement requirements of Section 8.

#### 8.10.2.1 Initiation/Cease of SLSS transmissions with ProSe Direct Discovery

The requirements in this subclause are applicable to a UE capable of ProSe Direct Discovery and SLSS transmission and reception.

The requirements apply when the conditions for SLSS transmissions specified in [2] are met; *networkControlledSyncTx* is not configured; and *syncTxThreshIC* is included in *SystemInformationBlockType19*. The UE shall be capable of measuring the RSRP of the cell used to transmit Prose Direct Discovery announcements and evaluate to initiate/cease SLSS transmissions within Tevaluate,SLSS where,

- Tevaluate,SLSS = 0.4 seconds when UE is not configured with DRX, or,

- Tevaluate,SLSS = as specified in Table 8.10.2.1-1 when UE is configured with DRX.

Table 8.10.2.1-1: Tevaluate,SLSS with ProSe Direct Discovery

|  |  |
| --- | --- |
| DRX cycle length [s] | Tevaluate,SLSS  [s] (number of DRX cycles) |
| ≤0.04 | 0.4 (Note 1) |
| 0.04<DRX-cycle≤2.56 | Note 2 (6) |
| Note1: Number of DRX cycles depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycles in use | |

If higher layer filtering is configured, an additional delay in evaluation to initiate/cease SLSS transmissions can be expected.

For the cell used to transmit ProSe Direct Discovery announcements:

- RSRP related side conditions given in Sections 9.1.2.1 and 9.1.2.2 and RSRQ related side conditions given in Clause 9.1.5.1 for a corresponding Band are fulfilled,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band are fulfilled.

#### 8.10.2.2 Initiation/Cease of SLSS transmissions with ProSe Direct Communication

The requirements in this subclause are applicable to a UE capable of ProSe Direct Communication.

The requirements apply when the conditions for SLSS transmissions specified in [2] are met; *networkControlledSyncTx* is not configured; and *syncTxThreshIC* is included in *SystemInformationBlockType18*. The UE shall be capable of measuring the RSRP of the cell used to transmit Prose Direct Communication to evaluate to initiate/cease SLSS transmissions within Tevaluate,SLSS

where,

- Tevaluate,SLSS = 0.4 seconds when UE is not configured with DRX.

- Tevaluate,SLSS = as specified in Table 8.10.2.2-1 when UE is configured with DRX.

Table 8.10.2.2-1: Tevaluate,SLSS with ProSe Direct Communication

|  |  |
| --- | --- |
| DRX cycle length [s] | Tevaluate,SLSS  [s] (number of DRX cycles) |
| ≤0.04 | 0.4 (Note 1) |
| 0.04<DRX-cycle≤2.56 | Note 2 (6) |
| Note1: Number of DRX cycles depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycles in use | |

If higher layer filtering is configured, an additional delay in evaluation to initiate/cease SLSS transmissions can be expected.

For the cell used to transmit ProSe Direct Communication:

- RSRP related side conditions given in Sections 9.1.2.1 and 9.1.2.2 and RSRQ related side conditions given in Clause 9.1.5.1 for a corresponding Band are fulfilled,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band are fulfilled.

## 8.11 Discovery Signal Measurements under Operation with Frame Structure 3

### 8.11.1 Introduction

This section contains requirements on the UE for measurement reporting in RRC\_CONNECTED state when discovery signal [16] is configured. The requirements are specified for E-UTRA CRS based discovery signal measurements and CSI-RS based discovery signal measurements.

The requirements in Section 8.11.2 shall apply for CRS based discovery signal measurements comprising RSRP and RSRQ measurements [4]. The requirements in Section 8.11.3 shall apply for CSI-RS based discovery signal measurements comprising CSI-RSRP measurements [4]. The requirements in Section 8.11.4 shall apply for UE RSSI measurements [4]. The requirements in Section 8.11.5 shall apply for UE channel occupancy measurements [2].

The measurement quantities are defined in [4], the measurement model is defined in [22] and measurement accuracy requirements are specified in Section 9. Control of measurement reporting is specified in TS 36.331 [2].

The requirements in Section 8.11 shall apply for carrier with E-UTRA operation following the frame structure type 3 [16].

The requirements in Section 9 are applicable for a UE performing measurements according to Section 8.11.

### 8.11.2 CRS based discovery signal measurements

#### 8.11.2.1 E-UTRAN intra-frequency measurements

NOTE: The requirements in this section are applicable only for measurements on SCC following the frame structure type 3 [16].

The UE shall be able to identify new intra-frequency FS3 cells and perform measurements of identified intra-frequency cells without an explicit intra-frequency neighbour cell list containing physical layer cell identities. During the RRC\_CONNECTED state the UE shall continuously measure identified intra-frequency cells and additionally search for and identify new intra-frequency cells.

##### 8.11.2.1.1 Requirements

###### 8.11.2.1.1.1 Requirements when no DRX is used

When no DRX is in use the UE shall be able to identify a new detectable FS3 intra-frequency cell within the cell identification time Tidentify\_intra\_ FS3, where the identification time of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of Tmeasure\_intra\_FS3\_CRS, where:

Tidentify\_intra\_FS3 is the intra-frequency cell identification period as specified in Table 8.11.2.1.1.1-1,

Tmeasure\_intra\_FS3\_CRS is the intra-frequency period for measurements as shown in Table 8.11.2.1.1.1-2,

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer,

L is the number of configured discovery signal occasions which are not available during Tidentify\_intra\_FS3 for cell identification at the UE due to the absence of the necessary radio signals from the cell or due to the corresponding downlink subframe being configured as an uplink subframe,

M is the number of configured discovery signal occasions which are not available during Tmeasure\_intra\_FS3\_CRS for the measurements at the UE due to the absence of the necessary radio signals from the cell or due to the corresponding downlink subframe being configured as an uplink subframe.

Table 8.11.2.1.1.1-1: Intra-frequency cell identification requirement under operation with frame structure 3

|  |  |  |  |
| --- | --- | --- | --- |
| SCH Ês/Iot | CRS measurement bandwidth [RB] Note2 | CRS Ês/Iot | Tidentify\_intra\_FS3 [ms] |
| 0 ≤ SCH Ês/Iot | <25 | -6 ≤ CRS Ês/Iot | (6+L) \* k1\*k2\* TDMTC\_periodicity |
| -6 ≤ SCH Ês/Iot < 0 | <25 | (24+L) \* k1\*k2\* TDMTC\_periodicity |
| 0 ≤ SCH Ês/Iot | 25 | 0 ≤ CRS Ês/Iot | (2+L) \* k1\*k2\* TDMTC\_periodicity |
| -6 ≤ SCH Ês/Iot < 0 | 25 | (8+L) \* k1\*k2\* TDMTC\_periodicity |
| NOTE 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  NOTE 2: The requirements for measurement bandwidth ≥25 RB are optional.  NOTE 3: k1=2 when the measurement gaps configured for inter-frequency measurements in DMTC occasions or for inter-frequency RSSI measurements in RMTC occasions on a carrier with frame structure 3 overlap with some but not all DMTC occasions of the measured cell; otherwise, k1=1, e.g., when measurement gaps configured for inter-frequency measurements on a carrier with frame structure 3 do not overlap with DMTC occasions of the measured cell or when the UE does not require the measurement gaps for the inter-frequency measurements. The requirements apply, provided that the inter-frequency measurement gap pattern does not overlap with all DMTC occasions of the measured cell.  k2= when DMTC occasions in the measured cell not overlapping with the inter-frequency measurement gaps overlap with DMTC occasions of *NFS3\_SCC* (*NFS3\_SCC*>0) SCells on other FS3 carriers; otherwise, k2=1, e.g., when *NFS3\_SCC* is 0.  NOTE 4: The requirements apply, provided that L is such that the intra-frequency cell identification period Tidentify\_intra\_FS3 does not exceed 72\*k1\*k2 TDMTC\_periodicity. | | | |

A cell shall be considered detectable when the following conditions are met during the discovery signal occasions which are available during Tidentify\_intra\_FS3:

- RSRP related side conditions given in Section 9.1.18.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Section 9.1.18.3 are fulfilled for a corresponding Band,

- SCH\_RP is according to Annex B.2.12 for a corresponding Band and SCH Ês/Iot is according to Table 8.11.2.1.1.1-1.

If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra-frequency measurements is Tmeasure\_intra\_FS3\_CRS as shown in Table 8.11.2.1.1.1-2, when no DRX is in use. The UE shall be capable of performing RSRP and RSRQ measurements for 3 identified intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers within the measurement period of Tmeasure\_intra\_FS3\_CRS.

Table 8.11.2.1.1.1-2: Intra-frequency measurement requirements under operation with frame structure 3

|  |  |  |  |
| --- | --- | --- | --- |
| SCH Ês/Iot | CRS measurement bandwidth [RB] Note2 | CRS Ês/Iot | Tmeasure\_intra\_FS3\_CRS [ms] |
| 0 ≤ SCH Ês/Iot | <25 | -6 ≤ CRS Ês/Iot | (5+M) \* k1\*k2\* TDMTC\_periodicity |
| -6 ≤ SCH Ês/Iot < 0 | <25 | (20+M) \* k1\*k2\* TDMTC\_periodicity |
| 0 ≤ SCH Ês/Iot | 25 | 0 ≤ CRS Ês/Iot | (1+M) \* k1\*k2\* TDMTC\_periodicity |
| -6 ≤ SCH Ês/Iot < 0 | 25 | (4+M) \* k1\*k2\* TDMTC\_periodicity |
| NOTE 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  NOTE 2: The requirements for measurement bandwidth ≥25 RB are optional.  NOTE 3: k1=2 when the measurement gaps configured for inter-frequency measurements in DMTC occasions or for inter-frequency RSSI measurements in RMTC occasions on a carrier with frame structure 3 overlap with some but not all DMTC occasions of the measured cell; otherwise, k1=1, e.g., when measurement gaps configured for inter-frequency measurements on a carrier with frame structure 3 do not overlap with DMTC occasions of the measured cell or when the UE does not require the measurement gaps for the inter-frequency measurements. The requirements apply, provided that the inter-frequency measurement gap pattern does not overlap with all DMTC occasions of the measured cell.  k2= when DMTC occasions in the measured cell not overlapping with the inter-frequency measurement gaps overlap with DMTC occasions of *NFS3\_SCC* (*NFS3\_SCC*>0) SCells on other FS3 carriers; otherwise, k2=1, e.g., when *NFS3\_SCC* is 0.  NOTE 4: The requirements apply, provided that M is such that the intra-frequency measurement period Tmeasure\_intra\_FS3\_CRS does not exceed 60\*k1\*k2 TDMTC\_periodicity. | | | |

The RSRP measurement accuracy for all measured cells shall be as specified in Section 9.1.18.2, and the RSRQ measurement accuracy for all measured cells shall be as specified in Section 9.1.18.3.

8.11.2.1.1.1.1 Measurement Reporting Requirements

8.11.2.1.1.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in Sections 9.1.18.2 and 9.1.18.3, respectively.

8.11.2.1.1.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in Sections 9.1.18.2 and 9.1.18.3, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in Section 8.11.2.1.1.1.1.3.

8.11.2.1.1.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in Sections 9.1.18.2 and 9.1.18.3, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report or by the LBT procedure performed by the UE in order to determine that the channel is clear for performing uplink transmission.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_intra\_FS3 defined in Section 8.11.2.1.1.1.When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_FS3 defined in Section 8.11.2.1.1.1 becomes undetectable for a period ≤ 8 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tidentify\_intra\_FS3\_CRS provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting, an additional delay can be expected.

###### 8.11.2.1.1.2 Requirements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable FS3 intra-frequency cell within the cell identification time Tidentify\_intra\_FS3\_DRX, where the cell identification time of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of Tmeasure\_intra\_FS3\_CRS\_DRX, where:.

Tidentify\_intra\_FS3\_DRX is the intra-frequency period for cell identification as shown in Table 8.11.2.1.1.2-1,

Tmeasure\_intra\_FS3\_CRS\_DRX is the intra-frequency period for measurements as shown in Table 8.11.2.1.1.2-2,

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer,

L is the number of configured discovery signal occasions during ON DURATION and which are not available during Tidentify\_intra\_FS3\_DRX for cell identification at the UE due to the absence of the necessary radio signals from the cell or due to the corresponding downlink subframe being configured as an uplink subframe,

M is the number of configured discovery signal occasions during ON DURATION and which are not available during Tmeasure\_intra\_FS3\_CRS\_DRX for the measurements at the UE due to the absence of the necessary radio signals from the cell or due to the corresponding downlink subframe being configured as an uplink subframe.

Table 8.11.2.1.1.2-1: Intra-frequency cell identification requirements under operation with frame structure 3

|  |  |  |  |
| --- | --- | --- | --- |
| SCH Ês/Iot | CRS measurement bandwidth [RB] Note2 | CRS Ês/Iot | Tidentify\_intra\_FS3\_DRX [ms] |
| 0 ≤ SCH Ês/Iot | <25 | -6 ≤ CRS Ês/Iot | (6+L)\* k1\*k2\*Max{TDMTC\_periodicity, DRX cycle length} |
| -6 ≤ SCH Ês/Iot < 0 | <25 | (24+L)\* k1\*k2\*Max{TDMTC\_periodicity, DRX cycle length} |
| 0 ≤ SCH Ês/Iot | 25 | 0 ≤ CRS Ês/Iot | (2+L)\* k1\*k2\*Max{TDMTC\_periodicity, DRX cycle length} |
| -6 ≤ SCH Ês/Iot < 0 | 25 | (8+L)\* k1\*k2\*Max{TDMTC\_periodicity, DRX cycle length} |
| NOTE 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  NOTE 2: The requirements for measurement bandwidth ≥25 RB are optional.  NOTE 3: k1=2 when the measurement gaps configured for inter-frequency measurements in DMTC occasions or for inter-frequency RSSI measurements in RMTC occasions on a carrier with frame structure 3 overlap with some but not all DMTC occasions of the measured cell during ON DURATION; otherwise, k1=1, e.g., when measurement gaps configured for inter-frequency measurements on a carrier with frame structure 3 do not overlap with DMTC occasions of the measured cell during ON DURATION or when the UE does not require the measurement gaps for the inter-frequency measurements. The requirements apply, provided that the inter-frequency measurement gap pattern does not overlap with all DMTC occasions of the measured cell.  k2= when DMTC occasions in the measured cell not overlapping with the inter-frequency measurement gaps measurement gaps overlap with DMTC occasions of *NFS3\_SCC* (*NFS3\_SCC*>0) SCells during ON DURATION on other FS3 carriers; otherwise, k2=1, e.g., when *NFS3\_SCC* is 0.  NOTE 4: The requirements apply, provided that L is such that the intra-frequency cell identification period Tidentify\_intra\_FS3\_DRX does not exceed 72\*k1\*k2\* Max{TDMTC\_periodicity, DRX cycle length}. | | | |

A cell shall be considered detectable when the following conditions are met during the discovery signal occasions which are available during Tidentify\_intra\_FS3\_DRX:

- RSRP related side conditions given in Section 9.1.18.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Section 9.1.18.3 are fulfilled for a corresponding Band,

- SCH\_RP is according to Annex B.2.12 for a corresponding Band and SCH Ês/Iot is according to Table 8.11.2.1.1.2-1.

If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra-frequency measurements is Tmeasure\_ intra\_FS3\_CRS\_DRX as shown in Table 8.11.2.1.1.2-2, when DRX is in use. The UE shall be capable of p performing RSRP and RSRQ measurements for 3 identified intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers within the measurement period of Tmeasure\_intra\_FS3\_CRS\_DRX.

Table 8.11.2.1.1.2-2: Intra-frequency measurement requirements under operation with frame structure 3

|  |  |  |  |
| --- | --- | --- | --- |
| SCH Ês/Iot | CRS measurement bandwidth [RB] Note2 | CRS Ês/Iot | Tmeasure\_intra\_FS3\_CRS\_DRX [ms] |
| 0 ≤ SCH Ês/Iot | <25 | -6 ≤ CRS Ês/Iot | (5+M)\* k1\*k2\*Max{TDMTC\_periodicity, DRX cycle length} |
| -6 ≤ SCH Ês/Iot < 0 | <25 | (20+M)\* k1\*k2\*Max{TDMTC\_periodicity, DRX cycle length} |
| 0 ≤ SCH Ês/Iot | 25 | 0 ≤ CRS Ês/Iot | (1+M)\* k1\*k2\*Max{TDMTC\_periodicity, DRX cycle length} |
| -6 ≤ SCH Ês/Iot < 0 | 25 | (4+M)\* k1\*k2\*Max{TDMTC\_periodicity, DRX cycle length} |
| NOTE 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  NOTE 2: The requirements for measurement bandwidth ≥25 RB are optional.  NOTE 3: k1=2 when the measurement gaps configured for inter-frequency measurements in DMTC occasions or for inter-frequency RSSI measurements in RMTC occasions on a carrier with frame structure 3 overlap with some but not all DMTC occasions of the measured cell during ON DURATION; otherwise, k1=1, e.g., when measurement gaps configured for inter-frequency measurements on a carrier with frame structure 3 do not overlap with DMTC occasions of the measured cell during ON DURATION or when the UE does not require the measurement gaps for the inter-frequency measurements. The requirements apply, provided that the inter-frequency measurement gap pattern does not overlap with all DMTC occasions of the measured cell.  k2= when DMTC occasions in the measured cell not overlapping with the inter-frequency measurement gaps measurement gaps overlap with DMTC occasions of *NFS3\_SCC* (*NFS3\_SCC*>0) SCells during ON DURATION on other FS3 carriers; otherwise, k2=1, e.g., when *NFS3\_SCC* is 0.  NOTE 4: The requirements apply, provided that M is such that the intra-frequency measurement period Tmeasure\_intra\_FS3\_CRS\_DRX does not exceed 60\*k1\*k2\* Max{TDMTC\_periodicity, DRX cycle length}. | | | |

The RSRP measurement accuracy for all measured cells shall be as specified in Section 9.1.18.2, and the RSRQ measurement accuracy for all measured cells shall be as specified in Section 9.1.18.3.

8.11.2.1.1.2.1 Measurement Reporting Requirements

8.11.2.1.1.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in Sections 9.1.18.2 and 9.1.18.3, respectively.

8.11.2.1.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in Sections 9.1.18.2 and 9.1.18.3, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in Section 8.11.2.1.1.2.1.3.

8.11.2.1.1.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in Sections 9.1.18.2 and 9.1.18.3, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report or by the LBT procedure performed by the UE in order to determine that the channel is clear for performing uplink transmission.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_intra\_FS3\_DRX defined in Section 8.11.2.1.1.2.When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_FS3\_DRX defined in Section 8.11.2.1.1.2 becomes undetectable for a period ≤ 8 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tidentify\_intra\_FS3\_CRS\_DRX provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting, an additional delay can be expected.

#### 8.11.2.2 E-UTRAN inter-frequency measurements

The UE shall be able to identify new inter-frequency cells and perform RSRP and RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the PCell, even if no explicit neighbour list with physical layer cell identities is provided. The discovery signal occasion and the measurement gap should be aligned, provided that also the following additional conditions are fulfilled:

Entire discovery signal occasion should be contained in the measurement gap.

The subframe contained discovery signal for the measurement is not overlapped with the first 0.5 ms period and the last 0.5 ms period in every gap.

##### 8.11.2.2.1 E-UTRAN FDD-FS3 inter-frequency measurements

8.11.2.2.1.1 E-UTRAN FDD – FS3 inter-frequency measurements when no DRX is used

When measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FS3 inter-frequency cell within the cell identification time Tidentify\_inter\_FS3, which shall include detection of the cell and additionally performing a single measurement within the measurement period of Tmeasure\_inter\_FS3\_CRS when no DRX is used, where:

Tidentify\_inter\_FS3 is the inter-frequency period for cell identification as shown in Table 8.11.2.2.1.1-1,

Tmeasure\_inter\_FS3\_CRS is the inter-frequency period for measurements as shown in Table 8.11.2.2.1.1-2,

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer,

*Nfreq* is defined in Section 8.1.2.1.1,

*N* is the number of carriers operating under FS3 and which are subject to the channel assessment prior to transmissions,

L is the number of configured discovery signal occasions which are not available during the time for cell identification at the UE during measurement gaps due to the absence of the necessary radio signals from the measured cell,

M is the number of configured discovery signal occasions which are not available during Tmeasure\_inter\_FS3\_CRS for the measurements at the UE during measurement gaps due to the absence of the necessary radio signals from the measured cell.

If higher layer filtering is used, an additional cell identification delay can be expected.

The requirements in this section apply, provided that L and M are such that: the inter-frequency cell identification period Tidentify\_inter\_FS3 does not exceed 75 \**Nfreq*\*Max{TDMTC\_periodicity, MGRP}, and the inter-frequency period Tmeasure\_inter\_FS3\_CRS for measurements does not exceed 60\* *Nfreq* \*Max{TDMTC\_periodicity, MGRP}.

Table 8.11.2.2.1.1-1: Inter-frequency cell identification requirements under operation with frame structure 3

|  |  |  |  |
| --- | --- | --- | --- |
| SCH Ês/Iot | CRS measurement bandwidth Note2 [RB] | CRS Ês/Iot | Tidentify\_inter\_FS3 [ms] |
| 0 ≤ SCH Ês/Iot | <25 | -6 ≤ CRS Ês/Iot | (7\**Nfreq* +L\*N)\*Max{TDMTC\_periodicity, MGRP} |
| -6 ≤ SCH Ês/Iot < 0 | <25 | (25\**Nfreq* +L\*N)\*Max{TDMTC\_periodicity, MGRP} |
| 0 ≤ SCH Ês/Iot | 25 | 0 ≤ CRS Ês/Iot | (3\**Nfreq* +L\*N)\*Max{TDMTC\_periodicity, MGRP} |
| -6 ≤ SCH Ês/Iot < 0 | 25 | (9\**Nfreq* +L\*N)\*Max{TDMTC\_periodicity, MGRP} |
| NOTE 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  NOTE 2: The requirements for measurement bandwidth cid:image003.png@01D1B7C5.AA96B9A025 RB are optional. | | | |

Table 8.11.2.2.1.1-2: Inter-frequency measurement requirements under operation with frame structure 3

|  |  |  |  |
| --- | --- | --- | --- |
| SCH Ês/Iot | CRS measurement bandwidth Note2 [RB] | CRS Ês/Iot | Tmeasure\_inter\_FS3\_CRS [ms] |
| 0 ≤ SCH Ês/Iot | <25 | -6 ≤ CRS Ês/Iot | (5\**Nfreq* +M\*N)\*Max{TDMTC\_periodicity, MGRP} |
| -6 ≤ SCH Ês/Iot < 0 | <25 | (20\**Nfreq* +M\*N)\*Max{TDMTC\_periodicity, MGRP} |
| 0 ≤ SCH Ês/Iot | 25 | 0 ≤ CRS Ês/Iot | (1\**Nfreq* +M\*N)\*Max{TDMTC\_periodicity, MGRP} |
| -6 ≤ SCH Ês/Iot < 0 | 25 | (4\**Nfreq* +M\*N)\*Max{TDMTC\_periodicity, MGRP} |
| NOTE 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  NOTE 2: The requirements for measurement bandwidth cid:image003.png@01D1B7C5.AA96B9A025 RB are optional. | | | |

A cell shall be considered detectable when the following conditions are met during the discovery signal occasions which are available during Tidentify\_inter\_FS3:

- RSRP related side conditions given in Section 9.1.18.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Section 9.1.18.3 are fulfilled for a corresponding Band,

- SCH\_RP|dBm is according to Annex B.2.13.1 for a corresponding Band,

- SCH Ês/Iot is according to Table 8.11.2.2.1.1-1.

When measurement gaps are scheduled for FS3 inter-frequency measurements or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with measurement accuracy as specified in Sections 9.1.18.2 and 9.1.18.3, respectively, with measurement period given by table 8.11.2.2.1.1-2.

The UE shall be capable of performing RSRP and RSRQ measurements of at least 3 identified inter-frequency cells per FS3 inter-frequency for up to 3 FS3 inter-frequencies and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period defined in table 8.11.2.2.1.1-2 when no DRX is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps.

The RSRP measurement accuracy for all measured cells shall be as specified in Section 9.1.18.2, and the RSRQ measurement accuracy for all measured cells shall be as specified in Section 9.1.18.3.

8.11.2.2.1.1.1 Measurement Reporting Requirements

8.11.2.2.1.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.18.2 and 9.1.18.3, respectively.

8.11.2.2.1.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.18.2, and 9.1.18.3, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in Section 8.11.2.2.1.1.1.3.

8.11.2.2.1.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.18.2 and 9.1.18.3, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report or by the LBT procedure performed by the UE in order to determine that the channel is clear for performing uplink transmission.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_inter\_FS3 defined in Section 8.11.2.2.1.1.When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_FS3 defined in Section 8.11.2.2.1.1 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasure\_inter\_FS3\_CRS provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting, an additional delay can be expected.

8.11.2.2.1.2 E-UTRAN FDD – FS3 inter-frequency measurements when DRX is used

When measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectavle FS3 inter-frequency cell within the cell identification time Tidentify\_inter\_FS3\_DRX, which shall include detection of the cell and additionally performing a single measurement within the measurement period of Tmeasure\_inter\_FS3\_CRS\_DRX when DRX is used, where:

Tidentify\_inter\_FS3\_DRX. is the inter-frequency period for measurements as shown in Table 8.11.2.2.1.2-1,

Tmeasure\_inter\_FS3\_CRS\_DRX is the inter-frequency period for measurements as shown in Table 8.11.2.2.1.2-2,

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer,

*Nfreq* is defined in Section 8.1.2.1.1,

*N* is the number of carriers operating under FS3 and which are subject to the channel assessment prior to transmissions,

L is the number of configured discovery signal occasions which are not available during the time for cell identification at the UE during measurement gaps due to the absence of the necessary radio signals from the measured cell,

M is the number of configured discovery signal occasions which are not available during Tmeasure\_inter\_FS3\_CRS\_DRX for the measurements at the UE during measurement gaps due to the absence of the necessary radio signals from the measured cell.

The requirements in this section apply, provided that L and M are such that: the inter-frequency cell identification period Tidentify\_inter\_FS3\_DRX does not exceed 75 \**Nfreq*\* Max{TDMTC\_periodicity, MGRP, DRX cycle length}, and the inter-frequency period Tmeasure\_inter\_FS3\_CRS\_DRX for measurements does not exceed 60\* *Nfreq* \* Max{TDMTC\_periodicity, MGRP, DRX cycle length}.

If higher layer filtering is used, an additional cell identification delay can be expected.

Table 8.11.2.2.1.2-1: Inter-frequency cell identification requirements under operation with frame structure 3

|  |  |  |  |
| --- | --- | --- | --- |
| SCH Ês/Iot | CRS measurement bandwidth Note2 [RB] | CRS Ês/Iot | Tidentify\_inter\_FS3\_DRX [ms] |
| 0 ≤ SCH Ês/Iot | <25 | -6 ≤ CRS Ês/Iot | (7\**Nfreq* +L\*N)\*Max{TDMTC\_periodicity, MGRP, DRX cycle length} |
| -6 ≤ SCH Ês/Iot < 0 | <25 | (25\**Nfreq* +L\*N)\*Max{TDMTC\_periodicity, MGRP, DRX cycle length} |
| 0 ≤ SCH Ês/Iot | 25 | 0 ≤ CRS Ês/Iot | (3\**Nfreq* +L\*N)\*Max{TDMTC\_periodicity, MGRP, DRX cycle length} |
| -6 ≤ SCH Ês/Iot < 0 | 25 | (9\**Nfreq* +L\*N)\*Max{TDMTC\_periodicity, MGRP, DRX cycle length} |
| NOTE 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  NOTE 2: The requirements for measurement bandwidth cid:image003.png@01D1B7C5.AA96B9A025 RB are optional. | | | |

Table 8.11.2.2.1.2-2: Inter-frequency measurement requirements under operation with frame structure 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SCH Ês/Iot | | CRS measurement bandwidth Note2 [RB] | CRS Ês/Iot | Tmeasure\_inter\_FS3\_CRS\_DRX [ms] |
| 0 ≤ SCH Ês/Iot | | <25 | -6 ≤ CRS Ês/Iot | (5\**Nfreq* +M\*N)\*Max{TDMTC\_periodicity, MGRP, DRX cycle length} |
| -6 ≤ SCH Ês/Iot < 0 | | <25 | (20\**Nfreq* +M\*N)\*Max{TDMTC\_periodicity, MGRP, DRX cycle length} |
| 0 ≤ SCH Ês/Iot | | 25 | 0 ≤ CRS Ês/Iot | (1\**Nfreq* +M\*N)\*Max{TDMTC\_periodicity, MGRP, DRX cycle length} |
| -6 ≤ SCH Ês/Iot < 0 | | 25 | (4\**Nfreq* +M\*N)\*Max{TDMTC\_periodicity, MGRP, DRX cycle length} |
| NOTE 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  NOTE 2: The requirements for measurement bandwidth cid:image003.png@01D1B7C5.AA96B9A025 RB are optional. | | | |

A cell shall be considered detectable when the following conditions are met during the discovery signal occasions which are available during Tidentify\_inter\_FS3\_DRX:

- RSRP related side conditions given in Section 9.1.18.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Section 9.1.18.3 are fulfilled for a corresponding Band,

- SCH\_RP|dBm is according to Annex B.2.13.1 for a corresponding Band,

- SCH Ês/Iot is according to Table 8.11.2.2.1.2-1.

The UE shall be capable of performing RSRP and RSRQ measurements of at least 3 identified inter-frequency cells per FS3 inter-frequency for up to 3 FS3 inter-frequencies and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period defined in table 8.11.2.2.1.2-2 when DRX is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps.

The RSRP measurement accuracy for all measured cells shall be as specified in Section 9.1.18.2, and the RSRQ measurement accuracy for all measured cells shall be as specified in Section 9.1.18.3.

8.11.2.2.1.2.1 Measurement Reporting Requirements

8.11.2.2.1.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.18.2 and 9.1.18.3, respectively.

8.11.2.2.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.18.2 and 9.1.18.3, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in Section 8.11.2.2.1.2.1.3.

8.11.2.2.1.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.18.2, and 9.1.18.3, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report or by the LBT procedure performed by the UE in order to determine that the channel is clear for performing uplink transmission.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_inter\_FS3\_DRX defined in Section 8.11.2.2.1.2.When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_FS3\_DRX defined in Section 8.11.2.2.1.2 becomes undetectable for a period ≤ 8 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tidentify\_inter\_FS3\_CRS\_DRX provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting, an additional delay can be expected.

##### 8.11.2.2.2 E-UTRAN TDD – FS3 inter-frequency measurements

8.11.2.2.2.1 E-UTRAN TDD – FS3 inter-frequency measurements when no DRX is used

The requirements in this section for UE configured with TDD PCell and no DRX are the same as the requirements in Section 8.11.2.2.1.1.

8.11.2.2.2.2 E-UTRAN TDD – FS3 inter-frequency measurements when DRX is used

The requirements in this section for UE configured with TDD PCell and DRX are the same as the requirements in Section 8.11.2.2.1.2.

### 8.11.3 CSI-RS based discovery signal measurements

#### 8.11.3.1 E-UTRAN intra-frequency measurements

The UE shall be able to identify new intra-frequency FS3 TPs and perform CSI-RSRP measurements of intra-frequency TPs with an explicit intra-frequency TP list containing physical layer cell identities. During the RRC\_CONNECTED state the UE shall continuously measure identified intra-frequency TPs and additionally search for and identify new intra-frequency TPs.

##### 8.11.3.1.1 Requirements

###### 8.11.3.1.1.1 Requirements when no DRX is used

When no DRX is in use the UE shall be able to identify a new detectable FS3 intra-frequency TP within the identification period Tidentify\_intra\_TP\_FS3, where identification of a TP shall include cell identification and additionally performing a single measurement on the TP.

Tidentify\_intra\_TP\_FS3 = Tidentify\_intra\_FS3 + Tmeasure\_intra\_FS3\_CSI-RS,

where

Tidentify\_intra\_FS3 is the intra-frequency period for cell identification in Section 8.11.2.1.1.1,

Tmeasure\_ intra\_FS3\_CSI-RS is the intra-frequency period for TP measurement as shown in Table 8.11.3.1.1.1-1,

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer,

M is the number of configured discovery signal occasions which are not available during Tmeasure\_ intra\_FS3\_CSI-RS for the measurements at the UE due to the absence of the necessary radio signals from the TP or due to the corresponding downlink subframe being configured as an uplink subframe.

During Tidentify\_intra\_TP\_FS3 over multiple discovery signal occasions, the UE may assume the following:

- in all the discovery signal occasions, which are available at the UE, the corresponding necessary cell-specific discovery signals are always available from the same set of TPs in the measured cell, and

- in all the discovery signal occasions, which are not available at the UE, the corresponding necessary cell-specific discovery signals are not available from any TP within the same measured cell.

A TP shall be considered detectable when the following conditions are met during the discovery signal occasions which are available during Tidentify\_intra\_TP\_FS3:

- CSI-RSRP related side conditions given in Section 9.1.18.4 are fulfilled for a corresponding Band,

- SCH\_RP is according to Annex B.2.12 for a corresponding Band and SCH Ês/Iot is according to Section 8.11.2.1.1.1.

Identification of a TP shall include identification of the cell and additionally performing a single measurement on the TP within the measurement period of Tmeasure\_ intra\_FS3\_CSI-RS when no DRX is used. If higher layer filtering is used, an additional TP identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra-frequency measurements is Tmeasure\_intra\_FS3\_CSI-RS as shown in table 8.11.3.1.1.1-1, when no DRX is in use. The UE shall be capable of performing CSI-RSRP measurements for 3 identified intra-frequency TPs, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_FS3\_CSI-RS

Table 8.11.3.1.1.1-1: Intra-frequency TP measurement requirements under operation with frame structure 3

|  |  |  |  |
| --- | --- | --- | --- |
| SCH Ês/Iot | CRS measurement bandwidth [RB] Note2 | CSI-RS Ês/Iot | Tmeasure\_intra\_FS3\_CSI-RS [ms] |
| 0 ≤ SCH Ês/Iot | <25 | 0 ≤ CSI-RS Ês/Iot | (5+M) \*k1\*k2\* TDMTC\_periodicity |
| -6 ≤ SCH Ês/Iot < 0 | <25 | (20+M) \*k1\*k2\* TDMTC\_periodicity |
| 0 ≤ SCH Ês/Iot | 25 | 0 ≤ CSI-RS Ês/Iot | (1+M) \*k1\*k2\* TDMTC\_periodicity |
| -6 ≤ SCH Ês/Iot < 0 | 25 | (4+M) \*k1\*k2\* TDMTC\_periodicity |
| NOTE 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  NOTE 2: The requirements for measurement bandwidth ≥25 RB are optional.  NOTE 3: k1=2 when the measurement gaps configured for inter-frequency measurements in DMTC occasions or for inter-frequency RSSI measurements in RMTC occasions on a carrier with frame structure 3 overlap with some but not all DMTC occasions of the measured TP; otherwise, k1=1, e.g., when measurement gaps configured for inter-frequency measurements on a carrier with frame structure 3 do not overlap with DMTC occasions of the measured TP or when the UE does not require the measurement gaps for the inter-frequency measurements. The requirements apply, provided that the inter-frequency measurement gap pattern does not overlap with all DMTC occasions of the measured cell.  k2= when DMTC occasions in the measured TP not overlapping with the inter-frequency measurement gaps measurement gaps overlap with DMTC occasions of *NFS3\_SCC* (*NFS3\_SCC*>0) SCells on other FS3 carriers; otherwise, k2=1, e.g., when *NFS3\_SCC* is 0.  NOTE 4: The requirements apply, provided that M is such that the intra-frequency period for TP measurement Tmeasure\_intra\_FS3\_CSI-RS does not exceed 60\*k1\*k2\* TDMTC\_periodicity. | | | |

The CSI-RSRP measurement accuracy for all measured TPs shall be as specified in Section 9.1.18.4.

8.11.3.1.1.1.1 Measurement Reporting Requirements

8.11.3.1.1.1.1.1 Periodic Reporting

Reported CSI-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in Section 9.1.18.4.

8.11.3.1.1.1.1.2 Event-triggered Periodic Reporting

Reported CSI-RSRP measurements contained in event triggered periodic measurement reports shall meet the requirements in Section 9.1.18.4.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in Section 8.11.3.1.1.1.1.3.

8.11.3.1.1.1.1.3 Event Triggered Reporting

Reported CSI-RSRP measurements contained in event triggered measurement reports shall meet the requirements in Section 9.1.18.4.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report or by the LBT procedure performed by the UE in order to determine that the channel is clear for performing uplink transmission.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_intra\_TP\_FS3 defined in Section 8.11.3.1.1.1.When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

If a TP which has been detectable at least for the time period Tidentify\_intra\_TP\_FS3 defined in Section 8.11.3.1.1.1 becomes undetectable for a period ≤ 8 seconds and then the TP becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tidentify\_intra\_FS3\_CSI-RS provided the timing to that TP has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting, an additional delay can be expected.

###### 8.11.3.1.1.2 Requirements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable FS3 intra-frequency TP within the identification period Tidentify\_intra\_TP\_FS3\_DRX , where identification of a TP shall include cell identification and additionally performing a single measurement on the TP.

Tidentify\_intra\_TP\_FS3\_DRX = Tidentify\_intra\_FS3\_DRX + Tmeasure\_ intra\_FS3\_CSI-RS\_DRX,

where:

Tidentify\_intra\_FS3\_DRX is the intra-frequency period for cell identification in Section 8.11.2.1.1.2.

Tmeasure\_ intra\_FS3\_CSI-RS\_DRX is the intra-frequency period for TP measurement as shown in Table 8.11.3.1.1.2-1, where

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer,

M is the number of configured discovery signal occasions during ON DURATION and which are not available duting Tmeasure\_intra\_FS3\_CSI-RS\_DRX for the measurements at the UE due to the absence of the necessary radio signals from the TP or due to the corresponding downlink subframe being configured as an uplink subframe.

During Tidentify\_intra\_TP\_FS3\_DRX over multiple discovery signal occasions, the UE may assume the following:

- in all the discovery signal occasions, which are available at the UE, the corresponding necessary cell-specific discovery signals are always available from the same set of TPs in the measured cell, and

- in all the discovery signal occasions, which are not available at the UE, the corresponding necessary cell-specific discovery signals are not available from any TP within the same measured cell.

A TP shall be considered detectable when the following conditions are met during the discovery signal occasions which are available during Tidentify\_intra\_TP\_FS3\_DRX:

- CSI-RSRP related side conditions given in Section 9.1.18.4 are fulfilled for a corresponding Band,

- SCH\_RP is according to Annex B.2.12 for a corresponding Band and SCH Ês/Iot is according to Section 8.11.2.1.1.2.

Identification of a TP shall include identification of the cell and additionally performing a single measurement on the TP within measurement period of Tmeasure\_intra\_FS3\_CSI-RS\_DRX when DRX is used. If higher layer filtering is used, an additional TP identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra\_FS3\_CSI-RS\_DRX as shown in Table 8.11.3.1.1.2-1, when DRX is in use. The UE shall be capable of performing CSI-RSRP measurements for 3 identified intra-frequency TPs, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_FS3\_CSI-RS\_DRX.

Table 8.11.3.1.1.2-1: Intra-frequency TP measurement requirements under operation with frame structure 3

|  |  |  |  |
| --- | --- | --- | --- |
| SCH Ês/Iot | CRS measurement bandwidth [RB] Note2 | CSI-RS Ês/Iot | Tmeasure\_intra\_FS3\_CSI-RS\_DRX [ms] |
| 0 ≤ SCH Ês/Iot | <25 | 0 ≤CSI-RS Ês/Iot | (5+M) \*k1\*k2\* Max{TDMTC\_periodicity, DRX cycle length} |
| -6 ≤ SCH Ês/Iot < 0 | <25 | (20+M) \*k1\*k2\* Max{TDMTC\_periodicity, DRX cycle length} |
| 0 ≤ SCH Ês/Iot | 25 | 0 ≤CSI-RS Ês/Iot | (1+M) \*k1\*k2\* Max{TDMTC\_periodicity, DRX cycle length} |
| -6 ≤ SCH Ês/Iot < 0 | 25 | (4+M) \*k1\*k2\* Max{TDMTC\_periodicity, DRX cycle length} |
| NOTE 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  NOTE 2: The requirements for measurement bandwidth ≥25 RB are optional.  NOTE 3: k1=2 when the measurement gaps configured for inter-frequency measurements in DMTC occasions or for inter-frequency RSSI measurements in RMTC occasions on a carrier with frame structure 3 overlap with some but not all DMTC occasions of the measured TP during ON DURATION; otherwise, k1=1, e.g., when measurement gaps configured for inter-frequency measurements on a carrier with frame structure 3 do not overlap with DMTC occasions of the measured TP during ON DURATION or when the UE does not require the measurement gaps for the inter-frequency measurements. The requirements apply, provided that the inter-frequency measurement gap pattern does not overlap with all DMTC occasions of the measured cell.  k2= when DMTC occasions in the measured TP not overlapping with the inter-frequency measurement gaps overlap with DMTC occasions of *NFS3\_SCC* (*NFS3\_SCC*>0) SCells during ON DURATION on other FS3 carriers; otherwise, k2=1, e.g., when *NFS3\_SCC*=0.  NOTE 4: The requirements apply, provided that M is such that the intra-frequency period for TP measurement Tmeasure\_intra\_FS3\_CSI-RS\_DRX does not exceed 60\*k1\*k2\* Max{TDMTC\_periodicity, DRX cycle length}. | | | |

The CSI-RSRP measurement accuracy for all measured TPs shall be as specified in Section 9.1.18.4.

8.11.3.1.1.2.1 Measurement Reporting Requirements

8.11.3.1.1.2.1.1 Periodic Reporting

Reported CSI-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in Section 9.1.18.4.

8.11.3.1.1.2.1.2 Event-triggered Periodic Reporting

Reported CSI-RSRP measurements contained in event triggered periodic measurement reports shall meet the requirements in Section 9.1.18.4.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in Section 8.11.3.1.1.2.1.3.

8.11.3.1.1.2.1.3 Event Triggered Reporting

Reported CSI-RSRP measurements contained in event triggered measurement reports shall meet the requirements in Section 9.1.18.4.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report or by the LBT procedure performed by the UE in order to determine that the channel is clear for performing uplink transmission.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_intra\_TP\_FS3\_DRX defined in Section 8.11.3.1.1.2.When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

If a TP which has been detectable at least for the time period Tidentify\_intra\_TP\_FS3\_DRX defined in Section 8.11.3.1.1.2 becomes undetectable for a period ≤ 8 seconds and then the TP becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tidentify\_intra\_FS3\_CSI-RS\_DRX provided the timing to that TP has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting, an additional delay can be expected.

#### 8.11.3.2 E-UTRAN inter-frequency measurements

The UE shall be able to identify new inter-frequency TPs and perform CSI-RSRP measurements of the idenitified inter-frequency TPs with an explicit inter-frequency TP list containing physical layer cell identities. The discovery signal occasion and the measurement gap should be aligned, provided that also the following additional conditions are fulfilled:

Entire discovery signal occasion should be contained in the measurement gap.

The subframe contained discovery signal for the measurement is not overlapped with the first 0.5 ms period and the last 0.5 ms period in every gap.

##### 8.11.3.2.1 E-UTRAN FDD – FS3 inter-frequency measurements

8.11.3.2.1.1 E-UTRAN FDD – FS3 inter-frequency measurements when no DRX is used

When measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FS3 inter-frequency TP within the TP identification time Tidentify\_inter\_TP\_FS3 according to the following expression:

Tidentify\_inter\_TP\_FS3 = Tidentify\_inter\_FS3 + Tmeasure\_inter\_FS3\_CSI-RS,

where

Tidentify\_inter\_FS3 is the inter-frequency period for cell identification in Section 8.11.2.2.1.1,

Tmeasure\_inter\_FS3\_CSI-RS is the inter-frequency period for TP measurement as shown in Table 8.11.3.2.1.1-1,

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer,

*Nfreq* is defined in section 8.1.2.1.1,

*N* is the number of carriers operating under FS3 and which are subject to the channel assessment prior to transmissions,

M is the number of configured discovery signal occasions which are not available during Tmeasure\_inter\_FS3\_CSI-RS for the measurements at the UE during measurement gaps due to the absence of the necessary radio signals from the measured TP.

The requirements in this section apply, provided that M is such that: the inter-frequency period Tmeasure\_inter\_FS3\_CSI-RS for TP measurements does not exceed 60\* *Nfreq*\* Max{TDMTC\_periodicity, MGRP }.

During Tidentify\_inter\_TP\_FS3 over multiple discovery signal occasions, the UE may assume the following:

- in all the discovery signal occasions, which are available at the UE, the corresponding necessary cell-specific discovery signals are always available from the same set of TPs in the measured cell, and

- in all the discovery signal occasions, which are not available at the UE, the corresponding necessary cell-specific discovery signals are not available from any TP within the same measured cell.

A TP shall be considered detectable when the following conditions are met during the discovery signal occasions which are available during Tidentify\_inter\_TP\_FS3:

- CSI-RSRP related side conditions given in Section 9.1.18.4 are fulfilled for a corresponding Band,

- SCH\_RP is according to Annex B.2.13.2 for a corresponding Band,

- SCH Ês/Iot is according to Table 8.11.2.2.1.1-1.

When measurement gaps are scheduled for FS3 inter-frequency measurements or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting CSI-RSRP measurements to higher layers with measurement accuracy as specified in section 9.1.18.4, with measurement period given by table 8.11.3.2.1.1-1.

The UE shall be capable of performing CSI-RSRP measurements of at least 3 identified inter-frequency TPs per FS3 inter-frequency for up to 3 FS3 inter-frequencies and the UE physical layer shall be capable of reporting CSI-RSRP measurements to higher layers with the measurement period defined in table 8.11.3.2.1.1-1 when no DRX is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps.

Table 8.11.3.2.1.1-1: Requirements to measure FS3 inter-frequency TP

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SCH Ês/Iot | | CSI-RS measurement bandwidth Note2 [RB] | CSI-RS Ês/Iot | Tmeasure\_inter\_FS3\_CSI-RS [ms] |
| 0 ≤ SCH Ês/Iot | | <25 | 0 ≤ CSI-RS Ês/Iot | (5\**Nfreq* +M\*N)\*Max{TDMTC\_periodicity, MGRP} |
| -6 ≤ SCH Ês/Iot < 0 | | <25 | (20\**Nfreq* +M\*N)\*Max{TDMTC\_periodicity, MGRP } |
| 0 ≤ SCH Ês/Iot | | 25 | 0 ≤ CSI-RS Ês/Iot | (1\**Nfreq* +M\*N)\*Max{TDMTC\_periodicity, MGRP} |
| -6 ≤ SCH Ês/Iot < 0 | | 25 | (4\**Nfreq* +M\*N)\*Max{TDMTC\_periodicity, MGRP} |
| NOTE 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  NOTE 2: The requirements for measurement bandwidth cid:image003.png@01D1B7C5.AA96B9A025 RB are optional. | | | |

The CSI-RSRP measurement accuracy for all measured TPs shall be as specified in section 9.1.18.4.

8.11.3.2.1.1.1 Measurement Reporting Requirements

8.11.3.2.1.1.1.1 Periodic Reporting

Reported CSI-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.18.4.

8.11.3.2.1.1.1.2 Event-triggered Periodic Reporting

Reported CSI-RSRP measurements contained in event triggered periodic measurement reports shall meet the requirements in section 9.1.18.4.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in section 8.11.3.2.1.1.1.3.

8.11.3.2.1.1.1.3 Event Triggered Reporting

Reported CSI-RSRP measurements contained in event triggered measurement reports shall meet the requirements in section 9.1.18.4.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report or by the LBT procedure performed by the UE in order to determine that the channel is clear for performing uplink transmission.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_inter\_TP\_FS3 defined in Section 8.11.3.2.1.1.When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

If a TP which has been detectable at least for the time period Tidentify\_inter\_TP\_FS3 defined in Section 8.11.3.2.1.1 becomes undetectable for a period ≤ 8 seconds and then the TP becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tidentify\_inter\_FS3\_CSI-RS provided the timing to that TP has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting, an additional delay can be expected.

8.11.3.2.1.2 E-UTRAN FDD – FS3 inter-frequency measurements when DRX is used

When DRX is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FS3 inter-frequency TP within Tidentify\_inter\_TP\_FS3\_DRX according to the following expression:

Tidentify\_inter\_TP\_FS3\_DRX = Tidentify\_inter\_FS3\_DRX + Tmeasure\_inter\_FS3\_CSI-RS\_DRX ,

where

Tidentify\_inter\_FS3\_DRX is the inter-frequency period for cell identification in Section 8.11.2.2.1.2,

Tmeasure\_inter\_FS3\_CSI-RS\_DRX is the inter-frequency period for TP measurement as shown in Table 8.11.3.2.1.2-1,

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer,

*Nfreq* is defined in section 8.1.2.1.1,

*N* is the number of carriers operating under FS3 and which are subject to the channel assessment prior to transmissions,

M is the number of configured discovery signal occasions which are not available during Tmeasure\_inter\_FS3\_CSI-RS\_DRX for the measurements at the UE during measurement gaps due to the absence of the necessary radio signals from the measured cell.

The requirements in this section apply, provided that M is such that: the inter-frequency period Tmeasure\_inter\_FS3\_CSI-RS\_DRX for TP measurements does not exceed 60\* *Nfreq* \* Max{TDMTC\_periodicity, MGRP, DRX cycle length}.

During Tidentify\_inter\_TP\_FS3\_DRX over multiple discovery signal occasions, the UE may assume the following:

- in all the discovery signal occasions, which are available at the UE, the corresponding necessary cell-specific discovery signals are always available from the same set of TPs in the measured cell, and

- in all the discovery signal occasions, which are not available at the UE, the corresponding necessary cell-specific discovery signals are not available from any TP within the same measured cell.

A TP shall be considered detectable when the following conditions are met during the discovery signal occasions which are available during Tidentify\_inter\_TP\_FS3\_DRX:

- CSI-RSRP related side conditions given in Sections 9.1.18.4 are fulfilled for a corresponding Band,

- SCH\_RP is according to Annex B.2.13.2 for a corresponding Band,

- SCH Ês/Iot is according to Table 8.11.2.2.1.2-1.

When measurement gaps are scheduled for FS3 inter-frequency measurements or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting CSI-RSRP measurements to higher layers with measurement accuracy as specified in section 9.1.18.4, with measurement period given by table 8.11.3.2.1.2-1.

The UE shall be capable of performing CSI-RSRP measurements of at least 3 identified inter-frequency TPs per FS3 inter-frequency for up to 3 FS3 inter-frequencies and the UE physical layer shall be capable of reporting CSI-RSRP measurements to higher layers with the measurement period defined in table 8.11.3.2.1.2-1 when DRX is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps.

Table 8.11.3.2.1.2-1: Requirements to measure FS3 inter-frequency TP

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SCH Ês/Iot | | CSI-RS measurement bandwidth Note2 [RB] | CSI-RS Ês/Iot | Tmeasure\_inter\_FS3\_CSI-RS\_DRX [ms] |
| 0 ≤ SCH Ês/Iot | | <25 | 0 ≤ CSI-RS Ês/Iot | (5\**Nfreq* +M\*N)\*Max{TDMTC\_periodicity, MGRP, DRX cycle length} |
| -6 ≤ SCH Ês/Iot < 0 | | <25 | (20\**Nfreq* +M\*N)\*Max{TDMTC\_periodicity, MGRP, DRX cycle length} |
| 0 ≤ SCH Ês/Iot | | 25 | 0 ≤ CSI-RS Ês/Iot | (1\**Nfreq* +M\*N)\*Max{TDMTC\_periodicity, MGRP, DRX cycle length} |
| -6 ≤ SCH Ês/Iot < 0 | | 25 | (4\**Nfreq* +M\*N)\*Max{TDMTC\_periodicity, MGRP, DRX cycle length} |
| NOTE 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  NOTE 2: The requirements for measurement bandwidth cid:image003.png@01D1B7C5.AA96B9A025 RB are optional. | | | |

The CSI-RSRP measurement accuracy for all measured TPs shall be as specified in section 9.1.18.4.

8.11.3.2.1.2.1 Measurement Reporting Requirements

8.11.3.2.1.2.1.1 Periodic Reporting

Reported CSI-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.18.4.

8.11.3.2.1.2.1.2 Event-triggered Periodic Reporting

Reported CSI-RSRP measurements contained in event triggered periodic measurement reports shall meet the requirements in section 9.1.18.4.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in section 8.11.3.2.1.2.1.3.

8.11.3.2.1.2.1.3 Event Triggered Reporting

Reported CSI-RSRP measurements contained in event triggered measurement reports shall meet the requirements in section 9.1.18.4.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report. When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected or by the LBT procedure performed by the UE in order to determine that the channel is clear for performing uplink transmission.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_inter\_TP\_FS3\_DRX defined in section 8.11.3.2.1.2.When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

If a TP which has been detectable at least for the time period Tidentify\_inter\_TP\_SCE\_DRX defined in clause 8.11.3.2.1.2 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasure\_inter\_FS3\_CSI-RS\_DRX provided the timing to that TP has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting, an additional delay can be expected.

##### 8.11.3.2.2 E-UTRAN TDD – FS3 inter-frequency measurements

8.11.3.2.2.1 E-UTRAN TDD – FS3 inter-frequency measurements when no DRX is used

The requirements in this section for UE configured with TDD PCell and no DRX are the same as the requirements in Section 8.11.3.2.1.1.

8.11.3.2.2.2 E-UTRAN TDD – FS3 inter-frequency measurements when DRX is used

The requirements in this section for UE configured with TDD PCell and DRX are the same as the requirements in Section 8.11.3.2.1.2.

### 8.11.4 RSSI measurements

#### 8.11.4.1 E-UTRAN intra-frequency measurements

NOTE: The requirements in this section are applicable only for measurements on SCC following the frame structure type 3 [16].

The UE physical layer shall be capable of performing the RSSI measurements [4] on one or more serving carriers operating under frame structure type 3 [16], if the carrier(s) are indicated by higher layers [2], and reporting the RSSI measurements to higher layers. The UE physical layer shall provide to higher layers a single RSSI sample for each OFDM symbol within each configured RSSI measurement duration [2] occurring with a configured RSSI measurement timing configuration periodicity [2]. The RSSI measurement period corresponds to max(*reportInterval*, *rmtc-Period*) when no DRX is used and max(*reportInterval*, *rmtc-Period, DRX cycle length*) when DRX is used, where *reportInterval* and *rmtc-Period* [2] are configured for the RSSI measurement by higher layers.

The RSSI measurement performed and reported according to this section shall meet the RSSI measurement accuracy requirement in Section 9.1.18.5.2.

#### 8.11.4.2 E-UTRAN inter-frequency measurements

The UE physical layer shall be capable of performing the RSSI measurements [4] on one or more inter-frequency carriers operating under frame structure type 3 [16], if the carrier(s) are indicated by higher layers [2], and reporting the RSSI measurements to higher layers. The UE physical layer shall provide to higher layers a single RSSI sample for each OFDM symbol within each configured RSSI measurement duration [2] occurring with a configured RSSI measurement timing configuration periodicity [2]. The RSSI measurement period corresponds to max(*reportInterval*, *rmtc-Period\* Nfreq,* MGRP\**Nfreq*) when no DRX is used and max(*reportInterval*, *Nfreq \** max*(rmtc-Period,* MGRP*, DRX cycle length*)) when DRX is used, where *reportInterval* and *rmtc-Period* [2] are configured for the RSSI measurement by higher layers, and *Nfreq* is defined in clause 8.1.2.1.1.

If the UE requires measurement gaps to perform inter-frequency measurements, a single measurement gap pattern is used for all concurrent inter-frequency measurements, including inter-frequency RSSI measurements. The RSSI measurement duration and the measurement gap should be aligned, and the following additional condition should fulfilled:

Entire RSSI measurement duration should be contained in the measurement gap.

UE is not required to perform RSSI measurement on symbols overlapped with the first 0.5 ms period and the last 0.5 ms period in every gap.

The RSSI measurement performed and reported according to this section shall meet the RSSI measurement accuracy requirement in Section 9.1.18.5.3.

### 8.11.5 Channel occupancy measurements

#### 8.11.5.1 E-UTRAN intra-frequency channel occupancy measurements

NOTE: The requirements in this section are applicable only for measurements on SCC following the frame structure type 3 [16].

The UE shall be capable of estimating the channel occupancy on one or more serving carrier frequencies indicated by higher layers [2], based on RSSI samples provided by the physical layer. The channel occupancy measurement period corresponds to max(*reportInterval*, *rmtc-Period*) when no DRX is used and max(*reportInterval*, *rmtc-Period, DRX cycle length*) when DRX is used, where *reportInterval* and *rmtc-Period* [2] are configured for the channel occupancy measurement by higher layers.

The channel occupancy measurement performed and reported according to this section shall meet the channel occupancy measurement accuracy requirements in Section 9.1.18.6.1.

#### 8.11.5.2 E-UTRAN inter-frequency channel occupancy measurements

The UE shall be capable of estimating the channel occupancy on one or more carrier frequencies indicated by higher layers [2], based on RSSI samples provided by the physical layer. The channel occupancy measurement period corresponds to max(*reportInterval*, *rmtc-Period\*Nfreq,* MGRP*\*Nfreq*) when no DRX is used and max(*reportInterval*, *Nfreq \** max*(rmtc-Period,* MGRP*, DRX cycle length*)) when DRX is used, where *reportInterval* and *rmtc-Period* [2] are configured for the channel occupany measurement by higher layers, and *Nfreq* is defined in clause 8.1.2.1.1.

If the UE requires measurement gaps to perform inter-frequency measurements, a single measurement gap pattern is used for all concurrent inter-frequency measurements, including inter-frequency channel occupancy measurements.

The channel occupancy measurement performed and reported according to this section shall meet the channel occupancy measurement accuracy requirements in Section 9.1.18.6.2.

## 8.12 Discovery Signal Measurements for E-UTRA Carrier Aggregation under Operation with Frame Structure 3

### 8.12.1 Introduction

This section contains requirements on UE capabilities for support of E-UTRA carrier aggregation under operation with frame structure 3.

Non configured frequencies may be measured with measurement gaps according to the requirements in Section 8.11.2.2 and Section 8.11.3.2.

The requirements in Section 8.12 shall apply for SCC with E-UTRA operation following the frame structure type 3 [16].

### 8.12.2 CRS based discovery signal measurements for E-UTRA carrier aggregation

#### 8.12.2.1 Introduction

The requirements in Section 8.12.2 shall apply for CRS based discovery signal measurements comprising RSRP and RSRQ measurements [4].

#### 8.12.2.2 Measurements of a secondary component carrier

A secondary component carrier may be activated and deactivated by MAC-CE commands as specified in [17]. The applicable performance requirements depend on whether the SCell on the corresponding frequency is actived or deactivated.

#### 8.12.2.3 Measurements of a secondary component carrier with active SCell

When the SCell is activated, measurement performance requirements for the frequency are those given in Section 8.11.2.1. If common DRX is in use, then the requirements for that secondary component carrier are given by the DRX requirements in Section 8.11.2.1.1.2, otherwise the non-DRX requirements are applicable. The applicable measurement accuracy requirements are in Section 9.1.19.

#### 8.12.2.4 Measurements of a secondary component carrier with deactivated SCell

This section defines the measurement requirements of a secondary component carrier with deactivated SCell based on the parameter *measCycleSCell* defined in TS 36.331 [2].

##### 8.12.2.4.1 E-UTRAN secondary component carrier measurements when no common DRX is used

When no DRX is in use the UE shall be able to identify a new detectable cell on a secondary component carrier within the cell identification time Tidentify\_SCC\_FS3, where the cell identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of Tmeasure\_SCC\_FS3\_CRS.

Tidentify\_SCC\_FS3 is the time period for cell identification as specified in Table 8.12.2.4.1-1,

Tmeasure\_SCC\_FS3\_CRS is thetime period for measurements as shown in Table 8.12.2.4.1-2,

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer,

L is the number of configured discovery signal occasions which are not available during Tidentify\_SCC\_FS3 for cell identification at the UE due to the absence of the necessary radio signals from the cell,

M is the number of configured discovery signal occasions which are not available during Tmeasure\_SCC\_FS3\_CRS for the measurements at the UE due to the absence of the necessary radio signals from the cell.

Table 8.12.2.4.1-1: Cell identification with deactivated SCell on SCC under operation with frame structure 3

|  |  |  |  |
| --- | --- | --- | --- |
| SCH Ês/Iot | CRS measurement bandwidth [RB] Note2 | CRS Ês/Iot | Tidentify\_SCC\_FS3 [ms] |
| 0 ≤ SCH Ês/Iot | <25 | -6 ≤ CRS Ês/Iot | (7+L)\*k1\*k2\**measCycleSCell* |
| -6 ≤ SCH Ês/Iot < 0 | <25 | (25+L)\*k1\*k2\**measCycleSCell* |
| 0 ≤ SCH Ês/Iot | 25 | 0 ≤ CRS Ês/Iot | (3+L)\*k1\*k2\**measCycleSCell* |
| -6 ≤ SCH Ês/Iot < 0 | 25 | (9+L)\*k1\*k2\**measCycleSCell* |
| Note 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  Note 2: The requirements for measurement bandwidth 25 RB are optional.  Note 3: k1=2 when the measurement gaps configured for inter-frequency measurements in DMTC occasions or for inter-frequency RSSI measurements in RMTC occasions on a carrier with frame structure 3 overlap with some but not all DMTC occasions of the measured cell; otherwise, k1=1, e.g., when measurement gaps configured for inter-frequency measurements on a carrier with frame structure 3 do not overlap with DMTC occasions of the measured cell or when the UE does not require the measurement gaps for the inter-frequency measurements. The requirements apply, provided that the inter-frequency measurement gap pattern does not overlap with all DMTC occasions of the measured cell.  k2= when DMTC occasions in the measured cell not overlapping with the inter-frequency measurement gaps overlap with DMTC occasions of *NFS3\_SCC* (*NFS3\_SCC*>0) SCells on other FS3 carriers; otherwise, k2=1, e.g., when *NFS3\_SCC*=0.  Note 4: The requirements apply, provided that L is such that the cell identification period Tidentify\_SCC\_FS3 does not exceed 75\*k1\*k2*\*measCycleSCell.* | | | |

A cell shall be considered detectable when the following conditions are met during the discovery signal occasions which are available during Tidentify\_SCC\_FS3:

- RSRP related side condition given in Section 9.1.19 are fulfilled for a corresponding Band,

- SCH\_RP|dBm is according to Annex B.2.12 for a corresponding Band and SCH Ês/Iot is according to Table 8.12.2.4.1-1.

The measurement period for deactivated SCell measurements is Tmeasure\_SCC\_FS3\_CRS according to the parameter *measCycleSCell* shown in Table 8.12.2.4.1-1.

Table 8.12.2.4.1-2: Measurement requirements on SCC with deactivated SCell under operation with frame structure 3 with deactivated SCell

|  |  |  |  |
| --- | --- | --- | --- |
| SCH Ês/Iot | CRS measurement bandwidth [RB] Note2 | CRS Ês/Iot | Tmeasure\_SCC\_FS3\_CRS [ms] |
| 0 ≤ SCH Ês/Iot | <25 | -6 ≤ CRS Ês/Iot | *(5+M)\*k1\*k2\*measCycleSCell* |
| -6 ≤ SCH Ês/Iot < 0 | <25 | *(20+M)\*k1\*k2\*measCycleSCell* |
| 0 ≤ SCH Ês/Iot | 25 | 0 ≤ CRS Ês/Iot | *(1+M)\*k1\*k2\*measCycleSCell* |
| -6 ≤ SCH Ês/Iot < 0 | 25 | *(4+M)\*k1\*k2\*measCycleSCell* |
| Note 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  Note 2: The requirements for measurement bandwidth 25 RB are optional.  Note 3: k1=2 when the measurement gaps configured for inter-frequency measurements in DMTC occasions or for inter-frequency RSSI measurements in RMTC occasions on a carrier with frame structure 3 overlap with some but not all DMTC occasions of the measured cell; otherwise, k1=1, e.g., when measurement gaps configured for inter-frequency measurements on a carrier with frame structure 3 do not overlap with DMTC occasions of the measured cell or when the UE does not require the measurement gaps for the inter-frequency measurements. The requirements apply, provided that the inter-frequency measurement gap pattern does not overlap with all DMTC occasions of the measured cell.  k2= when DMTC occasions in the measured cell not overlapping with the inter-frequency measurement gaps overlap with DMTC occasions of *NFS3\_SCC* (*NFS3\_SCC*>0) SCells on other FS3 carriers; otherwise, k2=1, e.g., when *NFS3\_SCC*=0.  Note 4: The requirements apply, provided that M is such that the time period Tmeasure\_SCC\_FS3\_CRS for measurements does not exceed 60\*k1\*k2*\*measCycleSCell*. | | | |

The UE shall be capable of performing RSRP and RSRQ measurements for 3 identified cells on a secondary component carrier, and the UE physical layer shall be capable of reporting measurements to higher layers within the measurement period of Tmeasure\_SCC\_FS3\_CRS.

The measurement accuracy for all measured cells shall be as specified in Section 9.1.19.

A UE may reconfigure the receiver bandwidth or turn on/off one of the RF chains when performing measurements on one SCC with deactivated SCell. This may cause interruptions on PCell that are specified in Section 7.8.

8.12.2.4.1.1 Measurement Reporting Requirements

8.12.2.4.1.1.1 Periodic Reporting

Reported measurements contained in periodically triggered measurement reports shall meet the requirements in Section 9.

8.12.2.4.1.1.2 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in Section 9.

The first report in event triggered periodic CRS based measurement reporting shall meet the requirements specified in Section 8.12.2.4.1.1.3.

8.12.2.4.1.1.3 Event Triggered Reporting

Reported measurements contained in event triggered measurement reports shall meet the requirements in Section 9.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which is caused by no UL resources for UE to send the measurement report or by the LBT procedure performed by the UE in order to determine that the channel is clear for performing uplink transmission.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_SCC\_FS3 defined in Section 8.12.2.4.1. When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_SCC\_FS3 defined in Section 8.12.2.4.1 becomes undetectable for a period ≤ 8 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tidentify\_SCC\_FS3\_CRS provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

##### 8.12.2.4.2 E-UTRAN secondary component carrier measurements when common DRX is used

When DRX is in use the UE shall be able to identify a new detectable FS3 cell on a secondary component carrier within the cell identification time Tidentify\_SCC\_FS3\_DRX, according to the parameter *measCycleSCell* , where the cell identification time of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of Tmeasure\_SCC\_FS3\_CRS\_DRX.

Tidentify\_SCC\_FS3\_DRX is the time period for cell identification as shown in Table 8.12.2.4.2-1,

Tmeasure\_SCC\_FS3\_CRS\_DRX is the time period for measurements as shown in Table 8.12.2.4.2-2,

TDMTC\_periodicity is the discovery signal measurement timing configuration periodicity of higher layer,

L is the number of configured discovery signal occasions during ON DURATION and which are not available during Tidentify\_SCC\_FS3\_DRX for cell identification at the UE due to the absence of the necessary radio signals from the cell,

M is the number of configured discovery signal occasions during ON DURATION and which are not available during Tmeasure\_SCC\_FS3\_CRS\_DRX for the measurements at the UE due to the absence of the necessary radio signals from the cell.

Table 8.12.2.4.2-1: Cell identification on SCC with deactivated SCell under operation with frame structure 3

|  |  |  |  |
| --- | --- | --- | --- |
| SCH Ês/Iot | CRS measurement bandwidth [RB] Note2 | CRS Ês/Iot | Tidentify\_SCC\_FS3\_DRX [ms] |
| 0 ≤ SCH Ês/Iot | <25 | -6 ≤ CRS Ês/Iot | *(7+L)\* k1\*k2\**Max{*measCycleSCell*, DRX cycle length} |
| -6 ≤ SCH Ês/Iot < 0 | <25 | *(25+L)\* k1\*k2\**Max{*measCycleSCell*, DRX cycle length} |
| 0 ≤ SCH Ês/Iot | 25 | 0 ≤ CRS Ês/Iot | *(3+L)\* k1\*k2\**Max{*measCycleSCell*, DRX cycle length} |
| -6 ≤ SCH Ês/Iot < 0 | 25 | *(9+L)\* k1\*k2\**Max{*measCycleSCell*, DRX cycle length} |
| Note 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  Note 2: The requirements for measurement bandwidth 25 RB are optional.  Note 3: k1=2 when the measurement gaps configured for inter-frequency measurements in DMTC occasions or for inter-frequency RSSI measurements in RMTC occasions on a carrier with frame structure 3 overlap with some but not all DMTC occasions of the measured cell during ON DURATION; otherwise, k1=1, e.g., when measurement gaps configured for inter-frequency measurements on a carrier with frame structure 3 do not overlap with DMTC occasions of the measured cell during ON DURATION or when the UE does not require the measurement gaps for the inter-frequency measurements. The requirements apply, provided that the inter-frequency measurement gap pattern does not overlap with all DMTC occasions of the measured cell.  k2= when DMTC occasions in the measured cell not overlapping with the inter-frequency measurement gaps overlap with DMTC occasions of *NFS3\_SCC* (*NFS3\_SCC*>0) SCells during ON DURATION on other FS3 carriers; otherwise, k2=1, e.g., when *NFS3\_SCC*=0.  Note 4: The requirements apply, provided that L is such that the cell identification period Tidentify\_SCC\_FS3\_DRX does not exceed 75\*k1\*k2\*Max{*measCycleSCell*, DRX cycle length}*.* | | | |

A cell shall be considered detectable when the following conditions are met during the discovery signal occasions which are available during Tidentify\_SCC\_FS3\_DRX:

- RSRP related side condition given in Section 9.1.19 are fulfilled for a corresponding Band,

- SCH\_RP|dBm is according to Annex B.2.12 for a corresponding Band and SCH Ês/Iot is according to Table 8.12.2.4.2-1.

The measurement period for deactivated scell measurements is Tmeasure\_SCC\_FS3\_CRS\_DRX according to the parameter *measCycleSCell* shown in Table 8.12.2.4.2-2.

Table 8.12.2.4.2-2: Measurement requirements on SCC with deactivated SCell under operation with frame structure 3

|  |  |  |  |
| --- | --- | --- | --- |
| SCH Ês/Iot | CRS measurement bandwidth [RB] Note2 | CRS Ês/Iot | Tmeasure\_SCC\_FS3\_CRS\_DRX [ms] |
| 0 ≤ SCH Ês/Iot | <25 | -6 ≤ CRS Ês/Iot | *(5 +M)\* k1\*k2\**Max{*measCycleSCell*, DRX cycle length} |
| -6 ≤ SCH Ês/Iot < 0 | <25 | *(20+M)\* k1\*k2\**Max{*measCycleSCell*, DRX cycle length} |
| 0 ≤ SCH Ês/Iot | 25 | 0 ≤ CRS Ês/Iot | *(1+M)\* k1\*k2\**Max{*measCycleSCell*, DRX cycle length} |
| -6 ≤ SCH Ês/Iot < 0 | 25 | *(4+M)\* k1\*k2\**Max{*measCycleSCell*, DRX cycle length} |
| Note 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  Note 2: The requirements for measurement bandwidth 25 RB are optional.  Note 3: k1=2 when the measurement gaps configured for inter-frequency measurements in DMTC occasions or for inter-frequency RSSI measurements in RMTC occasions on a carrier with frame structure 3 overlap with some but not all DMTC occasions of the measured cell during ON DURATION; otherwise, k1=1, e.g., when measurement gaps configured for inter-frequency measurements on a carrier with frame structure 3 do not overlap with DMTC occasions of the measured cell during ON DURATION or when the UE does not require the measurement gaps for the inter-frequency measurements. The requirements apply, provided that the inter-frequency measurement gap pattern does not overlap with all DMTC occasions of the measured cell.  k2= when DMTC occasions in the measured cell not overlapping with the inter-frequeny measurement gaps overlap with DMTC occasions of *NFS3\_SCC* (*NFS3\_SCC*>0) SCells during ON DURATION on other FS3 carriers; otherwise, k2=1, e.g., when *NFS3\_SCC*=0.  Note 4: The requirements apply, provided that M is such that the time period Tmeasure\_SCC\_FS3\_CRS\_DRX for measurements does not exceed 60\*k1\*k2\*Max{*measCycleSCell*, DRX cycle length}. | | | |

The UE shall be capable of performing RSRP and RSRQ measurements for 3 identified cells on a secondary component carrier, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_SCC\_FS3\_CRS\_DRX.

The measurement accuracy for all measured cells shall be as specified in Section 9.1.19.

A UE may reconfigure receiver bandwidth taking into account the SCell activation/deactivation status, and when making measurements of cells on one SCC with deactivated SCell. This may cause interruptions (packet drops) to a PCell. No interruptions while the On Duration timer is running shall be allowed when common DRX is used. The requirement considers only interruptions due to reconfiguration of the receiver bandwidth, and not due to other causes such as RF impairments or channel conditions.

8.12.2.4.2.1 Measurement Reporting Requirements

8.12.2.4.2.1.1 Periodic Reporting

Reported measurements contained in periodically triggered measurement reports shall meet the requirements in Section 9.

8.12.2.4.2.1.2 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in Section 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in Section 8.12.2.4.2.1.3.

8.12.2.4.2.1.3 Event Triggered Reporting

Reported measurements contained in event triggered measurement reports shall meet the requirements in Section 9.

The UE shall not send any event triggered CRS based measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which is caused by no UL resources for UE to send the measurement report or by the LBT procedure performed by the UE in order to determine that the channel is clear for performing uplink transmission.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_SCC\_FS3 defined in Section 8.12.2.4.2. When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_SCC\_FS3\_DRX defined in Section 8.12.2.4.2 becomes undetectable for a period ≤ 8 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tidentify\_SCC\_FS3\_CRS\_DRX provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

### 8.12.3 Requirements for CSI-RS based discovery signal measurements for E-UTRA carrier aggregation

#### 8.12.3.1 Introduction

The requirements in Section 8.12.3 shall apply for CSI-RS based discovery signal measurements comprising CSI-RSRP measurements [4].

#### 8.12.3.2 Measurements of a secondary component carrier

A Secondary component carrier may be activated and deactivated by MAC-CE commands as specified in [17]. The applicable performance requirements depend on whether the SCell on the corresponding frequency is actived or deactivated.

#### 8.12.3.3 Measurements of a secondary component carrier with active SCell

When the SCell is activated, measurement performance requirements for the frequency are those given in Section 8.11.3.1. If common DRX is in use, then the requirements for that secondary component carrier are given by the DRX requirements in Section 8.11.3.1.1.2, otherwise the non DRX requirements are applicable. The applicable measurement accuracy requirements are in Section 9.1.19.

#### 8.12.3.4 Measurements of a secondary component carrier with deactivated SCell

This section defines the measurement requirements of a secondary component carrier with deactivated SCell based on the parameter *measCycleSCell* defined in TS 36.331 [2].

##### 8.12.3.4.1 E-UTRAN secondary component carrier measurements when no common DRX is used

When no DRX is in use the UE shall be able to identify a new detectable FS3 TP on a secondary component carrier within the cell identification time Tidentify\_SCC\_TP\_FS3, where the identification of a TP shall include cell identification and a single measurement on the TP within the measurement period Tmeasure\_SCC\_FS3\_CSI-RS.

Tidentify\_SCC\_TP\_FS3 = Tidentify\_SCC\_FS3 + Tmeasure\_SCC\_FS3\_CSI-RS,

where:

Tidentify\_SCC\_FS3 is the time period for cell identification in Section 8.12.2.4.1,

Tmeasure\_SCC\_FS3\_CSI-RS is the time period for TP measurement in Table 8.12.3.4.1-1,

M is the number of configured discovery signal occasions which are not available for the measurements at the UE during Tmeasure\_SCC\_FS3\_CSI-RS due to the absence of the necessary radio signals from the cell.

During Tidentify\_SCC\_TP\_FS3 over multiple discovery signal occasions, the UE may assume the following:

- in all the discovery signal occasions, which are available at the UE, the corresponding necessary cell-specific discovery signals are always available from the same set of TPs in the measured cell, and

- in all the discovery signal occasions, which are not available at the UE, the corresponding necessary cell-specific discovery signals are not available from any TP within the same measured cell.

Table 8.12.3.4.1-1: Measurement requirements for a TP on SCC with deactivated SCell under operation with frame structure 3

|  |  |  |  |
| --- | --- | --- | --- |
| SCH Ês/Iot | CSI-RS measurement bandwidth [RB] Note2 | CSI-RS Ês/Iot | Tmeasure\_SCC\_FS3\_CSI-RS [ms] |
| 0 ≤ SCH Ês/Iot | <25 | 0 ≤ CSI-RS Ês/Iot | (5+M) \* k1\*k2\* *measCycleSCell* |
| -6 ≤ SCH Ês/Iot < 0 | <25 | (20+M) \* k1\*k2\* *measCycleSCell* |
| 0 ≤ SCH Ês/Iot | 25 | 0 ≤ CSI-RS Ês/Iot | (1+M) \* k1\*k2\* *measCycleSCell* |
| -6 ≤ SCH Ês/Iot < 0 | 25 | (4+M) \* k1\*k2\* *measCycleSCell* |
| Note 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  Note 2: The requirements for measurement bandwidth 25 RB are optional.  Note 3: k1=2 when the measurement gaps configured for inter-frequency measurements in DMTC occasions or for inter-frequency RSSI measurements in RMTC occasions on a carrier with frame structure 3 overlap with some but not all DMTC occasions of the measured TP; otherwise, k1=1, e.g., when measurement gaps configured for inter-frequency measurements on a carrier with frame structure 3 do not overlap with DMTC occasions of the measured TP or when the UE does not require the measurement gaps for the inter-frequency measurements. The requirements apply, provided that the inter-frequency measurement gap pattern does not overlap with all DMTC occasions of the measured cell.  k2= when DMTC occasions in the measured TP not overlapping with the inter-frequency measurement gaps overlap with DMTC occasions of *NFS3\_SCC* (*NFS3\_SCC*>0) SCells on other FS3 carriers; otherwise, k2=1, e.g., when *NFS3\_SCC*=0.  Note 4: The requirements apply, provided that M is such that the time period Tmeasure\_SCC\_FS3\_CSI-RS for TP measurement does not exceed 60\*k1\*k2\* *measCycleSCell.* | | | |

A TP shall be considered detectable when the following conditions are met during the discovery signal occasions which are available during Tidentify\_SCC\_TP\_FS3:

- CSI-RSRP related side condition given in Section 9.1.19 are fulfilled for a corresponding Band,

- SCH\_RP|dBm is according to Annex B.2.12 for a corresponding Band and SCH Ês/Iot is accordin g to Table 8.12.2.4.1-1.

The UE shall be capable of performing RSRP measurements for 3 identified TPs on a secondary component carrier, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_SCC\_FS3\_CSI-RS.

The measurement accuracy for all measured TPs shall be as specified in Section 9.1.19.

A UE may reconfigure the receiver bandwidth or turn on/off one of the RF chains when performing measurements on one SCC with deactivated SCell. This may cause interruptions on PCell that are specified in Section 7.8.

8.12.3.4.1.1 Measurement Reporting Requirements

8.12.3.4.1.1.1 Periodic Reporting

Reported measurements contained in periodically triggered measurement reports shall meet the requirements in Section 9.

8.12.3.4.1.1.2 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in Section 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in Section 8.12.3.4.1.1.3.

8.12.3.4.1.1.3 Event Triggered Reporting

Reported measurements contained in event triggered measurement reports shall meet the requirements in Section 9.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which is caused by no UL resources for UE to send the measurement report or by the LBT procedure performed by the UE in order to determine that the channel is clear for performing uplink transmission.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_SCC\_TP\_FS3 defined in Section 8.12.3.4.1. When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

If a TP which has been detectable at least for the time period Tidentify\_SCC\_TP\_FS3 defined in Section 8.12.3.4.1 becomes undetectable for a period ≤ 8 seconds and then the TP becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tidentify\_SCC\_FS3\_CSI-RS provided the timing to that TP has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

##### 8.12.3.4.2 E-UTRAN secondary component carrier measurements when common DRX is used

When DRX is in use the UE shall be able to identify a new detectable FS3 TP on a secondary component carrier within Tidentify\_SCC\_TP\_FS3\_DRX, according to the parameter *measCycleSCell*, where the identification of a TP shall include cell identification and a single measurement on the TP within the measurement period Tmeasure\_SCC\_FS3\_CSI-RS\_DRX.

Tidentify\_SCC\_TP\_FS3\_DRX = Tidentify\_SCC\_FS3\_DRX + Tmeasure\_SCC\_FS3\_CSI-RS\_DRX,

where:

Tidentify\_SCC\_FS3\_DRX is the time period for cell identification in Section 8.12.2.4.2,

Tmeasure\_SCC\_FS3\_CSI-RS\_DRX is the time period for TP measurement in Table 8.12.3.4.2-1,

M is the number of configured discovery signal occasions during ON DURATION and which are not available during Tmeasure\_SCC\_FS3\_CSI-RS\_DRX for the measurements at the UE due to the absence of the necessary radio signals from the cell.

During Tidentify\_SCC\_TP\_FS3\_DRX over multiple discovery signal occasions, the UE may assume the following:

- in all the discovery signal occasions, which are available at the UE, the corresponding necessary cell-specific discovery signals are always available from the same set of TPs in the measured cell, and

- in all the discovery signal occasions, which are not available at the UE, the corresponding necessary cell-specific discovery signals are not available from any TP within the same measured cell.

Table 8.12.3.4.2-1: Measurement requirements for a TP on SCC with deactivated SCell under operation with frame structure 3

|  |  |  |  |
| --- | --- | --- | --- |
| SCH Ês/Iot | CSI-RS measurement bandwidth [RB] Note2 | CSI-RS Ês/Iot | Tmeasure\_SCC\_FS3\_CSI-RS\_DRX [ms] |
| 0 ≤ SCH Ês/Iot | <25 | 0 ≤ CSI-RS Ês/Iot | (5+M) \* k1\*k2\*Max{ *measCycleSCell*, DRX cycle length } |
| -6 ≤ SCH Ês/Iot < 0 | <25 | (20+M) \* k1\*k2\*Max{ *measCycleSCell*, DRX cycle length } |
| 0 ≤ SCH Ês/Iot | 25 | 0 ≤ CSI-RS Ês/Iot | (1+M) \* k1\*k2\*Max{ *measCycleSCell*, DRX cycle length } |
| -6 ≤ SCH Ês/Iot < 0 | 25 | (4+M) \* k1\*k2\*Max{ *measCycleSCell*, DRX cycle length } |
| Note 1: Discovery signal occasion duration (*ds-OccasionDuration*) is 1 ms.  Note 2: The requirements for measurement bandwidth 25 RB are optional.  Note 3: k1=2 when the measurement gaps configured for inter-frequency measurements in DMTC occasions or for inter-frequency RSSI measurements in RMTC occasions on a carrier with frame structure 3 overlap with some but not all DMTC occasions of the measured TP during ON DURATION; otherwise, k1=1, e.g., when measurement gaps configured for inter-frequency measurements on a carrier with frame structure 3 do not overlap with DMTC occasions of the measured TP during ON DURATION or when the UE does not require the measurement gaps for the inter-frequency measurements. The requirements apply, provided that the inter-frequency measurement gap pattern does not overlap with all DMTC occasions of the measured cell.  k2= when DMTC occasions in the measured TP not overlapping with the inter-frequency measurement gaps overlap with DMTC occasions of *NFS3\_SCC* (*NFS3\_SCC*>0) SCells during ON DURATION on other FS3 carriers; otherwise, k2=1, e.g., when *NFS3\_SCC*=0.  Note 4: The requirements apply, provided that M is such that the time period Tmeasure\_SCC\_FS3\_CSI-RS\_DRX for TP measurement does not exceed 60\*k1\*k2\*Max{*measCycleSCell*, DRX cycle length}*.* | | | |

A TP shall be considered detectable when the following conditions are met during the discovery signal occasions which are available during Tidentify\_SCC\_TP\_FS3\_DRX:

- CSI-RSRP related side condition given in Section 9.1.19 are fulfilled for a corresponding Band,

- SCH\_RP|dBm is according to Annex B.2.12 for a corresponding Band and SCH Ês/Iot is according to Table 8.12.2.4.2-1.

The UE shall be capable of performing CSI-RSRP measurements for 3 identified TPs on a secondary component carrier, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_SCC\_FS3\_CSI-RS\_DRX.

The measurement accuracy for all measured TPs shall be as specified in Section 9.1.19.

A UE may reconfigure receiver bandwidth taking into account the SCell activation/deactivation status, and when making measurements of TPs on one SCC with deactivated SCell. This may cause interruptions (packet drops) to a PCell. No interruptions while the On Duration timer is running shall be allowed when common DRX is used. The requirement considers only interruptions due to reconfiguration of the receiver bandwidth, and not due to other causes such as RF impairments or channel conditions.

8.12.3.4.2.1 Measurement Reporting Requirements

8.12.3.4.2.1.1 Periodic Reporting

Reported measurements contained in periodically triggered measurement reports shall meet the requirements in Section 9.

8.12.3.4.2.1.2 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in Section 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in Section 8.12.3.4.2.1.3.

8.12.3.4.2.1.3 Event Triggered Reporting

Reported measurements contained in event triggered measurement reports shall meet the requirements in Section 9.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which is caused by no UL resources for UE to send the measurement report or by the LBT procedure performed by the UE in order to determine that the channel is clear for performing uplink transmission.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_SCC\_TP\_FS3\_DRX defined in Section 8.12.3.4.2. When L3 filtering is used or IDC autonomous denial is configured or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

If a TP which has been detectable at least for the time period Tidentify\_SCC\_TP\_FS3\_DRX defined in Section 8.12.3.4.2 becomes undetectable for a period ≤ 8 seconds and then the TP becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tidentify\_SCC\_FS3\_CSI-RS\_DRX provided the timing to that TP has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or LBT is performed by the UE on the carrier used for the measurement reporting an additional delay can be expected.

## 8.13 Measurements for UE Category M1

### 8.13.1 Introduction

The UE category M1 applicability of the requirements in subclause 8.13 is defined in Section 3.6.

This clause contains requirements on the UE regarding measurement reporting in RRC\_CONNECTED state. The requirements are specified for E-UTRA intra frequency measurements. These measurements may be used by the E-UTRAN, e.g. for handover decisions. The measurement quantities are defined in TS 36.214 [4], the measurement model is defined in TS 36.302 [22] and measurement accuracies are specified in clause 9. Control of measurement reporting is specified in TS 36.331 [2].

The UE shall meet the requirements in Section 8.13, provided:

- the UE does not require measurement gaps for the corresponding measurements, or

- the UE requires measurement gaps for the corresponding measurements and is configured with the measurement gap pattern Id 0 or 1 and is not configured with any measurement gap pattern from Table 8.1.2.1-3.

If the UE requires measurement gaps for the corresponding measurements and is configured with the measurement gap pattern from Table 8.1.2.1-3, the UE is not required to perform any RRM measurements that requires gaps during the RSTD measurement period and the requirement in Section 8.13 shall not apply during the RSTD measurement period.

When the UE is provided with IDC solution, the UE shall also perform RRM measurements and meet the corresponding requirements in clause 8.

### 8.13.2 Requirements for UE category M1 with CE mode A

The UE category M1 applicability of the requirements in subclause 8.13.2 is defined in Section 3.6. The requirements defined in clause 8.13.2 apply provided the following conditions are met:

- UE is configured with measurement gap pattern ID#0 or ID#1 defined in Table 8.1.2.1-1.

Alternatively, the UE shall meet the requirements in subclause 8.13.2 defined for gap pattern ID#0 without using any measurement gaps provided:

- UE indicates it does not need gaps with the capability intraFreq-CE-NeedForGaps-r13 [2, TS 36.331] for the frequency band of the serving cell, or

- UE is not configured with any reporting configuration that requires measurement on any intra-frequency neighbour cell.

#### 8.13.2.1 E-UTRAN intra frequency measurements by UE category M1 with CE mode A

The UE shall be able to identify new intra-frequency cells and perform RSRP and RSRQ measurements of identified intra-frequency cells without an explicit intra-frequency neighbour cell list containing physical layer cell identities. During the RRC\_CONNECTED state the UE shall continuously measure identified intra frequency cells and additionally search for and identify new intra frequency cells.

The UE is allowed to perform RSRP measurements based on RSS signals provided UE is configured with *rss-ConfigCarrierInfo* [2] and following conditions are met:

- If measurement gaps are configured, the measured subframes containing RSS are available before or after the measurement gaps and UE shall measure RSS outside the gaps, and

- RSS frequency location of the cell being measured occurs in the NB(s) that UE monitors for MPDDCH if UE supports measuring neighbour cell RSS in the same MPDCCH bandwidth, or within the same RSS RB location of the serving cell if UE does not support measuring neighbour cell RSS in the same MPDCCH bandwidth, for 3 successive DRX cycles or MPDCCH monitoring cycles and the last subframe of the RSS occasion of the measured cell is in the window of [n-5, n-1] where n is the first subframe of DRX ON duration or MPDCCH monitoring occasion, and

- RSS-based measurement period (Tmeasure\_intra\_UE cat M1) is not longer than CRS-based measurement period, and

- RSS power offset (PRSS) with respect to CRS as defined in *RSS-Config* or *rss-MeasPowerBias* [2], where PRSS ≥ 0 dB.

- RSRQ is not configured as trigger quantity or report quantity for intra-frequency measurement

If UE performs RSRP measurement based on RSS for serving or neighbour cell, it is not expected to perform RSRP measurement based on CRS on that cell. UE shall compensate the RSS power offset (PRSS) with respect to CRS when derving the RSRP measurement based on RSS.

For performing RSRP measurement based on RSS on detected intra-frequency cells, UE assumes BL/CE DL subframe configuration of each neighbor cell is same as serving cell. The requirements for RSRP measurement based on RSS for a neighbour cell apply provided that BL/CE DL subframe configuration of the neighbor cell is same as serving cell.

Additionally, for performing RSS-based RSRP measurements on detected intra-frequency cells, the UE assumes that the RSS transmission of each neighbor cell starts in the radio frame that is closest in time, i.e. within a window of +/- 5ms, around the corresponding radio frame offset calculated from RRC signalling in the serving cell, as described in TS 36.331 subclause 6.3. The requirements for RSS-based RSRP measurements for neighbor cells apply provided that the RSS transmission of each neighbor cell starts in the radio frame within a window of +/- 5ms around the calculated radio frame offset of the serving cell.

##### 8.13.2.1.1 E-UTRAN FDD intra frequency measurements

8.13.2.1.1.1 E-UTRAN intra frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify and measure a new detectable FDD intra frequency cell according to requirements in Table 8.13.2.1.1.1-1 when SCH Ês/Iot >= -6 dB, provided

- G=1, or

- rmax\*G < 80ms, or

- UE is receiving PDSCH.

Otherwise, requirements in Table 8.13.2.1.1.1-3 apply, where rmax and G are given by higher layer parameter *mPDCCH-NumRepetition* and *mPDCCH-startSF-UESS* respectively as defined in TS 36.213 [3].

Table 8.13.2.1.1.1-1: Requirement on cell identification delay and measurement delay for FDD intrafrequency cell

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | Cell identification delay (Tidentify\_intra\_UE cat M1) | Measurement delay (Tmeasure\_intra\_UE cat M1) |
| 0 | 1.44 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC seconds | 480 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC ms |
| 1 | 2.88 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC seconds | 960 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC ms |
| N/A | N/A | 3 x TRSS (Note 1) |
| Note 1: It is the measurement period for RSRP measured on RSS signals defined in *RSS-Config* [2]. | | |

Kintra\_M1\_NC = 100 / X where X is signalled by the RRC parameter *measGapSharingScheme* [2] and is defined as in Table 8.13.2.1.1.1-2 when *highSpeedMeasGapCE-ModeA* [2]is not configured, and in Table 8.13.2.1.1.1-2A when *highSpeedMeasGapCE-ModeA* [2] is configured.  is total number of inter-frequency layers to be monitored as defined in 8.1.2.1.1. When inter frequency measurement is not configured, Kintra\_M1\_NC=1 regardless whether or how parameter measGapSharingScheme [2] is configured.

Table 8.13.2.1.1.1-2: Value of parameter X for CEModeA

|  |  |
| --- | --- |
| *measGapSharingScheme* | Value of X (%) |
| ‘00’ |  |
| ‘01’ | 40 |
| ‘10’ | 50 |
| ‘11’ | 60 |

Table 8.13.2.1.1.1-2A: Value of parameter X for CEModeA for UE configured with *highSpeedMeasGapCE-ModeA*

|  |  |
| --- | --- |
| *measGapSharingScheme* | Value of X (%) |
| ‘00’ |  |
| ‘01’ | 50 |
| ‘10’ | 80 |
| ‘11’ | 90 |

Table 8.13.2.1.1.1-3: Requirement on cell identification delay and measurement delay for FDD intrafrequency cell with MPDCCH scaling

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | Cell identification delay (Tidentify\_intra\_UE cat M1) | Measurement delay (Tmeasure\_intra\_UE cat M1) |
| 0 | Max(20 \* rmax\*G / 1000, 1.44) \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC seconds | Max(5 \* rmax\*G, 480) \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC ms |
| 1 | Max(20 \* rmax\*G / 1000, 2.88) \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC seconds | Max(5 \* rmax\*G, 960) \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC ms |
| N/A | N/A | Max(rmax\*G, TRSS) x 3 (Note 1) |
| Note 1: It is the measurement period for RSRP measured on RSS signals defined in *RSS-Config* [2]. | | |



KRSTD\_M1\_NC is applicable provided following conditions are met:

-  > 40 ms

-  > 

* PRS bandwidth is less than the bandwidth of the cell used for RSTD measurement in which case gaps are required

where

- is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

- **** is the number of consecutive downlink positioning subframes in a positioning occation defined in TS 36.211

Otherwise KRSTD\_M1\_NC = 1.

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.1 and 9.1.21.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.6 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-1 for a corresponding Band.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of Tmeasure\_intra\_UE cat M1. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is according to Table 8.13.2.1.1.1-1. When measurement gaps are activated the UE shall be capable of performing measurements for at least 6cells. If the UE has identified more than 6 cells, the UE shall perform measurements but the reporting rate of RSRP and RSRQ measurement of cells from UE physical layer to higher layers may be decreased.

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.1 and 9.1.21.2.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.6.

8.13.2.1.1.1.1 Measurement Reporting Requirements

8.13.2.1.1.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

8.13.2.1.1.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.1.1.1.1.3.

8.13.2.1.1.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify intra\_UE cat M1\_NC defined in Clause 8.13.2.1.1.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_NC defined in clause 8.13.2.1.1.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_UE cat M1, Intra provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.2.1.1.2 E-UTRAN intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra\_UE cat M1\_NC as shown in table 8.13.2.1.1.2-1.

When eDRX\_CONN is in use the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra\_UE cat M1\_NC as shown in table 8.13.2.1.1.2-1A.

Table 8.13.2.1.1.2-1: Requirement to identify a newly detectable FDD intrafrequency cell

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | DRX cycle length (s) | Tidentify\_intra\_UE cat M1\_NC (s) (DRX cycles) |
| 0 | ≤0.04 | 1.44 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.04<DRX-cycle≤0.08 | Note 2 (40 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.128 | 3.2 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (25 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2(20 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 1 | <0.128 | 2.88 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.128 | 3.2 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (25 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2(20 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

Table 8.13.2.1.1.2-1A: Requirement to identify a newly detectable FDD intrafrequency cell when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_intra\_UE cat M1\_NC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (20 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.1 and 9.1.21.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.6 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.14-1 for a corresponding Band

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra\_UE cat M1. When DRX is used, Tmeasure\_intra\_UE cat M1\_NC is as specified in table 8.13.2.1.1.2-2. When eDRX\_CONN is used, Tmeasure\_intra\_UE cat M1\_NC is as specified in table 8.13.2.1.1.2-3. The UE shall be capable of performing RSRP and RSRQ measurements for 6 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_UE cat M1.

Table 8.13.2.1.1.2-2: Requirement to measure FDD intrafrequency cells

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | DRX cycle length (s) | Tmeasure\_intra\_UE cat M1\_NC (s) (DRX cycles) |
| 0 | <0.128 | 0.48 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note1) |
| 0.128≤DRX-cycle≤2.56 | Note 2 (5 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 1 | <0.256 | 0.960 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.256≤DRX-cycle≤2.56 | Note 2 (\*Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| N/A | N/A | Max(DRX cycle length, TRSS ) x 3(Note 3) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use  Note 3 It is the measurement period for RSRP measured on RSS signals defined in *RSS-Config* [2]. | | |

Table 8.13.2.1.1.2-3: Requirement to measure FDD intrafrequency cells when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_intra\_UE cat M1\_NC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.1 and 9.1.21.2.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.6.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.2.1.1.2.1 Measurement Reporting Requirements

8.13.2.1.1.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

8.13.2.1.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.1.1.2.1.3.

8.13.2.1.1.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra, UE cat M1 defined in Clause 8.13.2.1.1.2 When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_NC  defined in clause 8.13.2.1.1.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_UE cat M1\_NC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

##### 8.13.2.1.2 E-UTRAN intra frequency measurements for HD-FDD

8.13.2.1.2.1 E-UTRAN intra frequency measurements when no DRX is used

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.13.2.1.1.1 also apply for this section provided the following conditions are met:

- at least downlink subframe # 0 or downlink subframe # 5 per radio frame of an intra-frequency cell to be identified by the UE is available at the UE over Tidentify\_intra\_UE cat M1;

- at least one downlink subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell over Tmeasure\_intra\_UE cat M1.

- RSRP related side conditions given in Sections 9.1.2.1 and 9.1.2.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.6 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-2 for a corresponding Band

8.13.2.1.2.2 E-UTRAN intra frequency measurements when DRX is used

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

When DRX is in use the UE shall be able to identify a new detectable HD-FDD intra frequency cell within Tidentify\_intra\_UE cat M1\_NC  as shown in table 8.13.2.1.2.2-1.

When eDRX\_CONN is in use, the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra\_UE cat M1\_NC as shown in table 8.13.2.1.2.2-1A.

Table 8.13.2.1.2.2-1: Requirement to identify a newly detectable HD-FDD intrafrequency cell

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | DRX cycle length (s) | Tidentify\_intra\_UE cat M1\_NC (s) (DRX cycles) |
| 0 | ≤0.04 | 1.44 \* Kintra\_M1\_NC  \*  KRSTD\_M1\_NC (Note 1) |
| 0.04<DRX-cycle≤0.08 | Note 2 (40 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.128 | 3.2 \* Kintra\_M1\_NC  \*  KRSTD\_M1\_NC (32 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2 (25 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 1 | ≤0.08 | 2.88 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.128 | 3.2 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (32 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2 (25 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

Table 8.13.2.1.2.2-1A: Requirement to identify a newly detectable HD-FDD intrafrequency cell when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_intra\_UE cat M1\_NC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (25 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.1 and 9.1.21.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.6 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-2 for a corresponding Band

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra\_UE cat M1. When DRX is used, Tmeasure\_intra\_UE cat M1\_NC is as specified in table 8.13.2.1.2.2-2. When eDRX\_CONN is used, Tmeasure\_intra\_UE cat M1\_NC is as specified in table 8.13.2.1.2.2-3. The UE shall be capable of performing RSRP and RSRQ measurements for 6 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_UE cat M1.

Table 8.13.2.1.2.2-2: Requirement to measure HD-FDD intrafrequency cells

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | DRX cycle length (s) | Tmeasure\_intra\_UE cat M1\_NC (s) (DRX cycles) |
| 0 | <0.08 | 0.48 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.08≤DRX-cycle≤0.16 | Note 2 (7 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.16<DRX-cycle≤2.56 | Note 2 (5 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 1 | <0.16 | 0.96 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| DRX-cycle=0.16 | 1.12 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (7 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.16<DRX-cycle≤2.56 | Note 2 (5 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| N/A | N/A | Max(DRX cycle length, TRSS ) x 3 (Note 3) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use  Note 3: It is the measurement period for RSRP measured on RSS signals defined in *RSS-Config* [2]. | | |

Table 8.13.2.1.2.2-3: Requirement to measure HD-FDD intrafrequency cells when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_intra\_UE cat M1\_NC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.1 and 9.1.21.2.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.6.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.2.1.2.2.1 Measurement Reporting Requirements

8.13.2.1.2.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

8.13.2.1.2.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2, and 9.1.21.6.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.1.2.2.1.3.

8.13.2.1.2.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra\_UE cat M1\_NC defined in Clause 8.13.2.1.2.2When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_NC defined in clause 8.13.2.1.2.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_UE cat M1\_NC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

##### 8.13.2.1.3 E-UTRAN TDD intra frequency measurements

8.13.2.1.3.1 E-UTRAN intra frequency measurements when no DRX is used

When no DRX is in use, the UE shall be able to identify and measure a new detectable TDD intra frequency cell according to requirements in Table 8.13.2.1.3.1-1 when SCH Ês/Iot >= -6 dB, provided

- G=1, or

- rmax\*G < 80ms, or

- UE is receiving PDSCH.

Otherwise, requirements in Table 8.13.2.1.3.1-3 apply, where rmax and G are given by higher layer parameter *mPDCCH-NumRepetition* and *mPDCCH-startSF-UESS* respectively as defined in TS 36.213 [3].

Table 8.13.2.1.3.1-1: Requirement on cell identification delay and measurement delay for TDD intrafrequency cell

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | Cell identification delay (Tidentify\_intra\_UE cat M1) | Measurement delay (Tmeasure\_intra\_UE cat M1) |
| 0 | 1.44 \* Kintra\_M1\_NC  \*  KRSTD\_M1\_NC seconds | 480 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC ms |
| 1 | 2.88 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC seconds | 960 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC ms |
| N/A | N/A | 3 x TRSS (Note 1) |
| Note 1: It is the measurement period for RSRP measured on RSS signals defined in *RSS-Config* [2]. | | |

Kintra\_M1\_NC = 100 / X where X is signalled by the RRC parameter *measGapSharingScheme* [2] and is defined as in Table 8.13.2.1.3.1-2 when *highSpeedMeasGapCE-ModeA* [2] is not configured, and in Table 8.13.2.1.3.1-2A when *highSpeedMeasGapCE-ModeA* [2] is configured.  is total number of inter-frequency layers to be monitored as defined in 8.1.2.1.1. When inter frequency measurement is not configured, Kintra\_M1\_NC=1 regardless whether or how parameter measGapSharingScheme [2] is configured.

Table 8.13.2.1.3.1-2: Value of parameter X for CEModeA

|  |  |
| --- | --- |
| *measGapSharingScheme* | Value of X (%) |
| ‘00’ |  |
| ‘01’ | 40 |
| ‘10’ | 50 |
| ‘11’ | 60 |

Table 8.13.2.1.3.1-2A: Value of parameter X for CEModeA for UE configured with *highSpeedMeasGapCE-ModeA*

|  |  |
| --- | --- |
| *measGapSharingScheme* | Value of X (%) |
| ‘00’ |  |
| ‘01’ | 50 |
| ‘10’ | 80 |
| ‘11’ | 90 |

Table 8.13.2.1.3.1-3: Requirement on cell identification delay and measurement delay for TDD intrafrequency cell with MPDCCH scaling

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | Cell identification delay (Tidentify\_intra\_UE cat M1) | Measurement delay (Tmeasure\_intra\_UE cat M1) |
| 0 | Max(20 \* rmax\*G / 1000, 1.44) \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC seconds | Max(5 \* rmax\*G, 480) \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC ms |
| 1 | Max(20 \* rmax\*G / 1000, 2.88) \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC seconds | Max(5 \* rmax\*G, 960) \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC ms |
| N/A | N/A | Max(rmax\*G, TRSS) x 3 (Note 1) |
| Note 1: It is the measurement period for RSRP measured on RSS signals defined in *RSS-Config* [2]. | | |



KRSTD\_M1\_NC is applicable provided following conditions are met:

-  > 40 ms

-  > 

* PRS bandwidth is less than the bandwidth of the cell used for RSTD measurement in which case gaps are required

where

- is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

- **** is the number of consecutive downlink positioning subframes in a positioning occation defined in TS 36.211

Otherwise KRSTD\_M1\_NC = 1.

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.1 and 9.1.21.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.6 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-1 for a corresponding Band.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of Tmeasure\_intra\_UE cat M1. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is according to Table 8.13.2.1.3.1-1. When measurement gaps are activated the UE shall be capable of performing measurements for at least 6cells. If the UE has identified more than 6 cells, the UE shall perform measurements but the reporting rate of RSRP and RSRQ measurements of cells from UE physical layer to higher layers may be decreased.

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.1 and 9.1.21.2.

The RSRQmeasurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.6.

8.13.2.1.3.1.1 Measurement Reporting Requirements

8.13.2.1.3.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

8.13.2.1.3.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.1.3.1.1.3.

8.13.2.1.3.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify intra\_UE cat M1\_NC defined in Clause 8.13.2.1.3.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_NC defined in clause 8.13.2.1.3.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period Intra\_UE cat M1\_NC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.2.1.3.2 E-UTRAN intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable TDD intra frequency cell within Tidentify\_intra\_ UE catM1 as shown in table 8.13.2.1.3.2-1.

When eDRX\_CONN is in use the UE shall be able to identify a new detectable TDD intra frequency cell within Tidentify\_intra\_UE cat M1\_NC as shown in table 8.13.2.1.3.2-1A.

Table 8.13.2.1.3.2-1: Requirement to identify a newly detectable TDD intrafrequency cell

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | DRX cycle length (s) | Tidentify\_intra\_UE cat M1\_NC (s) (DRX cycles) |
| 0 | ≤0.04 | 1.44 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.04<DRX-cycle≤0.08 | Note 2 (40 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.128 | 3.2 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (25 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2 (20 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 1 | <0.128 | 2.88 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.128 | 3.2 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (25 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2 (20 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

Table 8.13.2.1.3.2-1A: Requirement to identify a newly detectable TDD intrafrequency cell when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_intra\_UE cat M1\_NC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (20 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Clause 9.1.21.1 and 9.1.21.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.6 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-1 for a corresponding Band

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra\_UE cat M1. When DRX is used, Tmeasure\_intra\_UE cat M1\_NC is as specified in table 8.13.2.1.3.2-2. When eDRX\_CONN is used, Tmeasure\_intra\_UE cat M1\_NC is as specified in table 8.13.2.1.3.2-3. The UE shall be capable of performing RSRP and RSRQ measurements for 6 identified intra-frequency cells and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_UE cat M1.

Table 8.13.2.1.3.2-2: Requirement to measure TDD intra frequency cells

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | DRX cycle length (s) | Tmeasure\_intra\_UE cat M1\_NC (s) (DRX cycles) |
| 0 | <0.128 | 0.48 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.128≤DRX-cycle≤2.56 | Note 2 (5 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| 1 | <0.256 | 0.96 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.256≤DRX-cycle≤2.56 | Note 2 (5 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| N/A | N/A | Max(DRX cycle length, TRSS ) x 3 (Note 3) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use  Note 3: It is the measurement period for RSRP measured on RSS signals defined in *RSS-Config* [2]. | | |

Table 8.13.2.1.3.2-3: Requirement to measure TDD intra frequency cells when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_intra\_UE cat M1\_NC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5 \* Kintra\_M1\_NC \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use. | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.1 and 9.1.21.2.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.6.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.2.1.3.2.1 Measurement Reporting Requirements

8.13.2.1.3.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

8.13.2.1.3.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.1.3.2.1.3.

8.13.2.1.3.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.1, 9.1.21.2 and 9.1.21.6.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra\_UE cat M1\_NC defined in Clause 8.13.2.1.3.2.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_NC defined in clause 8.13.2.1.3.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_UE cat M1\_NC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

#### 8.13.2.2 Void

#### 8.13.2.3 E-UTRAN OTDOA Intra-Frequency RSTD Measurements for Cat-M1 UE in CEModeA

All intra-frequency RSTD measurement requirements specified in Sections 8.13.2.3 shall apply without DRX as well as for any DRX and eDRX\_CONN cycles specified in TS 36.331 [2]. All the measurement requirements specified in Sections 8.13.2.3 shall apply provided that the UE is configured:

- with the single PRS configuration for the reference cell and all the neighbour cells and

- with either the measurement gap pattern ID #0 specified in Clause 8.1.2.1 or any applicable measurement gap pattern specified in Table 8.1.2.1-3 for cat M1 RSTD measurements if the PRS bandwidth is less than the bandwidth of the cell used for the RSTD measurement in which case gaps are required

If CRS muting is enabled in a cell for which the UE performs RSTD measurements, the UE capable of supporting CRS muting [31] shall perform RSTD measurements and meet all the requirements in this section, provided the CRS are available within at least the PRS bandwidth in the subframes with PRS during all positioning occasions within the RSTD measurement period.

##### 8.13.2.3.1 E-UTRAN FDD Intra-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below (see also Figure 8.13.2.3.1-1):

+TMIB ms,

where

 is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] for UE not configured with measurement gaps for intra-frequency RSTD. For UE configured with measurement gaps for intra-frequency RSTD measurements,  = max(, MGRP), where MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1.

 is the number of PRS positioning occasions as defined in Table 8.13.2.3.1-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355[24],

is the number of PRS subframes within a PRS occasion available at the UE; = when the measurement gaps are not required for the intra-frequency RSTD measurements; for UE configured with measurement gaps for intra-frequency RSTD measurements  is the number of PRS subframes which can be measured by UE within MGL, where  = (MGL-2) if MGRP≥>(MGL-2),  = if >MGRP, and = if ≤(MGL-2).

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.21.20.

, ,  and ,  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

Editor’s note: Requirements have assumed that prsOccGroupLength is not configured in the measurement period.

Table 8.13.2.3.1-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f1 Note1 | f1 and f2 Note2 |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.22 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE as illustrated in Figure 8.13.2.3.1-1.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.21.20.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

is the number of times the intra-frequency handover occurs during.

is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover.



Figure 8.13.2.3.1-1: Illustration of the RSTD reporting time requirement in an FDD system.

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

8.13.2.3.1.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.20.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.13.2.3.1.

##### 8.13.2.3.2 E-UTRAN TDD Intra-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

+ TMIB,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] for UE not configured with measurement gaps for intra-frequency RSTD. For UE configured with measurement gaps for intra-frequency RSTD measurements,  = max(, MGRP), where MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1.

 is the number of PRS positioning occasions as defined in Table 8.13.2.3.1-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

 is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355 [24],

 is the number of PRS subframes within a PRS occasion available at the UE; = when the measurement gaps are not required for the intra-frequency RSTD measurements; for UE configured with measurement gaps for intra-frequency RSTD measurements  is the number of PRS subframes which can be measured by UE within MGL, where  = (MGL-2) if MGRP≥>(MGL-2),  = if >MGRP, and = if ≤(MGL-2).

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.21.20.

, ,  and , are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

Table 8.13.2.3.1-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f1 Note1 | f1 and f2 Note2 |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.22 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.21.20.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the intra-frequency handover occurs during,

 is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover.

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

The intra-frequency requirements in this clause (8.13.2.3.2) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.13.2.3.2-2.

Table 8.13.2.3.2-2: TDD uplink-downlink subframe configurations applicable for TDD intra-frequency requirements

|  |  |
| --- | --- |
| PRS Transmission Bandwidth [RB] | Applicable TDD uplink-downlink configurations |
| 6 | 1, 2, 3, 4 and 5 |
| Note: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.13.2.3.2.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.20.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.13.2.3.2.

##### 8.13.2.3.3 E-UTRAN HD-FDD Intra-Frequency OTDOA Measurements

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.13.2.3.1 also apply for this section except the reporting delay requirement provided the following conditions are met:

- all positioning subframes indicated in the OTDOA assistance data and specified in Section 9.1.21.20 are available for RSTD measurements in the measured and reference cells.

8.13.2.3.3.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.20.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than measurement perioddefined in Clause 8.13.2.3.3.

#### 8.13.2.4 E-UTRAN OTDOA Inter-Frequency RSTD Measurements for Cat-M1 UE in CEModeA

All inter-frequency RSTD measurement requirements specified in Sections 8.13.2.4 shall apply, provided that

- the UE is capable of inter-frequency RSTD measurements for OTDOA [24], and

- either the measurement gap pattern ID # 0 specified in Table 8.1.2.1-1 or any applicable measurement gap pattern specified in Table 8.1.2.1-3 is used or the UE supports capability of conducting inter-frequency measurements without gaps.

All inter-frequency RSTD measurement requirements specified in Sections 8.13.2.4 shall apply without DRX as well as for any DRX and eDRX\_CONN cycles specified in TS 36.331 [2].

All positioning subframes indicated in the OTDOA assistance data and specified in sub-clause 9.1.21.17 are available for RSTD measurements in the measured and reference cell.

All the measurement requirements specified in Sections 8.13.2.4 shall apply provided that the UE is configured with the single PRS configuration for the reference cell and all the neighbour cells.

If CRS muting is enabled in a cell for which the UE performs RSTD measurements, the UE capable of supporting CRS muting [31] shall perform RSTD measurements and meet all the requirements in this section, provided the CRS are available within at least the PRS bandwidth in the subframes with PRS during all positioning occasions within the RSTD measurement period.

##### 8.13.2.4.1 E-UTRAN FDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below (see also Figure 8.13.2.3.1-1):

+ TMIB ms,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24]; if <MGRP,  equals to MGRP; MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1,

 is the number of PRS positioning occasions as defined in Table 8.13.2.4.1-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355[24];

 is the number of PRS subframes within a PRS occasion that can be measured by UE within MGL; if MGRP>=>(MGL-2ms), =(MGL-2ms); if >MGRP, =; = if ≤(MGL-2);

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.21.17.

, ,  and  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

Table 8.13.2.4.1-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f2 Note1 | f1 and f2 Note2 |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the FDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving FDD carrier frequency f1 and the FDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.20 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.21.17.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

is the number of times the inter-frequency handover occurs during.

is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

8.13.2.4.1.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.17.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.13.2.4.1.

##### 8.13.2.4.2 E-UTRAN TDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

+ TMIB ms ,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24]; if <MGRP,  equals to MGRP; MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1,

 is the number of PRS positioning occasions as defined in Table 8.13.2.4.2-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355[24];

 is the number of PRS subframes within a PRS occasion that can be measured by UE within MGL; if MGRP>=>(MGL-2ms), =(MGL-2ms); if >MGRP, =; = if ≤(MGL-2);

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.21.17.

, ,  and  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

Table 8.13.2.4.2-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f21 Note1 | f1 and f2 Note2 |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the TDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving TDD carrier frequency f1 and the TDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.20 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.21.17.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

The inter-frequency requirements in this clause (8.13.2.4.2) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.13.2.4.2-2.

Table 8.13.2.4.2-2: TDD uplink-downlink subframe configurations applicable for TDD inter-frequency requirements

|  |  |
| --- | --- |
| PRS Transmission Bandwidth [RB] | Applicable TDD uplink-downlink configurations |
| 6 | 1, 2, 3, 4 and 5 |
| Note: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.13.2.4.2.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.17.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.13.2.4.2.

##### 8.13.2.4.3 E-UTRAN HD-FDD Inter-Frequency OTDOA Measurements

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.13.2.4.1 also apply for this section except reporting delay requirement provided the following conditions are met:

- all positioning subframes indicated in the OTDOA assistance data and specified in Section 9.1.21.17 are available for RSTD measurements in the measured and reference cells.

8.13.2.4.3.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.17.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than measurement period as defined in Clause 8.13.2.4.3.

#### 8.13.2.5 E-UTRAN E-CID Measurements Requirements for UE category M1 with CE mode A

##### 8.13.2.5.1 Intra-frequency FDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeA

8.13.2.5.1.1 Introduction

The requirements in section 8.13.2.5.1 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN FDD intra-frequency RSRP and RSRQ measurements [24].

8.13.2.5.1.2 Measurement Requirements

The requirements in section 8.13.2.1.1 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.2.5.1.3.

8.13.2.5.1.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.1, 9.1.21.2 and 9.1.21.6.

##### 8.13.2.5.2 Intra-frequency HD-FDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeA

8.13.2.5.2.1 Introduction

The requirements in section 8.13.2.5.2 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN HD-FDD intra-frequency RSRP and RSRQ measurements [24].

8.13.2.5.2.2 Measurement Requirements

The requirements in section 8.13.2.1.2 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.2.5.2.3.

8.13.2.5.2.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.1, 9.1.21.2 and 9.1.21.6.

##### 8.13.2.5.3 Intra-frequency TDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeA

8.13.2.5.3.1 Introduction

The requirements in section 8.13.2.5.3 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN TDD intra-frequency RSRP and RSRQ measurements [24].

8.13.2.5.3.2 Measurement Requirements

The requirements in section 8.13.2.1.3 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.2.5.3.3.

8.13.2.5.3.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.1, 9.1.21.2 and 9.1.21.6.

##### 8.13.2.5.4 Inter-frequency FDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeA

8.13.2.5.4.1 Introduction

The requirements in section 8.13.2.5.4 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN FDD inter-frequency RSRP and RSRQ measurements [24].

8.13.2.5.4.2 Measurement Requirements

The requirements in section 8.13.2.6.1 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.2.5.4.3.

8.13.2.5.4.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

##### 8.13.2.5.5 Inter-frequency HD-FDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeA

8.13.2.5.5.1 Introduction

The requirements in section 8.13.2.5.5 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN HD-FDD inter-frequency RSRP and RSRQ measurements [24].

8.13.2.5.5.2 Measurement Requirements

The requirements in section 8.13.2.6.2 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.2.5.5.3.

8.13.2.5.5.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

##### 8.13.2.5.6 Inter-frequency TDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeA

8.13.2.5.6.1 Introduction

The requirements in section 8.13.2.5.6 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN TDD inter-frequency RSRP and RSRQ measurements [24].

8.13.2.5.6.2 Measurement Requirements

The requirements in section 8.13.2.6.3 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.2.5.6.3.

8.13.2.5.6.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

##### 8.13.2.5.7 E-UTRAN FDD UE Rx-Tx Time Difference Measurements for UE category M1 in CEModeA

When no DRX is used the physical layer measurement period of the UE Rx-Tx time difference measurement shall be 480 ms.

When DRX is used in RRC\_CONNECTED state the physical layer measurement period (Tmeasure\_FDD\_UE\_Rx\_Tx1) of the UE Rx-Tx time difference measurement shall be as specified in table 8.13.2.5.7-1.

Table 8.13.2.5.7-1: FDD UE Rx-Tx time difference measurement requirement when DRX is used

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_FDD\_UE\_Rx\_Tx1 (s) (DRX cycles) |
| < 0.128 | 0.48 (Note1) |
| 0.128 ≤ DRX-cycle ≤ 2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | |

If the UE is performing UE Rx-Tx time difference measurement while the PCell is changed due to the handover then the UE shall restart the Rx-Tx measurement on the new cell. In this case the UE shall also meet the UE Rx-Tx time difference measurement and accuracy requirements. However the physical layer measurement period of the UE Rx-Tx measurement shall not exceed Tmeasure\_FDD\_UE\_Rx\_Tx3 as defined in the following expression:

Tmeasure\_FDD\_UE\_Rx\_Tx3 = (K+1)\*(Tmeasure\_FDD\_UE\_Rx\_Tx1) + K\*TPCcell\_change\_handover

Where:

K is the number of times the PCell is changed over the measurement period (Tmeasure\_FDD\_UE\_Rx\_Tx3),

TPCell\_change\_handover is the time necessary to change the PCell due to handover.

The measurement accuracy for the UE Rx-Tx time difference measurement when DRX is used as well as when no DRX is used shall be as specified in the sub-clause 9.1.21.19.

If CRS muting is enabled in a cell for which the UE performs UE Rx-Tx time difference measurement, the UE capable of supporting CRS muting [31] shall perform the UE Rx-Tx time difference measurements and meet all the requirements in this section, provided the CRS are available within UE bandwiwidth in the serving cell during the UE Rx-Tx time difference measurement period.

8.13.2.5.7.1 UE Rx-Tx Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.21.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive ECID-RequestLocationInformation message and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeA* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeA* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode A provided that *pusch-maxNumRepetitionCEmodeA >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than the physical layer measurement period defined in Clause 8.13.2.5.7.

##### 8.13.2.5.8 E-UTRAN TDD UE Rx-Tx Time Difference Measurements for UE category M1 in CEModeA

When no DRX is used the physical layer measurement period of the UE Rx-Tx time difference measurement shall be 480 ms.

When DRX is used in RRC\_CONNECTED state the physical layer measurement period (Tmeasure\_TDD\_UE\_Rx\_Tx1) of the UE Rx-Tx time difference measurement shall be as specified in table 8.13.2.5.8-1.

Table 8.13.2.5.8-1: TDD UE Rx-Tx time difference measurement requirement when DRX is used

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_TDD\_UE\_Rx\_Tx1 (s) (DRX cycles) |
| < 0.128 | 0.48 (Note1) |
| 0.128 ≤ DRX-cycle ≤ 2.56 | Note2 (5) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | |

If the UE is performing UE Rx-Tx time difference measurement while the PCell is changed due to the handover then the UE shall restart the Rx-Tx measurement on the new cell. In this case the UE shall also meet the UE Rx-Tx time difference measurement and accuracy requirements. However the physical layer measurement period of the UE Rx-Tx measurement shall not exceed Tmeasure\_TDD\_UE\_Rx\_Tx3 as defined in the following expression:

Tmeasure\_TDD\_UE\_Rx\_Tx3 = (K+1)\*(Tmeasure\_TDD\_UE\_Rx\_Tx1) + K\*TPCell\_change\_handover

Where:

K is the number of times the PCell is changed over the measurement period (Tmeasure\_TDD\_UE\_Rx\_Tx3),

TPCell\_change\_handover is the time necessary to change the PCell due to handover.

The measurement accuracy for the UE Rx-Tx time difference measurement when DRX is used as well as when no DRX is used shall be as specified in the sub-clause 9.1.21.19.

If CRS muting is enabled in a cell for which the UE performs UE Rx-Tx time difference measurement, the UE capable of supporting CRS muting [31] shall perform the UE Rx-Tx time difference measurements and meet all the requirements in this section, provided the CRS are available within UE bandwiwidth in the serving cell during the UE Rx-Tx time difference measurement period.

8.13.2.5.8.1 UE Rx-Tx Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.21.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive ECID-RequestLocationInformation message and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeA* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeA* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode A provided that *pusch-maxNumRepetitionCEmodeA >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than the physical layer measurement period defined in Clause 8.13.2.5.8.

##### 8.13.2.5.9 E-UTRAN HD-FDD UE Rx-Tx Time Difference Measurements for UE category M1 in CEModeA

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands.

The requirements defined in clause 8.13.2.5.7 also apply for this section except the measurement reporting requirements provided the following conditions are met:

- At least one downlink and one uplink subframes per radio frame are available for the UE Rx-Tx time difference measurement in the measured cell.

- at least downlink subframe # 0 or downlink subframe # 5 per radio frame of an intra-frequency cell to be identified by the UE is available at the UE;

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-2 for a corresponding Band

8.13.2.5.9.1 UE Rx-Tx Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.19.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive ECID-RequestLocationInformation message and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeA* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeA* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode A provided that *pusch-maxNumRepetitionCEmodeA >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than the physical layer measurement period defined in Clause 8.13.2.5.9.

#### 8.13.2.6 E-UTRAN inter frequency measurements by UE category M1 with CE mode A

The UE shall be able to identify new inter-frequency cells and perform RSRP and RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the PCell, even if no explicit neighbour list with physical layer cell identities is provided. During the RRC\_CONNECTED state the UE shall continuously measure identified inter frequency cells and additionally search for and identify new inter frequency cells.

##### 8.13.2.6.1 E-UTRAN FDD - FDD inter frequency measurements

8.13.2.6.1.1 E-UTRAN FDD - FDD inter frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify and measure a new detectable FDD inter-frequency cell according to requirements in Table 8.13.2.6.1.1-1 when SCH Ês/Iot >= -6 dB, provided

- G=1, or

- rmax\*G < 80ms, or

- UE is receiving PDSCH.

Otherwise, requirements in Table 8.13.2.6.1.1-3 apply, where rmax and G are given by higher layer parameter *mPDCCH-NumRepetition* and *mPDCCH-startSF-UESS* respectively as defined in TS 36.213 [3].

Table 8.13.2.6.1.1-1: Requirement on cell identification delay and measurement delay for FDD interfrequency cell

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | Cell identification delay (Tidentify\_inter\_UE cat M1\_NC) | Measurement delay (Tmeasure\_inter\_UE cat M1\_NC\_NC) |
| 0 | 1.44 \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC seconds | 480 \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC ms |
| 1 | 2.88 \* Kinter\_M1\_NC seconds | 960 \* Kinter\_M1\_NC ms |



where X is signalled by the RRC parameter *measGapSharingScheme* [2] and is defined as in Table 8.13.2.6.1.1-2 when *highSpeedMeasGapCE-ModeA* [2] is not configured, and in Table 8.13.2.6.1.1-2A when *highSpeedMeasGapCE-ModeA* [2] is configured.  is total number of inter-frequency layers to be monitored as defined in 8.1.2.1.1.

Table 8.13.2.6.1.1-2: Value of parameter X for CEModeA

|  |  |
| --- | --- |
| *measGapSharingScheme* | Value of X (%) |
| ‘00’ |  |
| ‘01’ | 40 |
| ‘10’ | 50 |
| ‘11’ | 60 |

Table 8.13.2.6.1.1-2A: Value of parameter X for CEModeA for UE configured with *highSpeedMeasGapCE-ModeA*

|  |  |
| --- | --- |
| *measGapSharingScheme* | Value of X (%) |
| ‘00’ |  |
| ‘01’ | 50 |
| ‘10’ | 80 |
| ‘11’ | 90 |

Table 8.13.2.6.1.1-3: Requirement on cell identification delay and measurement delay for FDD interfrequency cell with MPDCCH scaling

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | Cell identification delay (Tidentify\_inter\_UE cat M1) | Measurement delay (Tmeasure\_inter\_UE cat M1) |
| 0 | Max(20 \* rmax\*G / 1000, 1.44) \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC seconds | Max(5 \* rmax\*G, 480) \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC ms |
| 1 | Max(20 \* rmax\*G / 1000, 2.88) \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC seconds | Max(5 \* rmax\*G, 960) \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC ms |



KRSTD\_M1\_NC is applicable provided following conditions are met:

-  > 40 ms

-  > 

where

- is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

- **** is the number of consecutive downlink positioning subframes in a positioning occation defined in TS 36.211

Otherwise KRSTD\_M1\_NC = 1.

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.9 and 9.1.22.10 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.13 and 9.1.21.14 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-1 for a corresponding Band.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of Tmeasure\_inter\_UE cat M1\_NC. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for inter frequency measurements is according to Table 8.13.2.6.1.1-1. When measurement gaps are scheduled for FDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency for up to 2 FDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period defined in Table 8.13.2.6.1.1-1.

8.13.2.6.1.1.1 Measurement Reporting Requirements

8.13.2.6.1.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

8.13.2.6.1.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.6.1.1.1.3.

8.13.2.6.1.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify inter\_UE cat M1\_NC defined in Clause 8.13.2.6.1.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_NC defined in clause 8.13.2.6.1.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_UE cat M1\_NC, Inter provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.2.6.1.2 E-UTRAN inter frequency measurements when DRX is used

When DRX is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FDD inter-frequency cell within Tidentify\_inter\_UE cat M1\_NC as shown in table 8.13.2.6.1.2-1.

When eDRX\_CONN is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FDD inter-frequency cell within Tidentify\_inter\_UE cat M1\_NC as shown in table 8.13.2.6.1.2-1A.

Table 8.13.2.6.1.2-1: Requirement to identify a newly detectable FDD interfrequency cell

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | DRX cycle length (s) | Tidentify\_inter\_UE cat M1\_NC (s) (DRX cycles) |
| 0 | ≤0.04 | 1.44 \* Kinter\_M1 \*  KRSTD\_M1\_NC (Note 1) |
| 0.04<DRX-cycle≤0.08 | Note 2 (40 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.128 | 3.2 \* Kinter\_M1 \*  KRSTD\_M1\_NC (25 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2(20 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 1 | <0.128 | 2.88 \* Kinter\_M1 \*  KRSTD\_M1\_NC (Note 1) |
| 0.128 | 3.2 \* Kinter\_M1 \*  KRSTD\_M1\_NC (25 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2(20 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

Table 8.13.2.6.1.2-1A: Requirement to identify a newly detectable FDD interfrequency cell when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_inter\_UE cat M1\_NC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (20 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.9 and 9.1.21.10 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.13 and 9.21.14 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.14-1 for a corresponding Band

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency and the UE physical layer shall be capable of reporting RSRP and RSRQ to higher layers with the measurement period Tmeasure\_inter\_UE cat M1\_NC, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is used, Tmeasure\_inter\_UE cat M1\_NC is as defined in Table 8.13.2.6.1.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter\_UE cat M1\_NC is as defined in Table 8.13.2.6.1.2-3.

Table 8.13.2.6.1.2-2: Requirement to measure FDD interfrequency cells

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | DRX cycle length (s) | Tmeasure\_inter\_UE cat M1\_NC (s) (DRX cycles) |
| 0 | <0.128 | 0.48 \* Kinter\_M1 cat M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.128≤DRX-cycle≤2.56 | Note 2 (5 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 1 | <0.256 | 0.960 \* Kinter\_M1 cat M1\_NC \*  KRSTD\_M1\_NC (Note 1) |
| 0.256≤DRX-cycle≤2.56 | Note 2 (5 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

Table 8.13.2.6.1.2-3: Requirement to measure FDD interfrequency cells when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_inter\_UE cat M1\_NC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.9 and 9.1.21.10.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.13 and 9.1.21.14.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.2.6.1.2.1 Measurement Reporting Requirements

8.13.2.6.1.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

8.13.2.6.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.6.1.2.1.3.

8.13.2.6.1.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_inter, UE cat M1\_NC defined in Clause 8.13.2.6.1.2 When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_NC defined in clause 8.13.2.6.1.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_inter\_UE cat M1\_NC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

##### 8.13.2.6.2 E-UTRAN inter-frequency measurements for HD-FDD

8.13.2.6.2.1 E-UTRAN inter-frequency measurements when no DRX is used

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.13.2.6.1.1 also apply for this section provided the following conditions are met:

- at least downlink subframe # 0 or downlink subframe # 5 per radio frame of an inter-frequency cell to be identified by the UE is available at the UE over Tidentify\_inter\_UE cat M1\_NC;

- at least one downlink subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell over Tmeasure\_inter\_UE cat M1\_NC.

- RSRP related side conditions given in Sections 9.1.21.9 and 9.1.21.10 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.13 and 9.1.21.14 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-2 for a corresponding Band

8.13.2.6.2.2 E-UTRAN inter frequency measurements when DRX is used

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

When DRX is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FDD inter-frequency cell within Tidentify\_inter\_UE cat M1\_NC as shown in table 8.13.2.6.2.2-1.

When eDRX\_CONN is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FDD inter-frequency cell within Tidentify\_inter\_UE cat M1\_NC as shown in table 8.13.2.6.2.2-1A.

Table 8.13.2.6.2.2-1: Requirement to identify a newly detectable HD-FDD interfrequency cell

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | DRX cycle length (s) | Tidentify\_inter\_UE cat M1\_NC (s) (DRX cycles) |
| 0 | ≤0.04 | 1.44 \* Kinter\_M1 \*  KRSTD\_M1\_NC (Note1) |
| 0.04<DRX-cycle≤0.08 | Note 2 (40 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.128 | 3.2 \* Kinter\_M1 \*  KRSTD\_M1\_NC (32 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2(25 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 1 | ≤0.08 | 2.88 \* Kinter\_M1 \*  KRSTD\_M1\_NC (Note1) |
| 0.128 | 3.2 \* Kinter\_M1 \*  KRSTD\_M1\_NC (32 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2(25 \* Kinter\_M \*  KRSTD\_M1\_NC 1) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

Table 8.13.2.6.2.2-1A: Requirement to identify a newly detectable HD-FDD interfrequency cell when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_inter\_UE cat M1\_NC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (25 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.9 and 9.1.21.10 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.13 and 9.1.21.14 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-2 for a corresponding Band

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency and the UE physical layer shall be capable of reporting RSRP and RSRQ to higher layers with the measurement period Tmeasure\_inter\_UE cat M1\_NC, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is used, Tmeasure\_inter\_UE cat M1\_NC is as defined in Table 8.13.2.6.2.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter\_UE cat M1\_NC is as defined in Table 8.13.2.6.2.2-3.

Table 8.13.2.6.2.2-2: Requirement to measure HD-FDD interfrequency cells

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | DRX cycle length (s) | Tmeasure\_inter\_UE cat M1\_NC (s) (DRX cycles) |
| 0 | <0.08 | 0.48 \* Kinter\_M1 \*  KRSTD\_M1\_NC (Note 1) |
| 0.08≤DRX-cycle≤0.16 | Note 2 (7 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.16<DRX-cycle≤2.56 | Note 2(5 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 1 | <0.16 | 0.96 \* Kinter\_M1 \*  KRSTD\_M1\_NC (Note 1) |
| DRX-cycle=0.16 | 1.12 \* Kinter\_M1 \*  KRSTD\_M1\_NC (7 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.16<DRX-cycle≤2.56 | Note 2(5 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

Table 8.13.2.6.2.2-3: Requirement to measure HD-FDD interfrequency cells when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_inter\_UE cat M1\_NC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5 \* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.10 and 9.1.21.11.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.13 and 9.1.21.14.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.2.6.2.2.1 Measurement Reporting Requirements

8.13.2.6.2.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

8.13.2.6.2.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.6.2.2.1.3.

8.13.2.6.2.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_inter\_UE cat M1\_NC defined in Clause 8.13.2.6.2.2When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_NC defined in clause 8.13.2.6.2.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_inter\_UE cat M1\_NC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

##### 8.13.2.6.3 E-UTRAN TDD inter frequency measurements

8.13.2.6.3.1 E-UTRAN inter frequency measurements when no DRX is used

When no DRX is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify and measure a new detectable TDD inter frequency cell according to requirements in Table 8.13.2.6.3.1-1 when SCH Ês/Iot >= -6 dB, provided

- G=1, or

- rmax\*G < 80ms, or

- UE is receiving PDSCH.

Otherwise, requirements in Table 8.13.2.6.3.1-3 apply, where rmax and G are given by higher layer parameter *mPDCCH-NumRepetition* and *mPDCCH-startSF-UESS* respectively as defined in TS 36.213 [3].

Table 8.13.2.6.3.1-1: Requirement on cell identification delay and measurement delay for TDD interfrequency cell

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | Cell identification delay (Tidentify\_inter\_UE cat M1\_NC) | Measurement delay (Tmeasure\_inter\_UE cat M1\_NC) |
| 0 | 1.44\* Kinter\_M1\_NC \*  KRSTD\_M1\_NC seconds | 480\* Kinter\_M1\_NC \*  KRSTD\_M1\_NC ms |
| 1 | 2.88\* Kinter\_M1\_NC \*  KRSTD\_M1\_NC seconds | 960\* Kinter\_M1\_NC \*  KRSTD\_M1\_NC ms |



where X is signalled by the RRC parameter *measGapSharingScheme* [2] and is defined as in Table 8.13.2.6.3.1-2 when *highSpeedMeasGapCE-ModeA* [2] is not configured, and in Table 8.13.2.6.3.1-2A when *highSpeedMeasGapCE-ModeA* [2] is configured.  is total number of inter-frequency layers to be monitored as defined in 8.1.2.1.1.

Table 8.13.2.6.3.1-2: Value of parameter X for CEModeA

|  |  |
| --- | --- |
| *measGapSharingScheme* | Value of X (%) |
| ‘00’ |  |
| ‘01’ | 40 |
| ‘10’ | 50 |
| ‘11’ | 60 |

Table 8.13.2.6.3.1-2A: Value of parameter X for CEModeA for UE configured with *highSpeedMeasGapCE-ModeA*

|  |  |
| --- | --- |
| *measGapSharingScheme* | Value of X (%) |
| ‘00’ |  |
| ‘01’ | 50 |
| ‘10’ | 80 |
| ‘11’ | 90 |

Table 8.13.2.6.3.1-3: Requirement on cell identification delay and measurement delay for TDD interfrequency cell with MPDCCH scaling

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | Cell identification delay (Tidentify\_inter\_UE cat M1) | Measurement delay (Tmeasure\_inter\_UE cat M1) |
| 0 | Max(20 \* rmax\*G / 1000, 1.44) \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC seconds | Max(5 \* rmax\*G, 480) \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC  ms |
| 1 | Max(20 \* rmax\*G / 1000, 2.88) \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC seconds | Max(5 \* rmax\*G, 960) \* Kinter\_M1\_NC \*  KRSTD\_M1\_NC  ms |



KRSTD\_M1\_NC is applicable provided following conditions are met:

-  > 40 ms

-  > ****

where

-  is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

- **** is the number of consecutive downlink positioning subframes in a positioning occation defined in TS 36.211

Otherwise KRSTD\_M1\_NC = 1.

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.9 and 9.1.21.10 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.13 and 9.1.21.14 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-1 for a corresponding Band.

When measurement gaps are scheduled for TDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP and RSRQ to higher layers with measurement accuracy as specified in sub-clauses 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14 with measurement period (Tmeasure\_inter\_UE cat M1\_NC) given by table 8.13.2.6.3.1-1:

The UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per TDD inter-frequency and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period Tmeasure\_inter\_UE cat M1\_NC.

8.13.2.6.3.1.1 Measurement Reporting Requirements

8.13.2.6.3.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

8.13.2.6.3.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.6.3.1.1.3.

8.13.2.6.3.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify inter\_UE cat M1\_NC defined in Clause 8.13.2.6.3.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_NC defined in clause 8.13.2.6.3.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period Inter\_UE cat M1\_NC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.2.6.3.2 E-UTRAN inter frequency measurements when DRX is used

When DRX is in use and when DRX or eDRX\_CONN is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable TDD inter frequency cell within Tidentify\_inter\_ UE catM1 as shown in table 8.13.2.6.3.2-1.

When eDRX\_CONN is in use the UE shall be able to identify a new detectable TDD inter frequency cell within Tidentify\_inter\_UE cat M1\_NC as shown in table 8.13.2.6.3.2-1A.

Table 8.13.2.6.3.2-1: Requirement to identify a newly detectable TDD interfrequency cell

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | DRX cycle length (s) | Tidentify\_inter\_UE cat M1\_NC (s) (DRX cycles) |
| 0 | ≤0.04 | 1.44\* Kinter\_M1 \*  KRSTD\_M1\_NC (Note 1) |
| 0.04<DRX-cycle≤0.08 | Note 2 (40\* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.128 | 3.2\* Kinter\_M1 \*  KRSTD\_M1\_NC (25\* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2(20\* Kinter\_M 1 \*  KRSTD\_M1\_NC) |
| 1 | <0.128 | 2.88\* Kinter\_M1 \*  KRSTD\_M1\_NC (Note 1) |
| 0.128 | 3.2\* Kinter\_M1 \*  KRSTD\_M1\_NC (25\* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 0.128<DRX-cycle≤2.56 | Note 2(20\* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

Table 8.13.2.6.3.2-1A: Requirement to identify a newly detectable TDD interfrequency cell when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_inter\_UE cat M1\_NC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (20\* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Clause 9.1.21.9 and 9.1.21.10 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.13 and 9.1.21.14 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-1 for a corresponding Band

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per TDD inter-frequency for up to 3 TDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period Tmeasure\_inter\_UE cat M1\_NC, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is in use, Tmeasure\_inter\_UE cat M1\_NC is as defined in Table 8.13.2.6.3.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter\_UE cat M1\_NC  is as defined in Table 8.13.2.6.3.2-3.

Table 8.13.2.6.3.2-2: Requirement to measure TDD inter frequency cells

|  |  |  |
| --- | --- | --- |
| Gap pattern ID | DRX cycle length (s) | Tmeasure\_inter\_UE cat M1\_NC (s) (DRX cycles) |
| 0 | <0.128 | 0.48\* Kinter\_M1 \*  KRSTD\_M1\_NC (Note 1) |
| 0.128≤DRX-cycle≤2.56 | Note 2 (5\* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| 1 | <0.256 | 0.96\* Kinter\_M1 \*  KRSTD\_M1\_NC (Note 1) |
| 0.256≤DRX-cycle≤2.56 | Note 2 (5\* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | |

Table 8.13.2.6.3.2-3: Requirement to measure TDD inter frequency cells when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_inter\_UE cat M1\_NC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\* Kinter\_M1 \*  KRSTD\_M1\_NC) |
| Note: Time depends upon the eDRX\_CONN cycle in use. | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.9 and 9.1.21.10.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.13 and 9.1.21.14.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.2.6.3.2.1 Measurement Reporting Requirements

8.13.2.6.3.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

8.13.2.6.3.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.2.6.3.2.1.3.

8.13.2.6.3.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH.This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_inter\_UE cat M1\_NC defined in Clause 8.13.2.6.3.2.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_NC defined in clause 8.13.2.6.3.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_inter\_UE cat M1\_NC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

#### 8.13.2.7 Maximum allowed layers for multiple monitoring for UE category M1 with CE mode A

The UE UE category M1 configured with CE mode A shall be capable of monitoring at least:

- Depending on UE capability, 2 FDD E-UTRA inter-frequency carriers, and

- Depending on UE capability, 2 TDD E-UTRA carriers.

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 5 carrier frequency layers, which include one serving carrier frequency and any of the above defined combination of E-UTRA FDD inter-frequency and E-UTRA TDD inter-frequency layers.

#### 8.13.2.8 Channel quality report for UE Category M1 in connected mode with CE mode A

The requirements in this clause shall apply for UE supporting DL channel quality reporting for UE Category M1 as defined in TS 36.321 [17] section 5.25.

The DL channel quality provides the serving eNB with information about

- the minimum MPDCCH repetition level to satisfy the hypothetical MPDCCH block error rate of 1% with the parameters specified in Table 8.13.2.8-1 if the repetition level in DL quality report is larger than 1, or

- the minimum MPDCCH aggregation level to satisfy the hypothetical MPDCCH block error rate of 1% with the parameters specified in in Table 8.13.2.8-2 if the repetition level in DL quality report is 1.

Table 8.13.2.8-1: MPDCCH transmission parameters for downlink quality reporting, repetition number being reported

|  |  |
| --- | --- |
| Attribute | CEModeA |
| DCI format | 6-1A |
| Starting OFDM symbols | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz |
| MPDCCH Aggregation level (ECCE) Note2 | 24 |
| M-PDCCH Transmission type | Distributed |

Table 8.13.2.8-2: MPDCCH transmission parameters for downlink quality reporting, aggregation level being reported

|  |  |
| --- | --- |
| Attribute | CEModeA |
| DCI format | 6-1A |
| Starting OFDM symbols | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz |
| MPDCCH repetition level Note1 | 1 |
| M-PDCCH Transmission type | Distributed |
| NOTE 1: Not applicable if repetition number in DL quality information is larger than 1.  NOTE 2: Not applicable if repetition number in DL quality information equals to 1. | |

The MPDCCH repetition level or aggregation level is chosen from the supported MPDCCH repetition levels and aggregation levels [3]. The report mapping is defined in section 9.1.21.22.

The UE shall satisfy the downlink channel quality measurement accuracy requirements as specified in section 9.1.21.23.

### 8.13.3 Requirements for UE category M1 with CE mode B

The UE category M1 applicability of the requirements in subclause 8.13.3 is defined in Section 3.6. The requirements defined in clause 8.13.3 apply provided the following conditions are met:

- UE is configured with measurement gap pattern ID#0 or ID#1 defined in Table 8.1.2.1-1.

Alternatively, the UE shall meet the requirements in subclause 8.13.3 defined for gap pattern ID#0 without using any measurement gaps provided:

- UE indicates it does not need gaps with the capability intraFreq-CE-NeedForGaps-r13 [2, TS36.331] for the frequency band of the serving cell, or

- UE is not configured with any reporting configuration that requires measurement on any intra-frequency neighbour cell.

#### 8.13.3.1 E-UTRAN intra frequency measurements by UE category M1 with CE mode B

The UE shall be able to identify new intra-frequency cells and perform RSRP and RSRQ measurements of identified intra-frequency cells without an explicit intra-frequency neighbour cell list containing physical layer cell identities. During the RRC\_CONNECTED state the UE shall continuously measure identified intra frequency cells and additionally search for and identify new intra frequency cells.

The UE is allowed to perform RSRP measurements based on RSS signals provided UE is configured with *rss-ConfigCarrierInfo* [2] and following conditions are met:

- If measurement gaps are configured, the measured subframes containing RSS are available before or after the measurement gaps and UE shall measure RSS outside the gaps, and

- RSS frequency location of the cell being measured occurs in the NB(s) that UE monitors for MPDDCH if UE supports measuring neighbour cell RSS in the same MPDCCH bandwidth, or within the same RSS RB location of the serving cell if UE does not support measuring neighbour cell RSS in the same MPDCCH bandwidth, for 5 successive DRX cycles or MPDCCH monitoring cycles and the last subframe of the RSS occasion of the measured cell is in the window of [n-5, n-1] where n is the first subframe of DRX ON duration or MPDCCH monitoring occasion, and

- RSS-based measurement period (Tmeasure\_intra\_UE cat M1) is not longer than CRS-based measurement period, and

- RSS power offset (PRSS) with respect to CRS as defined in *RSS-Config* or *rss-MeasPowerBias* [2], where PRSS ≥ 0 dB.

- RSRQ is not configured as trigger quantity or report quantity for intra-frequency measurement

If UE performs RSRP measurement based on RSS for serving or neighbour cell, it is not expected to perform RSRP measurement based on CRS on that cell. UE shall compensate the RSS power offset (PRSS) with respect to CRS when derving the RSRP measurement based on RSS.

For performing RSRP measurement based on RSS on detected intra-frequency cells, UE assumes BL/CE DL subframe configuration of each neighbor cell is same as serving cell. The requirements for RSRP measurement based on RSS for a neighbour cell apply provided that BL/CE DL subframe configuration of the neighbor cell is same as serving cell.

Additionally, for performing RSS-based RSRP measurements on detected intra-frequency cells, the UE assumes that the RSS transmission of each neighbor cell starts in the radio frame that is closest in time, i.e. within a window of +/- 5ms, around the corresponding radio frame offset calculated from RRC signalling in the serving cell, as described in TS 36.331 subclause 6.3. The requirements for RSS-based RSRP measurements for neighbor cells apply provided that the RSS transmission of each neighbor cell starts in the radio frame within a window of +/- 5ms around the calculated radio frame offset of the serving cell.

##### 8.13.3.1.1 E-UTRAN FDD intra frequency measurements

8.13.3.1.1.1 E-UTRAN intra frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify and measure a new detectable FDD intra frequency cell according to requirements in Table 8.13.3.1.1.1-1 provided that additional conditions table 8.13.3.1.1.1-1 is met, and

- G=1, or

- rmax\*G < 800ms, or

- UE is receiving PDSCH.

Otherwise, requirements in Table 8.13.3.1.1.1-4 apply, where rmax and G are given by higher layer parameter *mPDCCH-NumRepetition* and *mPDCCH-startSF-UESS* respectively as defined in TS 36.213 [3].

Table 8.13.3.1.1.1-1: Requirement on cell identification delay and measurement delay for FDD intrafrequency cell

|  |  |  |  |
| --- | --- | --- | --- |
| Neighouring cell SCH Ês/Iot: Q2 [dB] | Gap pattern ID | Cell identification delay (Tidentify\_intra\_UE cat M1) | Measurement delay (Tmeasure\_intra\_UE cat M1) |
| -15≤ Q2 < -6 | 0 | 320.8 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | 800 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms |
| 1 | 321.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | 1600 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms |
| Q2≥-6 | 0 | 21.8\* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | 800 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms |
| 1 | 22.6\* Kintra\_M1\_EC\*  KRSTD\_M1\_EC s | 1600 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms |
| N/A | N/A | N/A | 5 x TRSS (Note 1) |
| Note 1: It is the measurement period for RSRP measured on RSS signals defined in *RSS-Config* [2]. | | | |

Table 8.13.3.1.1.1-2: Void

Kintra\_M1\_EC = 100 / X where X is signalled by the RRC parameter *measGapSharingScheme* [2] and is defined as in Table 8.13.3.1.1.1-3.  is total number of inter-frequency layers to be monitored as defined in 8.1.2.1.1. When inter frequency measurement is not configured, Kintra\_M1\_EC=1 regardless whether or how parameter measGapSharingScheme [2] is configured.

Table 8.13.3.1.1.1-3: Value of parameter X for CEModeB

|  |  |
| --- | --- |
| *measGapSharingScheme* | Value of X (%) |
| ‘00’ |  |
| ‘01’ | 50 |
| ‘10’ | 75 |
| ‘11’ | 87.5 |

Table 8.13.3.1.1.1-4: Requirement on cell identification delay and measurement delay for FDD intrafrequency cell

|  |  |  |  |
| --- | --- | --- | --- |
| Neighouring cell SCH Ês/Iot: Q2 [dB] | Gap pattern ID | Cell identification delay (Tidentify\_intra\_UE cat M1) | Measurement delay (Tmeasure\_intra\_UE cat M1) |
| -15≤ Q2 < -6 | 0 | Max(400 \* rmax\* G / 1000, 320.8) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 800) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms |
| 1 | Max(400 \* rmax\* G / 1000, 321.6) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 1600) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms |
| Q2≥-6 | 0 | Max(20 \* rmax\* G / 1000, 21.8)\* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 800) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms |
| 1 | Max(20 \* rmax\* G / 1000, 22.6)\* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 1600) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms |
| N/A | N/A | N/A | Max(rmax\*G, TRSS) x 5(Note 1) |
| Note 1: It is the measurement period for RSRP measured on RSS signals defined in *RSS-Config* [2]. | | | |



KRSTD\_M1\_NC is applicable provided following conditions are met:

-  > 40 ms

-  > 

* PRS bandwidth is less than the bandwidth of the cell used for RSTD measurement in which case gaps are required

where

- is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

- **** is the number of consecutive downlink positioning subframes in a positioning occation defined in TS 36.211

Otherwise KRSTD\_M1\_EC = 1.

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.3 and 9.1.21.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.7 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-3 for a corresponding Band.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of Tmeasure\_intra\_UE cat M1\_EC. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is according to Table 8.13.3.1.1.1-1. When measurement gaps are activated the UE shall be capable of performing measurements for at least 6cells. If the UE has identified more than 6 cells, the UE shall perform measurements but the reporting rate of RSRP and RSRQ measurements of cells from UE physical layer to higher layers may be decreased.

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.7.

8.13.3.1.1.1.1 Measurement Reporting Requirements

8.13.3.1.1.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

8.13.3.1.1.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.3,9.1.21.4 and 9.1.21.7.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.1.1.1.1.3.

8.13.3.1.1.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify intra\_UE cat M1\_EC defined in Clause 8.13.3.1.1.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_EC defined in clause 8.13.3.1.1.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_UE cat M1\_EC, Intra provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.3.1.1.2 E-UTRAN intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra\_UE cat M1\_EC as shown in table 8.13.3.1.1.2-1 provided that additional conditions Table 8.13.3.1.1.2-1 is met.

When eDRX\_CONN is in use the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra\_UE cat M1\_EC as shown in table 8.13.3.1.1.2-1B.

Table 8.13.3.1.1.2-1: Requirement to identify a newly detectable FDD intrafrequency cell

|  |  |  |  |
| --- | --- | --- | --- |
| Neighbouring cell SCH Ês/Iot: Q2 [dB] | Gap pattern ID | DRX cycle length (s) | Tidentify\_intra\_UE cat M1 (s) (DRX cycles) |
| -15≤ Q2 < -6 | 0 | ≤0.64 | 320.8 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2 (400 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 321.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(400 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC) |
| Q2≥-6 | 0 | ≤0.64 | 21.8 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 22.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | | | |

Table 8.13.3.1.1.2-1A: Void

Table 8.13.3.1.1.2-1B: Requirement to identify a newly detectable FDD intrafrequency cell when eDRX\_CONN is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_intra\_UE cat M1\_EC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (400 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC) |
| NOTE: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.3 and 9.1.21.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.7 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-3 for a corresponding Band

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra\_UE cat M1\_EC. When DRX is used, Tmeasure\_intra\_UE cat M1\_EC is as specified in table 8.13.3.1.1.2-2 provided that additional conditions table 8.13.3.1.1.2-2 is met. When eDRX\_CONN is used, Tmeasure\_intra\_UE cat M1\_EC is as specified in table 8.13.3.1.1.2-4. The UE shall be capable of performing RSRP and RSRQ measurements for 6 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_UE cat M1\_EC.

Table 8.13.3.1.1.2-2: Requirement to measure FDD intrafrequency cells

|  |  |  |  |
| --- | --- | --- | --- |
| Target cell SCH Ês/Iot: Q2 [dB] | Gap pattern ID | DRX cycle length (s) | Tmeasure\_intra\_UE cat M1 (s) (DRX cycles) |
| Q2≥-15 | 0 | ≤0.16 | 0.8 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.16<DRX-cycle≤2.56 | Note2(5 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC) |
| 1 | ≤0.32 | 1.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.32<DRX-cycle≤2.56 | Note2(5 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC) |
| N/A | N/A | N/A | Max(DRX cycle length, TRSS ) x 5 (Note 3) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | | | |

Table 8.13.3.1.1.2-3: Void

Table 8.13.3.1.1.2-4: Requirement to measure FDD intrafrequency cells when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_intra\_UE cat M1\_EC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC) |
| NOTE: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.3 and 9.1.21.4.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.7.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.3.1.1.2.1 Measurement Reporting Requirements

8.13.3.1.1.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

8.13.3.1.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.1.1.2.1.3.

8.13.3.1.1.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra, UE cat M1\_EC defined in Clause 8.13.3.1.1.2 When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_EC defined in clause 8.13.3.1.1.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_UE cat M1\_EC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

##### 8.13.3.1.2 E-UTRAN intra frequency measurements for HD-FDD

8.13.3.1.2.1 E-UTRAN intra frequency measurements when no DRX is used

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.13.3.1.1.1 also apply for this section provided the following conditions are met:

- at least downlink subframe # 0 and downlink subframe # 5 per radio frame of an intra-frequency cell to be identified by the UE is available at the UE over Tidentify\_intra\_UE cat M1\_EC;

- at least two consecutive downlink subframe per radio frame of measured cell is available at the UE for RSRP measurements assuming measured cell is identified cell over Tmeasure\_intra\_UE cat M1\_EC.

- RSRP related side conditions given in Sections 9.1.21.3 and 9.1.21.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.7 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-4

8.13.3.1.2.2 E-UTRAN intra frequency measurements when DRX is used

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

When DRX is in use the UE shall be able to identify a new detectable HD-FDD intra frequency cell within Tidentify\_intra\_UE cat M1\_EC as shown in table 8.13.3.1.2.2-1 provided that additional conditions table 8.13.3.1.2.2-1 is met.

When eDRX\_CONN is in use, the UE shall be able to identify a new detectable FDD intra frequency cell within Tidentify\_intra\_UE cat M1\_EC as shown in table 8.13.3.1.2.2-1B.

Table 8.13.3.1.2.2-1: Requirement to identify a newly detectable HD-FDD intrafrequency cell

|  |  |  |  |
| --- | --- | --- | --- |
| Neighbouring cell SCH Ês/Iot: Q2 [dB] | Gap pattern ID | DRX cycle length (s) | Tidentify\_intra\_UE cat M1 (s) (DRX cycles) |
| -15≤ Q2 < -6 | 0 | ≤0.64 | 320.8 \* Kintra\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2 (400 \* Kintra\_M1 \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 321.6 \* Kintra\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(400 \* Kintra\_M1 \*  KRSTD\_M1\_EC) |
| Q2≥-6 | 0 | ≤0.64 | 21.8 \* Kintra\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2 (24 \* Kintra\_M1 \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 22.6 \* Kintra\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kintra\_M1 \*  KRSTD\_M1\_EC) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | | | |

Table 8.13.3.1.2.2-1A: Void

Table 8.13.3.1.2.2-1B: Requirement to identify a newly detectable HD-FDD intrafrequency cell when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_intra\_UE cat M1\_EC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (400 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| NOTE: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.3 and 9.1.21.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.7 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-4 for a corresponding Band

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra\_UE cat M1\_EC. When DRX is used, Tmeasure\_intra\_UE cat M1\_EC is as specified in table 8.13.3.1.2.2-2 provided that additional conditions Table 8.13.3.1.2.2-2 is met. When eDRX\_CONN cycle is used, Tmeasure\_intra\_UE cat M1\_EC is as specified in table 8.13.3.1.2.2-4. The UE shall be capable of performing RSRP and RSRQ measurements for 6 identified-intra-frequency cells, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_UE cat M1\_EC.

Table 8.13.3.1.2.2-2: Requirement to measure HD-FDD intrafrequency cells

|  |  |  |  |
| --- | --- | --- | --- |
| Neighbouring cell SCH Ês/Iot: Q2 [dB] | Gap pattern ID | DRX cycle length (s) | Tmeasure\_intra\_UE cat M1 (s) (DRX cycles) |
| Q2≥-15 | 0 | <0.128 | 0.8 \* Kintra \_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.128≤DRX-cycle≤0.16 | Note2 (7 \* Kintra\_EC \*  KRSTD\_M1\_EC) |
| 0.16<DRX-cycle≤2.56 | Note2(5 \* Kintra\_EC \*  KRSTD\_M1\_EC) |
| 1 | ≤0.32 | 1.6 \* Kintra\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.32<DRX-cycle≤2.56 | Note2(5 \* Kintra\_EC \*  KRSTD\_M1\_EC) |
| N/A | N/A | N/A | Max (DRX cycle length, TRSS ) x 5 (Note 3) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use  Note3: It is the measurement period for RSRP measured on RSS signals defined in *RSS-Config* [2]. | | | |

Table 8.13.3.1.2.2-3: Void

Table 8.13.3.1.2.2-4: Requirement to measure HD-FDD intrafrequency cells when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_intra\_UE cat M1\_EC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | NOTE (5 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| NOTE: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.3 and 9.1.21.4.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.7.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.3.1.2.2.1 Measurement Reporting Requirements

8.13.3.1.2.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

8.13.3.1.2.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.1.2.2.1.3.

8.13.3.1.2.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra\_UE cat M1\_EC defined in Clause 8.13.3.1.2.2When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_EC defined in clause 8.13.3.1.2.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_UE cat M1\_EC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

##### 8.13.3.1.3 E-UTRAN TDD intra frequency measurements

8.13.3.1.3.1 E-UTRAN intra frequency measurements when no DRX is used

When no DRX is in use the UE shall be able to identify and measure a new detectable TDD intra frequency cell according to requirements in Table 8.13.3.1.3.1-1provided that additional conditions Table 8.13.3.1.3.1-2 is met, and

- G=1, or

- rmax\*G < 800ms, or

- UE is receiving PDSCH.

Otherwise, requirements in Table 8.13.3.1.3.1-4 apply, where rmax and G are given by higher layer parameter *mPDCCH-NumRepetition* and *mPDCCH-startSF-UESS* respectively as defined in TS 36.213 [3].

Table 8.13.3.1.3.1-1: Requirement on cell identification delay and measurement delay for TDD intrafrequency cell

|  |  |  |  |
| --- | --- | --- | --- |
| Neighouring cell SCH Ês/Iot: Q2 [dB] | Gap pattern ID | Cell identification delay (Tidentify\_intra\_UE cat M1) for neighbouring cell SCH Ês/Iot (Q): -15≤ Q2 < -6 | Measurement delay (Tmeasure\_intra\_UE cat M1) |
| -15≤ Q2 < -6 | 0 | 320.8 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | 800 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC Note1  1600 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC Note2 |
| 1 | 321.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | 1600 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note1  3200 \* Kintra\_M1\_EC ms Note2 |
| Q2≥-6 | 0 | 21.8 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC S | 800 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note1  1600 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note2 |
| 1 | 22.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC S | 1600 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note1  3200 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note2 |
| N/A | N/A | N/A | 5 x TRSS (Note 3) |
| Note1: Under TDD UL/DL configuration other than 0.  Note2: Under TDD UL/DL configuration 0.  Note3: It is the measurement period for RSRP measured on RSS signals defined in *RSS-Config* [2]. | | | |

Kintra\_M1\_EC = 100 / X where X is signalled by the RRC parameter *measGapSharingScheme* [2] and is defined as in Table 8.13.3.1.3.1-3.  is total number of inter-frequency layers to be monitored as defined in 8.1.2.1.1. When inter frequency measurement is not configured, Kintra\_M1\_EC=1 regardless whether or how parameter measGapSharingScheme [2] is configured.

Table 8.13.3.1.3.1-2: Void

Table 8.13.3.1.3.1-3: Value of parameter X for CEModeB

|  |  |
| --- | --- |
| *measGapSharingScheme* | Value of X (%) |
| ‘00’ |  |
| ‘01’ | 50 |
| ‘10’ | 75 |
| ‘11’ | 87.5 |

Table 8.13.3.1.3.1-4: Requirement on cell identification delay and measurement delay for TDD intrafrequency cell

|  |  |  |  |
| --- | --- | --- | --- |
| Neighouring cell SCH Ês/Iot: Q2 [dB] | Gap pattern ID | Cell identification delay (Tidentify\_intra\_UE cat M1) | Measurement delay (Tmeasure\_intra\_UE cat M1) |
| -15≤ Q2 < -6 | 0 | Max(400 \* rmax\* G / 1000, 320.8) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 800) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note1  Max(5 \* rmax\* G, 1600) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note2 |
| 1 | Max(400 \* rmax\* G / 1000, 321.6) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 1600) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note1  Max(5 \* rmax\* G, 3200) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note2 |
| Q2≥-6 | 0 | Max(20 \* rmax\* G / 1000, 21.8)\* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 800) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note1  Max(5 \* rmax\* G, 1600) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note2 |
| 1 | Max(20 \* rmax\* G / 1000, 22.6)\* Kintra\_M1\_EC \*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 1600) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note1  Max(5 \* rmax\* G, 3200) \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC ms Note2 |
| N/A | N/A | N/A | Max(rmax\*G, TRSS) x 5(Note 3) |
| Note1: Under TDD UL/DL configuration other than 0.  Note2: Under TDD UL/DL configuration 0.  Note3: It is the measurement period for RSRP measured on RSS signals defined in *RSS-Config* [2]. | | | |



KRSTD\_M1\_NC is applicable provided following conditions are met:

-  > 40 ms

-  > 

* PRS bandwidth is less than the bandwidth of the cell used for RSTD measurement in which case gaps are required

where

- is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

- **** is the number of consecutive downlink positioning subframes in a positioning occation defined in TS 36.211

Otherwise KRSTD\_M1\_EC = 1.

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.3 and 9.1.21.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.7 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-3 for a corresponding Band.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of **Tmeasure\_intra\_UE cat M1\_EC**. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is according to Table 8.13.3.1.3.1-1. When measurement gaps are activated the UE shall be capable of performing measurements for at least 6cells. If the UE has identified more than 6 cells, the UE shall perform measurements but the reporting rate of RSRP and RSRQ measurements of cells from UE physical layer to higher layers may be decreased.

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.3 and 9.1.21.4.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.7.

8.13.3.1.3.1.1 Measurement Reporting Requirements

8.13.3.1.3.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

8.13.3.1.3.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.1.3.1.1.3.

8.13.3.1.3.1.1.3 Event Triggered Reporting

Reported RSRP measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify intra\_UE cat M1\_EC defined in Clause 8.13.3.1.3.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_EC defined in clause 8.13.3.1.3.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period Intra\_UE cat M1\_EC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.3.1.3.2 E-UTRAN intra frequency measurements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable TDD intra frequency cell within Tidentify\_intra\_ UE cat M1\_EC as shown in table 8.13.3.1.3.2-1 provided that additional conditions table 8.13.3.1.3.2-1 is met.

When eDRX\_CONN is in use the UE shall be able to identify a new detectable TDD intra frequency cell within Tidentify\_intra\_UE cat M1\_EC as shown in table 8.13.3.1.3.2-1B.

Table 8.13.3.1.3.2-1: Requirement to identify a newly detectable TDD intrafrequency cell

|  |  |  |  |
| --- | --- | --- | --- |
| Neighbouring cell SCH Ês/Iot: Q2 [dB] | Gap pattern ID | DRX cycle length (s) | Tidentify\_intra\_UE cat M1 (s) (DRX cycles) |
| -15≤ Q2 < -6 | 0 | ≤0.64 | 320.8 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2 (400 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 321.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(400 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| Q2≥-6 | 0 | ≤0.64 | 21.8 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 22.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kintra\_M1\_EC\*  KRSTD\_M1\_EC) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | | | |

Table 8.13.3.1.3.2-1A: Void

Table 8.13.3.1.3.2-1B: Requirement to identify a newly detectable TDD intrafrequency cell when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_intra\_UE cat M1\_EC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (400 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| NOTE: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Clause 9.1.21.3 and 9.1.21.4 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.7 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-3 for a corresponding Band

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra\_UE cat M1\_EC. When DRX is used, Tmeasure\_intra\_UE cat M1\_EC is as shown in table 8.13.3.1.3.2-2 provided that additional conditions Table 8.13.3.1.3.2-2 is met. When eDRX\_CONN is used, Tmeasure\_intra\_UE cat M1\_EC is as shown in table 8.13.3.1.3.2-4. The UE shall be capable of performing RSRP and RSRQ measurement for 6 identified intra-frequency cells and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of Tmeasure\_intra\_UE cat M1\_EC.

Table 8.13.3.1.3.2-2: Requirement to measure TDD intra frequency cells

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Neighbouring cell SCH Ês/Iot: Q2 [dB] | TDD Uplink-downlink  configuration | Gap pattern ID | DRX cycle length (s) | Tmeasure\_intra\_UE cat M1 (s) (DRX cycles) |
| Q2≥-15 | Other than 0 | 0 | ≤0.16 | 0.8 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.16<DRX-cycle≤2.56 | Note2 (5 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| 1 | ≤0.32 | 1.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.32<DRX-cycle≤2.56 | Note2(5 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| 0 | 0 | ≤0.32 | 1.6 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.32<DRX-cycle≤2.56 | Note2 (5 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| 1 | ≤0.64 | 3.2 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC (Note1) |
| 0.64<DRX-cycle≤2.56 | Note2 (5 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| N/A | N/A | N/A | N/A | Max(DRX cycle length, TRSS) x 5 (Note 3) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use.  Note 2: Time depends upon the DRX cycle in use.  Note 3: It is the measurement period for RSRP measured on RSS signals defined in *RSS-Config* [2]. | | | | |

Table 8.13.3.1.3.2-3: Void

Table 8.13.3.1.3.2-4: Requirement to measure TDD intra frequency cells when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_intra\_UE cat M1\_EC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5 \* Kintra\_M1\_EC \*  KRSTD\_M1\_EC) |
| NOTE: Time depends upon the eDRX\_CONN cycle in use. | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.3 and 9.1.21.4.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.7.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.3.1.3.2.1 Measurement Reporting Requirements

8.13.3.1.3.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

8.13.3.1.3.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.1.3.2.1.3.

8.13.3.1.3.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.3, 9.1.21.4 and 9.1.21.7.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_intra\_UE cat M1\_EC defined in Clause 8.13.3.1.3.2.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_intra\_UE cat M1\_EC defined in clause 8.13.3.1.3.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_intra\_UE cat M1\_EC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

##### 8.13.3.1.4 E-UTRAN FDD intra frequency measurements with autonomous gaps for UE category M1 with CE mode B

The requirements defined in this subclause 8.13.3.1.4 apply provided the following condition is met:

- Tx diversity or transmission using multiple antennas are supported in the target cell to be detected.

- Repetitions of MIB/SIB1-BRare supported in the target cell to be detected.

8.13.3.1.4.1 Identification of a new CGI of E-UTRA cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose ‘reportCGI’. The UE may make autonomous gaps in downlink reception and uplink transmission for receiving MIB and SIB1-BRmessage according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI\_Cat M1, intra is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of an E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

- For UE not supporting cross-TTI MIB/SIB-BR decoding, Tbasic\_identify\_CGI\_Cat M1, intra = 5120 ms.

- For UE supporting cross-TTI MIB/SIB1-BR decoding, Tbasic\_identify\_CGI\_Cat M1, intra = 3200 ms provided that the target E-UTRA cell does not change the MIB payload information except the system frame number across MIB TTI and does not change the SIB1-BR information across SIB1-BR TTI. Otherwise Tbasic\_identify\_CGI\_Cat M1, intra = 5120 ms.

A cell shall be considered identifiable following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.14 for a corresponding Band

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI\_Cat M1,.intra is applicable when no DRX is used as well as when any of DRX and eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the PBCH repetition and SIB1-BR repetition level in the target cell shall be as specified in Table 8.13.3.1.4.1-1.

Table 8.13.3.1.4.1-1: Conditions in target cell during Tbasic\_identify\_CGI\_Cat M1, intra.

|  |  |  |  |
| --- | --- | --- | --- |
| Target cell | | | |
| Ês/Iot [dB] | PBCH repetition | SIB1-BR repetition level | SIB1-BR TBS |
| ≥ -15 | Configured as specified in TS 36.211 [16] | 16 | 208 |

8.13.3.1.4.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

##### 8.13.3.1.5 E-UTRAN intra frequency measurements with autonomous gaps for HD-FDD UE category M1 with CE mode B

The requirements in this section are applicable for the UE which supports half duplex FDD operation on one or more supported frequency bands [2].

The requirements defined in this subclause 8.13.3.1.5 apply provided the following condition is met:

- Tx diversity or transmission using multiple antennas are supported in the target cell to be detected.

- Repetitions of MIB/SIB1-BR are supported in the target cell to be detected.

8.13.3.1.5.1 Identification of a new CGI of E-UTRA cell with autonomous gaps

The CGI requirements defined in clause 8.13.3.1.4.1 also apply for this section.

8.13.3.1.5.2 ECGI Reporting Delay

The ECGI reporting delay defined in clause 8.13.3.1.5.2 also apply for this section

##### 8.13.3.1.6 E-UTRAN TDD intra frequency measurements with autonomous gaps for UE category M1 with CE mode B

The requirements defined in this subclause 8.13.3.1.6 apply provided the following condition is met:

- Tx diversity or transmission using multiple antennas are supported in the target cell to be detected.

- Repetitions of MIB/SIB1-BR are supported in the target cell to be detected.

8.13.3.1.6.1 Identification of a new CGI of E-UTRA cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose ‘reportCGI’. The UE may make autonomous gaps in downlink reception and uplink transmission for receiving MIB and SIB1-BR messages according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI\_Cat M1, intra is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of an E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

- For UE not supporting cross-TTI MIB/SIB-BR decoding, Tbasic\_identify\_CGI\_Cat M1, intra = 5120 ms.

- For UE supporting cross-TTI MIB/SIB1-BR decoding, Tbasic\_identify\_CGI\_Cat M1, intra = 3200 ms, provided that the target E-UTRA cell does not change the MIB payload information except the system frame number across MIB TTI and does not change the SIB1-BR information across SIB1-BR TTI. Otherwise Tbasic\_identify\_CGI\_Cat M1, intra = 5120 ms.

A cell shall be considered identifiable when the following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.14 for a corresponding Band

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI\_Cat M1, intra is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the PBCH repetition and SIB1-BR repetition level in the target cell shall be as specified Table 8.13.3.1.6.1-2.

Table 8.13.3.1.6.1-1: Conditions in target cell during Tbasic\_identify\_CGI\_Cat M1, intra.

|  |  |  |  |
| --- | --- | --- | --- |
| Target cell | | | |
| Ês/Iot [dB] | PBCH repetition level | SIB1-BR repetition level | SIB1-BR TBS |
| ≥ -15 | Configured with repetition, as specified in TS 36.211 [16] | 16 | 208 |

8.13.3.1.6.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

#### 8.13.3.2 Void

#### 8.13.3.3 E-UTRAN OTDOA Intra-Frequency RSTD Measurements for Cat-M1 UE in CEModeB

All intra-frequency RSTD measurement requirements specified in Sections 8.13.3.3 shall apply without DRX as well as for any DRX and eDRX\_CONN cycles specified in TS 36.331 [2].

All the measurement requirements specified in Sections 8.13.3.3 shall apply provided that the UE is configured:

- with the single PRS configuration for the reference cell and all the neighbour cells and

- with either the measurement gap pattern ID #0 specified in Clause 8.1.2.1 or any applicable measurement gap pattern specified in Table 8.1.2.1-3 for cat M1 RSTD measurements if the PRS bandwidth is less than the bandwidth of the cell used for the RSTD measurement in which case gaps are required.

If CRS muting is enabled in a cell for which the UE performs RSTD measurements, the UE capable of supporting CRS muting [31] shall perform RSTD measurements and meet all the requirements in this section, provided the CRS are available within at least the PRS bandwidth in the subframes with PRS during all positioning occasions within the RSTD measurement period.

##### 8.13.3.3.1 E-UTRAN FDD Intra-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below (see also Figure 8.13.3.3.1-1):

+ TMIB ms,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] for UE not configured with measurement gaps for intra-frequency RSTD. For UE configured with measurement gaps for intra-frequency RSTD measurements,  = max(, MGRP), where MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1.

 is the number of PRS positioning occasions as defined in Table 8.13.3.3.1-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355[24];

 is the number of PRS subframes within a PRS occasion available at the UE; = when the measurement gaps are not required for the intra-frequency RSTD measurements; for UE configured with measurement gaps for intra-frequency RSTD measurements  is the number of PRS subframes which can be measured by UE within MGL, where  = (MGL-2) if MGRP≥>(MGL-2),  = if >MGRP, and = if ≤(MGL-2).

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.21.21.

, ,  and ,  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

Table 8.13.3.3.1-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f1 Note1 | f1 and f2 Note2 |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-15 dB for all Frequency Bands for the reference cell,

≥-15 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.22 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE as illustrated in Figure 8.13.3.3.1-1.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.21.21.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

is the number of times the intra-frequency handover occurs during.

is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover.



Figure 8.13.3.3.1-1: Illustration of the RSTD reporting time requirement in an FDD system.

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

8.13.3.3.1.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.21.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.13.3.3.1.

##### 8.13.3.3.2 E-UTRAN TDD Intra-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

+ TMIB ,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] for UE not configured with measurement gaps for intra-frequency RSTD. For UE configured with measurement gaps for intra-frequency RSTD measurements,  = max(, MGRP), where MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1.

 is the number of PRS positioning occasions as defined in Table 8.13.3.3.1-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355[24];

 is the number of PRS subframes within a PRS occasion available at the UE; = when the measurement gaps are not required for the intra-frequency RSTD measurements; for UE configured with measurement gaps for intra-frequency RSTD measurements  is the number of PRS subframes which can be measured by UE within MGL, where  = (MGL-2) if MGRP≥>(MGL-2),  = if >MGRP, and = if ≤(MGL-2).

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.21.21.

, ,  and ,  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

Table 8.13.3.3.1-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f1 Note1 | f1 and f2 Note2 |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-15 dB for all Frequency Bands for the reference cell,

≥-15 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.22 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.21.21.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the intra-frequency handover occurs during,

 is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover.

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

The intra-frequency requirements in this clause (8.13.3.3.2) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.13.3.3.2-2.

Table 8.13.3.3.2-2: TDD uplink-downlink subframe configurations applicable for TDD intra-frequency requirements

|  |  |
| --- | --- |
| PRS Transmission Bandwidth [RB] | Applicable TDD uplink-downlink configurations |
| 6 | 1, 2, 3, 4 and 5 |
| Note: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.13.3.3.2.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.21.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.13.3.3.2.

##### 8.13.3.3.3 E-UTRAN HD-FDD Intra-Frequency OTDOA Measurements

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.13.3.3.1 also apply for this section except the reporting delay requirement provided the following conditions are met:

- all positioning subframes indicated in the OTDOA assistance data and specified in Section 9.1.21.21 are available for RSTD measurements in the measured and reference cells.

8.13.3.3.3.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.21.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than measurement perioddefined in Clause 8.13.3.3.3.

#### 8.13.3.4 E-UTRAN E-CID Measurements Requirements for UE category M1 with CE mode B

##### 8.13.3.4.1 Intra-frequency E-CID FDD RSRP and RSRQ Measurements for Cat-M1 UE in CEModeB

8.13.3.4.1.1 Introduction

The requirements in section 8.13.3.4.1 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN FDD intra-frequency RSRP and RSRQ measurements [24].

8.13.3.4.1.2 Measurement Requirements

The requirements in section 8.13.3.1.1 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.3.4.1.3.

8.13.3.4.1.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.3, 9.1.21.4 and 9.1.21.7.

##### 8.13.3.4.2 Intra-frequency HD-FDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeB

8.13.3.4.2.1 Introduction

The requirements in section 8.13.3.4.2 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN HD-FDD intra-frequency RSRP and RSRQ measurements [24].

8.13.3.4.2.2 Measurement Requirements

The requirements in section 8.13.3.4.2 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.3.4.2.3.

8.13.3.4.2.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.3, 9.1.21.4 and 9.1.21.7.

##### 8.13.3.4.3 Intra-frequency TDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeB

8.13.3.4.3.1 Introduction

The requirements in section 8.13.3.4.3 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN TDD intra-frequency RSRP and RSRQ measurements [24].

8.13.3.4.3.2 Measurement Requirements

The requirements in section 8.13.3.4.3 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.3.4.3.3.

8.13.3.4.3.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.3, 9.1.21.4 and 9.1.21.7.

##### 8.13.3.4.4 Inter-frequency E-CID FDD RSRP and RSRQ Measurements for Cat-M1 UE in CEModeB

8.13.3.4.4.1 Introduction

The requirements in section 8.13.3.4.4 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN FDD inter-frequency RSRP and RSRQ measurements [24].

8.13.3.4.4.2 Measurement Requirements

The requirements in section 8.13.3.5.1 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.3.4.4.3.

8.13.3.4.4.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

##### 8.13.3.4.5 Inter-frequency HD-FDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeB

8.13.3.4.5.1 Introduction

The requirements in section 8.13.3.4.5 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN HD-FDD inter-frequency RSRP and RSRQ measurements [24].

8.13.3.4.5.2 Measurement Requirements

The requirements in section 8.13.3.5.2 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.3.4.5.3.

8.13.3.4.5.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

##### 8.13.3.4.6 Inter-frequency TDD E-CID RSRP and RSRQ Measurements for Cat-M1 UE in CEModeB

8.13.3.4.6.1 Introduction

The requirements in section 8.13.3.4.6 shall apply provided the UE has received ECID-RequestLocationInformation message from E-SMLC via LPP requesting the UE to report E-CID E-UTRAN TDD inter-frequency RSRP and RSRQ measurements [24].

8.13.3.4.6.2 Measurement Requirements

The requirements in section 8.13.3.5.3 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in section 8.13.3.4.6.3.

8.13.3.4.6.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in section 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

#### 8.13.3.5 E-UTRAN inter frequency measurements by UE category M1 with CE Mode B

The UE shall be able to identify new inter-frequency cells and perform RSRP and RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the PCell, even if no explicit neighbour list with physical layer cell identities is provided. During the RRC\_CONNECTED state the UE shall continuously measure identified inter frequency cells and additionally search for and identify new inter frequency cells.

##### 8.13.3.5.1 E-UTRAN FDD - FDD inter frequency measurements

8.13.3.5.1.1 E-UTRAN FDD - FDD inter frequency measurements when no DRX is used

When no DRX is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify and measure a new detectable FDD inter-frequency cell according to requirements in Table 8.13.3.5.1.1-1 when additional condition in Table 8.13.3.5.1.1-1 is met, and

- G=1, or

- rmax\*G < 800ms, or

- UE is receiving PDSCH.

Otherwise, requirements in Table 8.13.3.5.1.1-3 apply, where rmax and G are given by higher layer parameter *mPDCCH-NumRepetition* and *mPDCCH-startSF-UESS* respectively as defined in TS 36.213 [3].

Table 8.13.3.5.1.1-1: Requirement on cell identification delay and measurement delay for FDD interfrequency cell

|  |  |  |  |
| --- | --- | --- | --- |
| Neighouring cell SCH Ês/Iot: Q2 [dB] | Gap pattern ID | Cell identification delay (Tidentify\_intra\_UE cat M1) | Measurement delay (Tmeasure\_intra\_UE cat M1) |
| -15≤ Q2 < -6 | 0 | 320.8 \* Kinter\_M1\_EC \*  KRSTD\_M1\_EC s | 800 \* Kinter\_M1\_EC \*  KRSTD\_M1\_EC ms |
| 1 | 321.6 \* Kinter\_M1 s | 1600 \* Kinter\_M1 ms |
| Q2≥-6 | 0 | 21.8 \* Kinter\_M1\_EC \*  KRSTD\_M1\_EC s | 800 \* Kinter\_M1\_EC \*  KRSTD\_M1\_EC  ms |
| 1 | 22.6 \* Kinter\_M1\_EC s | 1600 \* Kinter\_M1\_EC ms |



where X is signalled by the RRC parameter *measGapSharingScheme* [2] and is defined as in Table 8.13.3.5.1.1-2.  is total number of inter-frequency layers to be monitored as defined in 8.1.2.1.1.

Table 8.13.3.5.1.1-2: Value of parameter X for CEModeB

|  |  |
| --- | --- |
| *measGapSharingScheme* | Value of X (%) |
| ‘00’ |  |
| ‘01’ | 50 |
| ‘10’ | 75 |
| ‘11’ | 87.5 |

Table 8.13.3.5.1.1-3: Requirement on cell identification delay and measurement delay for FDD interfrequency cell

|  |  |  |  |
| --- | --- | --- | --- |
| Neighouring cell SCH Ês/Iot: Q2 [dB] | Gap pattern ID | Cell identification delay (Tidentify\_inter\_UE cat M1) | Measurement delay (Tmeasure\_inter\_UE cat M1) |
| -15≤ Q2 < -6 | 0 | Max(400 \* rmax\* G / 1000, 320.8) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 800) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms |
| 1 | Max(400 \* rmax\* G / 1000, 321.6) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 1600) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms |
| Q2≥-6 | 0 | Max(20 \* rmax\* G / 1000, 21.8)\* Kinter\_M1\_EC\*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 800) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms |
| 1 | Max(20 \* rmax\* G / 1000, 22.6)\* Kinter\_M1\_EC\*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 1600) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms |



KRSTD\_M1\_NC is applicable provided following conditions are met:

-  > 40 ms

-  > ****

where

-  is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

- **** is the number of consecutive downlink positioning subframes in a positioning occation defined in TS 36.211

Otherwise KRSTD\_M1\_EC = 1.

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.11 and 9.1.21.12 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.15 and 9.1.21.16 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.18-1 for a corresponding Band.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of Tmeasure\_inter\_UE cat M1\_EC. If higher layer filtering is used, an additional cell identification delay can be expected.

In the RRC\_CONNECTED state the measurement period for inter frequency measurements is according to Table 8.13.3.5.1.1-1. When measurement gaps are scheduled for FDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency for up to 3 FDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period defined in Table 8.13.3.5.1.1-1.

8.13.3.5.1.1.1 Measurement Reporting Requirements

8.13.3.5.1.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

8.13.3.5.1.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.5.1.1.1.3.

8.13.3.5.1.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify inter\_UE cat M1\_EC defined in Clause 8.13.3.5.1.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_EC defined in clause 8.13.3.5.1.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_UE cat M1\_EC, Inter provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.3.5.1.2 E-UTRAN inter frequency measurements when DRX is used

When DRX is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FDD inter-frequency cell within Tidentify\_inter\_UE cat M1\_EC as shown in table 8.13.3.5.1.2-1.

When eDRX\_CONN is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FDD inter-frequency cell within Tidentify\_inter\_UE cat M1\_EC as shown in table 8.13.3.5.1.2-1.

Table 8.13.3.5.1.2-1: Requirement to identify a newly detectable FDD interfrequency cell

|  |  |  |  |
| --- | --- | --- | --- |
| Neighbouring cell SCH Ês/Iot: Q2 [dB] | Gap pattern ID | DRX cycle length (s) | Tidentify\_intra\_UE cat M1 (s) (DRX cycles) |
| -15≤ Q2 < -6 | 0 | ≤0.64 | 320.8 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(400 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 321.6 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(400 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Q2≥-6 | 0 | ≤0.64 | 21.8 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 22.6 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note1: Number of DRX cycle depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycle in use | | | |

Table 8.13.3.5.1.2-1B: Requirement to identify a newly detectable FDD interfrequency cell when eDRX\_CONN is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_inter\_UE cat M1\_EC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (400 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.11 and 9.1.21.12 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.15 and 9.1.21.16 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.18-1 for a corresponding Band

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency and the UE physical layer shall be capable of reporting RSRP and RSRQ to higher layers with the measurement period Tmeasure\_inter\_UE cat M1\_EC, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is used, Tmeasure\_inter\_UE cat M1\_EC is as defined in Table 8.13.3.5.1.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter\_UE cat M1\_EC is as defined in Table 8.13.3.5.1.2-2.

Table 8.13.3.5.1.2-2: Requirement to measure FDD interfrequency cells

|  |  |  |  |
| --- | --- | --- | --- |
| Target cell SCH Ês/Iot: Q2 [dB] | Gap pattern ID | DRX cycle length (s) | Tmeasure\_intra\_UE cat M1 (s) (DRX cycles) |
| Q2≥-15 | 0 | ≤0.16 | 0.8 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.16<DRX-cycle≤2.56 | Note2(5 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | ≤0.32 | 1.6 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.32<DRX-cycle≤2.56 | Note2(5 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | | |

Table 8.13.3.5.1.2-3: Requirement to measure FDD interfrequency cells when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_inter\_UE cat M1\_EC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.11 and 9.1.21.12.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.15 and 9.1.21.16.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.3.5.1.2.1 Measurement Reporting Requirements

8.13.3.5.1.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

8.13.3.5.1.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.5.1.2.1.3.

8.13.3.5.1.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_inter, UE cat M1\_EC defined in Clause 8.13.3.5.1.2 When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_EC defined in clause 8.13.3.5.1.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_inter\_UE cat M1\_EC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

##### 8.13.3.5.2 E-UTRAN inter-frequency measurements for HD-FDD

8.13.3.5.2.1 E-UTRAN inter-frequency measurements when no DRX is used

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.13.3.5.1.1 also apply for this section provided the following conditions are met:

- RSRP related side conditions given in Sections 9.1.21.11 and 9.1.21.12 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.15 and 9.1.21.16 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.18-2 for a corresponding Band

8.13.3.5.2.2 E-UTRAN inter frequency measurements when DRX is used

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

When DRX is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FDD inter-frequency cell within Tidentify\_inter\_UE cat M1\_EC as shown in table 8.13.3.5.2.2-1.

When eDRX\_CONN is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FDD inter-frequency cell within Tidentify\_inter\_UE cat M1\_EC as shown in table 8.13.3.5.2.2-1.

Table 8.13.3.5.2.2-1: Requirement to identify a newly detectable HD-FDD interfrequency cell

|  |  |  |  |
| --- | --- | --- | --- |
| Neighbouring cell SCH Ês/Iot: Q2 [dB] | Gap pattern ID | DRX cycle length (s) | Tidentify\_intra\_UE cat M1 (s) (DRX cycles) |
| -15≤ Q2 < -6 | 0 | ≤0.64 | 320.8 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(400 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 321.6 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(400 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Q2≥-6 | 0 | ≤0.64 | 21.8 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 22.6 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | | |

Table 8.13.3.5.2.2-1B: Requirement to identify a newly detectable HD-FDD interfrequency cell when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_inter\_UE cat M1\_EC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (400 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.11 and 9.1.21.12 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.15 and 9.1.21.16 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.18-2 for a corresponding Band

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per FDD inter-frequency and the UE physical layer shall be capable of reporting RSRP and RSRQ to higher layers with the measurement period Tmeasure\_inter\_UE cat M1\_EC, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is used, Tmeasure\_inter\_UE cat M1\_EC is as defined in Table 8.13.3.5.2.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter\_UE cat M1\_EC is as defined in Table 8.13.3.5.2.2-2.

Table 8.13.3.5.2.2-2: Requirement to measure HD-FDD interfrequency cells

|  |  |  |  |
| --- | --- | --- | --- |
| Neighbouring cell SCH Ês/Iot: Q2 [dB] | Gap pattern ID | DRX cycle length (s) | Tmeasure\_intra\_UE cat M1 (s) (DRX cycles) |
| Q2≥-15 | 0 | <0.128 | 0.8 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.128≤DRX-cycle≤0.16 | Note2 (7 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 0.16<DRX-cycle≤2.56 | Note2(5 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | ≤0.32 | 1.6 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.32<DRX-cycle≤2.56 | Note2(5 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | | |

Table 8.13.3.5.2.2-3: Requirement to measure HD-FDD interfrequency cells when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_inter\_UE cat M1\_EC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.11 and 9.1.21.12.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.15 and 9.1.21.16.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.3.5.2.2.1 Measurement Reporting Requirements

8.13.3.5.2.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

8.13.3.5.2.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.5.2.2.1.3.

8.13.3.5.2.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_inter\_UE cat M1\_EC defined in Clause 8.13.3.5.2.2When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_EC defined in clause 8.13.3.5.2.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_inter\_UE cat M1\_EC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

##### 8.13.3.5.3 E-UTRAN TDD inter frequency measurements

8.13.3.5.3.1 E-UTRAN inter frequency measurements when no DRX is used

When no DRX is in use and when measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify and measure a new detectable TDD inter frequency cell according to requirements in Table 8.13.3.5.3.1-1 when additional condition in Table 8.13.3.5.3.1-1 is met, and

- G=1, or

- rmax\*G < 800ms, or

- UE is receiving PDSCH.

Otherwise, requirements in Table 8.13.3.5.3.1-3 apply, where rmax and G are given by higher layer parameter *mPDCCH-NumRepetition* and *mPDCCH-startSF-UESS* respectively as defined in TS 36.213 [3].

Table 8.13.3.5.3.1-1: Requirement on cell identification delay and measurement delay for TDD interfrequency cell

|  |  |  |  |
| --- | --- | --- | --- |
| Neighouring cell SCH Ês/Iot: Q2 [dB] | Gap pattern ID | Cell identification delay (Tidentify\_intra\_UE cat M1) for neighbouring cell SCH Ês/Iot (Q): -15≤ Q2 < -6 [dB] | Measurement delay (Tmeasure\_intra\_UE cat M1) |
| -15≤ Q2 < -6 | 0 | 320.8 \* Kinter\_M1\_EC \*  KRSTD\_M1\_EC s | 800 \* Kinter \_M1\_EC \*  KRSTD\_M1\_EC ms Note1  1600 \* Kinter \_M1\_EC \*  KRSTD\_M1\_EC ms Note2 |
| 1 | 321.6 \* Kinter\_M1\_EC s | 1600 \* Kinter\_M1\_EC ms Note1  3200 \* Kinter\_M1\_EC ms Note2 |
| Q2≥-6 | 0 | 21.8 \* Kinter\_M1\_EC \*  KRSTD\_M1\_EC S | 800 \* Kinter\_M1\_EC \*  KRSTD\_M1\_EC ms Note1  1600 \* Kinter\_M1\_EC \*  KRSTD\_M1\_EC ms Note2 |
| 1 | 22.6 \* Kinter\_M1\_EC S | 1600 \* Kinter\_M1\_EC ms Note1  3200 \* Kinter\_M1\_EC ms Note2 |
| Note 1: Under TDD UL/DL configuration other than 0.  Note 2: Under TDD UL/DL configuration 0. | | | |



where X is signalled by the RRC parameter *measGapSharingScheme* and is defined as in Table 8.13.3.5.3.1-2.  is total number of inter-frequency layers to be monitored as defined in 8.1.2.1.1.

Table 8.13.3.5.3.1-2: Value of parameter X for CEModeB

|  |  |
| --- | --- |
| *measGapSharingScheme* | Value of X (%) |
| ‘00’ |  |
| ‘01’ | 50 |
| ‘10’ | 75 |
| ‘11’ | 87.5 |

Table 8.13.3.5.3.1-3: Requirement on cell identification delay and measurement delay for TDD interfrequency cell

|  |  |  |  |
| --- | --- | --- | --- |
| Neighouring cell SCH Ês/Iot: Q2 [dB] | Gap pattern ID | Cell identification delay (Tidentify\_inter\_UE cat M1) | Measurement delay (Tmeasure\_inter\_UE cat M1) |
| -15≤ Q2 < -6 | 0 | Max(400 \* rmax\* G / 1000, 320.8) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 800) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms Note1  Max(5 \* rmax\* G, 1600) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms Note2 |
| 1 | Max(400 \* rmax\* G / 1000, 321.6) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 1600) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms Note1  Max(5 \* rmax\* G, 3200) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms Note2 |
| Q2≥-6 | 0 | Max(20 \* rmax\* G / 1000, 21.8)\* Kinter\_M1\_EC\*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 800) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms Note1  Max(5 \* rmax\* G, 1600) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms Note2 |
| 1 | Max(20 \* rmax\* G / 1000, 22.6)\* Kinter\_M1\_EC\*  KRSTD\_M1\_EC s | Max(5 \* rmax\* G, 1600) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms Note1  Max(5 \* rmax\* G, 3200) \* Kinter\_M1\_EC\*  KRSTD\_M1\_EC  ms Note2 |
| Note1: Under TDD UL/DL configuration other than 0.  Note2: Under TDD UL/DL configuration 0. | | | |



KRSTD\_M1\_NC is applicable provided following conditions are met:

-  > 40 ms

-  > ****

where

-  is the cell-specific positioning subframe configuration period as defined in TS 36.211 [16],

- **** is the number of consecutive downlink positioning subframes in a positioning occation defined in TS 36.211

Otherwise KRSTD\_M1\_EC = 1.

A cell shall be considered detectable when

- RSRP related side conditions given in Sections 9.1.21.11 and 9.1.21.12 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.15 and 9.1.21.16 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.16-1 for a corresponding Band.

When measurement gaps are scheduled for TDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP and RSRQ to higher layers with measurement accuracy as specified in sub-clauses 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16 with measurement period (Tmeasure\_inter\_UE cat M1\_EC) given by table 8.13.3.5.3.1-1:

The UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per TDD inter-frequency and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period Tmeasure\_inter\_UE cat M1\_EC.

8.13.3.5.3.1.1 Measurement Reporting Requirements

8.13.3.5.3.1.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

8.13.3.5.3.1.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.5.3.1.1.3.

8.13.3.5.3.1.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify inter\_UE cat M1\_EC defined in Clause 8.13.3.5.3.1.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_EC defined in clause 8.13.3.5.3.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than TMeasurement\_Period Inter\_UE cat M1\_EC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

8.13.3.5.3.2 E-UTRAN inter frequency measurements when DRX is used

When DRX is in use and when DRX or eDRX\_CONN is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable TDD inter frequency cell within Tidentify\_inter\_ UE catM1 as shown in table 8.13.3.5.3.2-1.

When eDRX\_CONN is in use the UE shall be able to identify a new detectable TDD inter frequency cell within Tidentify\_inter\_UE cat M1\_EC as shown in table 8.13.3.5.3.2-1.

Table 8.13.3.5.3.2-1: Requirement to identify a newly detectable TDD interfrequency cell

|  |  |  |  |
| --- | --- | --- | --- |
| Neighbouring cell SCH Ês/Iot: Q2 [dB] | Gap pattern ID | DRX cycle length (s) | Tidentify\_intra\_UE cat M1 (s) (DRX cycles) |
| -15≤ Q2 < -6 | 0 | ≤0.64 | 320.8 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(400 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 321.6 \* Kinter\_M1 (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(400 \* Kinter\_M1) |
| Q2≥-6 | 0 | ≤0.64 | 21.8 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | DRX-cycle ≤ 0.640 | 22.6 \* Kinter\_M1 (Note1) |
| 0.64< DRX-cycle≤2.56 | Note2(24 \* Kinter\_M1) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | | | |

Table 8.13.3.5.3.2-1A: Requirement to identify a newly detectable TDD interfrequency cell when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_inter\_UE cat M1\_EC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (400 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

A cell shall be considered detectable when

- RSRP related side conditions given in Clause 9.1.21.11 and 9.1.21.12 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Clause 9.1.21.15 and 9.1.21.16 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.16-1 for a corresponding Band

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP and RSRQ measurements of at least 4 inter-frequency cells per TDD inter-frequency for up to 3 TDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements to higher layers with the measurement period Tmeasure\_inter\_UE cat M1\_EC, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is in use, Tmeasure\_inter\_UE cat M1\_EC is as defined in Table 8.13.3.5.3.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter\_UE cat M1\_EC  is as defined in Table 8.13.3.5.3.2-2.

Table 8.13.3.5.3.2-2: Requirement to measure TDD inter frequency cells

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Neighbouring cell SCH Ês/Iot: Q2 [dB] | TDD Uplink-downlink  configuration | Gap pattern ID | DRX cycle length (s) | Tmeasure\_intra\_UE cat M1 (s) (DRX cycles) |
| Q2≥-15 | Other than 0 | 0 | ≤0.16 | 0.8 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.16<DRX-cycle≤2.56 | Note2(5 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | ≤0.32 | 1.6 \* Kinter\_M1 (Note1) |
| 0.32<DRX-cycle≤2.56 | Note2(5 \* Kinter\_M1) |
| 0 | 0 | ≤0.32 | 1.6 \* Kinter\_M1 \*  KRSTD\_M1\_EC (Note1) |
| 0.32<DRX-cycle≤2.56 | Note2(5 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| 1 | ≤0.64 | 3.2 \* Kinter\_M1 (Note1) |
| 0.64<DRX-cycle≤2.56 | Note2(5) \* Kinter\_M1 |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use.  Note 2: Time depends upon the DRX cycle in use. | | | | |

Table 8.13.3.5.3.2-3: Requirement to measure TDD inter frequency cells when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_inter\_UE cat M1\_EC (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5 \* Kinter\_M1 \*  KRSTD\_M1\_EC) |
| Note: Time depends upon the eDRX\_CONN cycle in use. | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.11 and 9.1.21.12.

The RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.21.15 and 9.1.21.16.

The requriements in this subcluse apply regardless of MPDCCH monitoring configuration.

8.13.3.5.3.2.1 Measurement Reporting Requirements

8.13.3.5.3.2.1.1 Periodic Reporting

Reported RSRP and RSRQ measurement contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

8.13.3.5.3.2.1.2 Event-triggered Periodic Reporting

Reported RSRP and RSRQ measurement contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.13.3.5.3.2.1.3.

8.13.3.5.3.2.1.3 Event Triggered Reporting

Reported RSRP and RSRQ measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.11, 9.1.21.12, 9.1.21.15 and 9.1.21.16.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeB* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeB* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode B provided that *pusch-maxNumRepetitionCEmodeB >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T identify\_inter\_UE cat M1\_EC defined in Clause 8.13.3.5.3.2.When L3 filtering is used or IDC autonomous denial is configured an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_inter\_UE cat M1\_EC defined in clause 8.13.3.5.3.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than Tmeasure\_inter\_UE cat M1\_EC provided the timing to that cell has not changed more than ± 50 Ts and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured, an additional delay can be expected.

#### 8.13.3.6 Maximum allowed layers for multiple monitoring for UE category M1 with CE mode B

The UE UE category M1 configured with CE mode B shall be capable of monitoring at least:

- Depending on UE capability, 2 FDD E-UTRA inter-frequency carriers, and

- Depending on UE capability, 2 TDD E-UTRA carriers.

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 5 carrier frequency layers, which include one serving carrier frequency and any of the above defined combination of E-UTRA FDD inter-frequency and E-UTRA TDD inter-frequency layers.

#### 8.13.3.7 E-UTRAN OTDOA Inter-Frequency RSTD Measurements for Cat-M1 UE in CEModeB

All inter-frequency RSTD measurement requirements specified in Sections 8.13.3.7 shall apply, provided that

- the UE is capable of inter-frequency RSTD measurements for OTDOA [24], and

- either the measurement gap pattern ID # 0 specified in Table 8.1.2.1-1 or any applicable measurement gap pattern specified in Table 8.1.2.1-3 is used or the UE supports capability of conducting inter-frequency measurements without gaps.

All inter-frequency RSTD measurement requirements specified in Sections 8.13.3.7 shall apply without DRX as well as for any DRX and eDRX\_CONN cycles specified in TS 36.331 [2].

All positioning subframes indicated in the OTDOA assistance data and specified in sub-clause 9.1.21.18 are available for RSTD measurements in the measured and reference cell.

All the measurement requirements specified in Sections 8.13.3.7 shall apply provided that the UE is configured with the single PRS configuration for the reference cell and all the neighbour cells.

If CRS muting is enabled in a cell for which the UE performs RSTD measurements, the UE capable of supporting CRS muting [31] shall perform RSTD measurements and meet all the requirements in this section, provided the CRS are available within at least the PRS bandwidth in the subframes with PRS during all positioning occasions within the RSTD measurement period.

##### 8.13.3.7.1 E-UTRAN FDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below (see also Figure 8.13.2.3.1-1):

+ TMIB  ms,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24]; if <MGRP,  equals to MGRP; MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1,

 is the number of PRS positioning occasions as defined in Table 8.13.3.7.1-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355[24];

 is the number of PRS subframes within a PRS occasion that can be measured by UE within MGL; if MGRP>=>(MGL-2ms), =(MGL-2ms); if >MGRP, =; = if ≤(MGL-2);

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.21.18.

, ,  and  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

Table 8.13.3.7.1-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f2 Note1 | f1 and f2 Note2 |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the FDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving FDD carrier frequency f1 and the FDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-15 dB for all Frequency Bands for the reference cell,

≥-15 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.20 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.21.18.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

is the number of times the inter-frequency handover occurs during.

is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

8.13.3.7.1.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.18.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.13.3.7.1.

##### 8.13.3.7.2 E-UTRAN TDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

+ TMIB  ms ,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24]; if <MGRP,  equals to MGRP; MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1,

 is the number of PRS positioning occasions as defined in Table 8.13.3.7.2-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355[24];

 is the number of PRS subframes within a PRS occasion that can be measured by UE within MGL; if MGRP>=>(MGL-2ms), =(MGL-2ms); if >MGRP, =; = if ≤(MGL-2);

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.21.18.

, ,  and  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

Table 8.13.3.7.2-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f2 Note1 | f1 and f2 Note2 |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the TDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving TDD carrier frequency f1 and the TDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-15 dB for all Frequency Bands for the reference cell,

≥-15 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.20 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.21.18.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

The inter-frequency requirements in this clause (8.13.3.7.2) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.13.3.7.2-2.

Table 8.13.3.7.2-2: TDD uplink-downlink subframe configurations applicable for TDD inter-frequency requirements

|  |  |
| --- | --- |
| PRS Transmission Bandwidth [RB] | Applicable TDD uplink-downlink configurations |
| 6 | 1, 2, 3, 4 and 5 |
| Note: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.13.3.7.2.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.18.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.13.3.7.2.

##### 8.13.3.7.3 E-UTRAN HD-FDD Inter-Frequency OTDOA Measurements

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.13.3.7.1 also apply for this section except reporting delay requirement provided the following conditions are met:

- all positioning subframes indicated in the OTDOA assistance data and specified in Section 9.1.21.18 are available for RSTD measurements in the measured and reference cells.

8.13.3.7.3.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.21.18.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than measurement period as defined in Clause 8.13.3.7.3.

#### 8.13.3.8 Channel quality report for UE Category M1 in connected mode with CE mode B

The requirements in this clause shall apply for UE supporting DL channel quality reporting for UE Category M1 as defined in TS 36.321 [17] section 5.25.

The DL channel quality provides the serving eNB with information about

- the minimum MPDCCH repetition level to satisfy the hypothetical MPDCCH block error rate of 1% with the parameters specified in Table 8.13.3.8-1.

**Table 8.13.3.8-1: MPDCCH transmission parameters for downlink quality reporting, repetition number being reported**

|  |  |
| --- | --- |
| **Attribute** | **CEModeB** |
| DCI format | 6-1B |
| Starting OFDM symbols | 2; Bandwidth >= 10MHz 3; 3MHz <= Bandwidth < 10MHz 4; Bandwidth = 1.4MHz |
| MPDCCH Aggregation level (ECCE) Note2 | 24 |
| M-PDCCH Transmission type | Distributed |

The MPDCCH repetition level or aggregation level is chosen from the supported MPDCCH repetition levels and aggregation levels [3]. The report mapping is defined in section 9.1.21.22.

The UE shall satisfy the downlink channel quality measurement accuracy requirements as specified in section 9.1.21.24.

## 8.14 Measurements for UE category NB1

### 8.14.1 Introduction

This clause contains requirements on the UE category NB1 regarding measurement in RRC\_CONNECTED state. The requirements are specified for NB-IoT intra frequency measurements for serving NB-IoT cell. These measurements may be used by the NB-IoT for uplink power control. The measurement quantities are defined in [4], the measurement model is defined in [22] and measurement accuracies are specified in clause 9. During the RRC\_CONNECTED state the UE shall continuously measure serving NB-IoT cell.

The UE shall meet all applicable requirements specified in clause 8.14 under the following conditions:

- at least 1 DL subframe per radio frame of serving NB-IoT cell is available at the UE during measurement period.

### 8.14.2 NB-IoT intra frequency measurements under normal coverage

#### 8.14.2.1 NB-IoT intra frequency measurements when no DRX is used

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is 800ms, unless the UE is capable of NSSS-based RRM measurements and *nsss-NumOccDiffPrecoders* value *n1* [2] is indicated by higher layers, by which the measurement period is [1600] ms. The NRSRP measurement accuracy shall be as specified in the sub-clauses 9.1.22.1.

#### 8.14.2.2 NB-IoT intra frequency measurements when DRX is used

When DRX is used in the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra as shown in table 8.14.2.2-1.

Table 8.14.2.2-1: Requirement for intrafrequency measurement

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_intra (s) (DRX cycles) |
| 0.256<DRX-cycle≤10.24 | Note1 (5) |
| Note1: Time depends upon the DRX cycle in use | |

The NRSRP measurement accuracy shall be as specified in the sub-clauses 9.1.22.1

### 8.14.3 NB-IoT intra frequency measurements under enhanced coverage

#### 8.14.3.1 NB-IoT intra frequency measurements when no DRX is used

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is 1600ms. The NRSRP measurement accuracy shall be as specified in the sub-clauses 9.1.22.1.

#### 8.14.3.2 NB-IoT intra frequency measurements when DRX is used

When DRX is used in the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra as shown in table 8.14.3.2-1.

Table 8.14.3.2-1: Requirement for intrafrequency measurement

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_intra (s) (DRX cycles) |
| 0.256<DRX-cycle≤10.24 | Note1 (5) |
| Note1: Time depends upon the DRX cycle in use | |

The NRSRP measurement accuracy shall be as specified in the sub-clauses 9.1.22.1.

### 8.14.4 Connected mode channel quality report for UE Category NB1

The requirements in this clause shall apply for UE supporting DL channel quality reporting for UE Category NB1 as defined in TS 36.331 [2] when triggered by the MAC-CE command as specified in TS 36.321 [17].

The DL channel quality provides the serving eNB with information about the minimum NPDCCH repetition level to satisfy the hypothetical NPDCCH block error rate of 1% with the parameters specified in Table 8.14.4-1.

Table 8.14.4-1: NPDCCH transmission parameters for downlink quality reporting

|  |  |
| --- | --- |
| Parameters | Values |
| DCI format | Format N1 |
| Number of information bits (excluding CRC) | 23bits |
| System bandwidth | 200kHz |
| Aggregation level | 2 |
| DRX | OFF |

The reported NPDCCH repetition level shall be derived from the channel quality measured over the NPDCCH period which carries the uplink grant of channel quality report for measurement of DL channel quality of the configured carrier.

The NPDCCH repetition level for QualityReport specified in TS 36.321 [17] is chosen from the supported NPDCCH repetition levels [3]. The report mapping is defined in 9.1.22.15.

The UE shall satisfy the downlink channel quality measurement accuracy requirements as specified in 9.1.22.16.

### 8.14.5 Connected mode channel quality report for UE Category NB2 supporting 16QAM

The requirements in this clause shall apply for UE Category NB2 supporting 16QAM for unicast NPDSCH as defined in TS 36.331 [2] when triggered by the MAC-CE command as specified in TS 36.321 [17].

The DL channel quality provides the serving eNB with the following information with the parameters specified in Table 8.14.5-1:

- The reported candidateRep should correspond to the minimum number of NPDCCH repetitions that achieves a hypothetical NPDCCH block error rate no larger than 1%, and correspond to the NPDSCH transport block size that achieves a NPDSCH block error rate no larger than 10%.

- If the candidateRep entry corresponds to NPDCCH repetitions level X and NPDSCH transport block size Y, then no other candidate with NPDCCH repetitions level ≤ X and NPDSCH transport block size ≥ Y should satisfy the block error rate conditions for both NPDCCH and NPDSCH.

- If there is no candidateRep entry to satisfy the condition, UE should report ‘noMeasurement’.

The report mapping is defined in Table 9.1.22.17-1.

Table 8.14.5-1: NPDCCH transmission parameters for downlink quality reporting

|  |  |
| --- | --- |
| Parameters | Values |
| DCI format | Format N1 |
| Number of information bits (excluding CRC) | 23bits |
| System bandwidth | 200kHz |
| Aggregation level | 2 |
| DRX | OFF |

The reported candidateRep value shall be derived from the channel quality measured from the time UE finishes the decoding of Downlink Channel Quality report MAC CE to the end of NPDCCH period which carries the uplink grant of channel quality report for measurement of DL channel quality of the configured carrier. During the measurement period, UE expects that NRS is transmitted in at least 4 consecutive subframes.

### 8.14.6 NB-IoT neighbour cell measurements

#### 8.14.6.1 Introduction

This clause contains requirements for the neighbour cell measurements performed by the UE category NB1 in RRC\_CONNECTED state. The requirements in this clause are applicable when:

* the UE is in normal coverage or in enhanced coverage on the serving cell and
* the target cell fulfils the criteria for normal coverage.

#### 8.14.6.2 Requirements

The UE supporting *connectedModeMeasurements-r17* [31] shall measure neighbour cells when the criterion for triggering the neighbour cell measurements defined in [1] is fulfilled and the UE is not in relaxed monitoring mode as defined in [1]. The UE may trigger the neighbour cell measurements before or during radio link failure depending on the fulfilment of the criterion.

The measurement quantities are defined in [4], the measurement model is defined in [22].

The requirements for intra-frequency neighbour cell measurement when the target carrier is same as serving carrier is defined in clause 8.14.6.3.

The requirements for inter-frequency neighbour cell measurement when the target carrier is different from serving carrier is defined in clause 8.14.6.4.

#### 8.14.6.3 Intra-frequency neighbour cell measurements

The UE shall be able to identify a new detectable intra-frequency cell within Tidentify\_intra ­­­when the criteria for intra-frequency measurements is fulfilled [1]. An intra frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.x.y for a corresponding Band.

Tidentify\_intra = Tdetect\_intra + Tmeasure \_intra

When DRX is not used, Tdetect\_intra is 1400 ms, and Tmeasure \_intra is 800 ms and 1600 ms for NRS-based measurement and NSSS-based measurement respectively.

When DRX is used, Tdetect\_intra and Tmeasure \_intra are defined in table 8.14.6.3-1 and 8.14.6.3-2.

Table 8.14.6.3-1: Requirement for intra-frequency detection

|  |  |
| --- | --- |
| DRX cycle length (s) | Tdetect\_intra (s) (DRX cycles) |
| 0.256<DRX-cycle≤10.24 | (6)Note 1 |
| Note1: Time depends upon the DRX cycle in use | |

Table 8.14.6.3-2: Requirement for intra-frequency measurement

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_intra (s) (DRX cycles) |
| 0.256<DRX-cycle≤10.24 | (5)Note 1 |
| Note1: Time depends upon the DRX cycle in use | |

When UE is monitoring multiple carriers, Tidentify\_intra = Tdetect + Tmeasure, where Tdetect = Tdetect \_intra+Nfreq\* Tdetect\_inter and Tmeasure = Tmeasure \_intra+Nfreq\* Tmeasure\_inter. Nfreq is number of inter-frequency carriers to be measured according to the measurement capability, and Tdetect\_inter  and Tmeasure\_inter are defined in clause 8.14.6.4

#### 8.14.6.4 Inter-frequency neighbour cell measurements

The UE shall be able to identify a new detectable inter-frequency cell within Tidentify\_inter\_NB1-NC ­­­when the criteria for inter-frequency measurement is fulfilled [1]. An inter frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.x.y for a corresponding Band.

Tidentify \_inter\_NB1-NC = Tdetect\_inter NB1-NC + Tmeasure \_inter NB1-NC

Where

ms

- N = 70,

- Ta,i is the interval between available measurement samples in measurement occasions (MOdetect\_inter\_NB1-NC) for inter-frequency detection, where

40 ms ≤ Ta,i ≤ 5000 ms

- The UE shall restart the cell detection when the interval between two samples are larger than 5000 ms.

- The UE is not required to monitor NPSS/NSSS more frequent than once per 40ms.

- MOdetect\_inter\_NB1-NC are time occasions containing NPSS/NSSS and fulfil the following conditions:

- Resources on which the UE is not scheduled for data transmission or reception,

- Resources on which the UE is not required to do NPDCCH monitoring,

- Resources occurring during the DRX inactive period

- Length of MOdetect\_inter\_NB1-NC  is at least 200 ms.

- The inter-frequency detection requirements apply when ≤ 60 seconds per inter-frequency carrier.

Tmeasure\_inter\_NB1-NC is the physical layer measurement period of NRSRP on the detected inter-frequency cell as defined below:

ms

- M = 60 for NRS-based RRM measurement and M = 40 for NSSS based RRM measurement,

- Tb,i is the interval between available measurement samples in measurement occasions (MOmeasure\_inter\_NB1-NC) for inter-frequency measurement, where

20 ms ≤ Tb,i ≤ 5000 ms for NRS based measurement or

40 ms ≤ Tb,i ≤ 5000 ms for NSSS-based measurement

- The UE shall restart the measurement when the interval between two samples are larger than 5000 ms.

- The UE is not required to monitor NRS more frequent than once per 20ms for NRS-based measurement and NSSS more frequent than 40 ms for NSSS-based measurement.

- MOmeasure\_inter\_NB1-NC are time occasion containing at least NRS or NSSS that fulfil the following conditions:

- Resources on which the UE is not scheduled for data transmission or reception,

- Resources on which the UE is not required to do NPDCCH monitoring,

- Resources occurring during the DRX inactive period,

- Length of MOmeasure\_inter\_NB1-NC  is at least 50 ms.

- The inter-frequency measurement requirements apply when ≤ 50 sec seconds per inter-frequency carrier.

When UE is monitoring multiple carriers, Tidentify\_inter\_NB1-NC = Tdetect\_NB1-NC + Tmeasure\_NB1-NC, where Tdetect\_NB1-NC = Tdetect \_intra\_NB1-NC +Nfreq\* Tdetect\_inter\_NB1-NC and Tmeasure\_NB1-NC = Tmeasure \_intra\_NB1-NC +Nfreq\* Tmeasure\_inter\_NB1-NC. Nfreq is number of inter-frequency carriers to be measured according to the measurement capability, and Tdetect\_intra\_NB1-NC and Tmeasure\_intra\_NB1-NC are defined in clause 8.14.6.3.

#### 8.14.6.5 Requirements for monitoring multiple carriers

For RRC\_CONNECTED state, the UE shall be capable of monitoring at least:

- Depending on UE capability, an intra-frequency carrier.

- Depending on UE capability, at least 2 inter-frequency carriers.

## 8.15 Void

## 8.16 Measurements for UE Category M2

### 8.16.1 Introduction

The UE category M2 applicability of the requirements in subclause 8.16 is defined in Section 3.6.

This clause contains requirements on the UE regarding measurement reporting in RRC\_CONNECTED state. The requirements are specified for E-UTRA intra frequency measurements. These measurements may be used by the E-UTRAN, e.g. for handover decisions. The measurement quantities are defined in TS 36.214 [4], the measurement model is defined in TS 36.302 [22] and measurement accuracies are specified in clause 9. Control of measurement reporting is specified in TS 36.331 [2].

The UE shall meet the requirements in Section 8.16, provided:

- the UE does not require measurement gaps for the corresponding measurements, or

- the UE requires measurement gaps for the corresponding measurements and is configured with the measurement gap pattern Id 0 or 1 and is not configured with any measurement gap pattern from Table 8.1.2.1-3.

If the UE requires measurement gaps for the corresponding measurements and is configured with the measurement gap pattern from Table 8.1.2.1-3, the UE is not required to perform any RRM measurements that requires gaps during the RSTD measurement period and the requirement in Section 8.16 shall not apply during the RSTD measurement period.

When the UE is provided with IDC solution, the UE shall also perform RRM measurements and meet the corresponding requirements in clause 8.

### 8.16.2 Requirements for UE category M2 with CE mode A

#### 8.16.2.1 E-UTRAN FDD UE Rx-Tx Time Difference Measurements for UE category M2 in CEModeA

When no DRX is used the physical layer measurement period of the UE Rx-Tx time difference measurement shall be 480 ms.

When DRX is used in RRC\_CONNECTED state the physical layer measurement period (Tmeasure\_FDD\_UE\_Rx\_Tx1) of the UE Rx-Tx time difference measurement shall be as specified in table 8.16.2.1-1.

Table 8.16.2.1-1: FDD UE Rx-Tx time difference measurement requirement when DRX is used

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_FDD\_UE\_Rx\_Tx1 (s) (DRX cycles) |
| < 0.128 | 0.48 (Note1) |
| 0.128 ≤ DRX-cycle ≤ 2.56 | Note2 (5) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | |

If the UE is performing UE Rx-Tx time difference measurement while the PCell is changed due to the handover then the UE shall restart the Rx-Tx measurement on the new cell. In this case the UE shall also meet the UE Rx-Tx time difference measurement and accuracy requirements. However the physical layer measurement period of the UE Rx-Tx measurement shall not exceed Tmeasure\_FDD\_UE\_Rx\_Tx3 as defined in the following expression:

Tmeasure\_FDD\_UE\_Rx\_Tx3 = (K+1)\*(Tmeasure\_FDD\_UE\_Rx\_Tx1) + K\*TPCcell\_change\_handover

Where:

K is the number of times the PCell is changed over the measurement period (Tmeasure\_FDD\_UE\_Rx\_Tx3),

TPCell\_change\_handover is the time necessary to change the PCell due to handover.

The measurement accuracy for the UE Rx-Tx time difference measurement when DRX or eDRX\_CONN is used as well as when no DRX is used shall be as specified in the sub-clause 9.1.25.3.

If CRS muting is enabled in a cell for which the UE performs UE Rx-Tx time difference measurement, the UE capable of supporting CRS muting [31] shall perform the UE Rx-Tx time difference measurements and meet all the requirements in this section, provided the CRS are available within UE bandwiwidth in the serving cell during the UE Rx-Tx time difference measurement period.

##### 8.16.2.1.1 UE Rx-Tx Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.25.5.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive ECID-RequestLocationInformation message and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeA* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeA* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode A provided that *pusch-maxNumRepetitionCEmodeA >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than the physical layer measurement period defined in Clause 8.16.2.1.

#### 8.16.2.2 E-UTRAN TDD UE Rx-Tx Time Difference Measurements for UE category M2 in CEModeA

When no DRX is used the physical layer measurement period of the UE Rx-Tx time difference measurement shall be 480 ms.

When DRX is used in RRC\_CONNECTED state the physical layer measurement period (Tmeasure\_TDD\_UE\_Rx\_Tx1) of the UE Rx-Tx time difference measurement shall be as specified in table 8.16.2.2-1.

Table 8.16.2.2-1: TDD UE Rx-Tx time difference measurement requirement when DRX is used

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_TDD\_UE\_Rx\_Tx1 (s) (DRX cycles) |
| < 0.128 | 0.48 (Note1) |
| 0.128 ≤ DRX-cycle ≤ 2.56 | Note2 (5) |
| Note 1: Number of DRX cycle depends upon the DRX cycle in use  Note 2: Time depends upon the DRX cycle in use | |

If the UE is performing UE Rx-Tx time difference measurement while the PCell is changed due to the handover then the UE shall restart the Rx-Tx measurement on the new cell. In this case the UE shall also meet the UE Rx-Tx time difference measurement and accuracy requirements. However the physical layer measurement period of the UE Rx-Tx measurement shall not exceed Tmeasure\_TDD\_UE\_Rx\_Tx3 as defined in the following expression:

Tmeasure\_TDD\_UE\_Rx\_Tx3 = (K+1)\*(Tmeasure\_TDD\_UE\_Rx\_Tx1) + K\*TPCell\_change\_handover

Where:

K is the number of times the PCell is changed over the measurement period (Tmeasure\_TDD\_UE\_Rx\_Tx3),

TPCell\_change\_handover is the time necessary to change the PCell due to handover.

The measurement accuracy for the UE Rx-Tx time difference measurement when DRX or eDRX\_CONN is used as well as when no DRX is used shall be as specified in the sub-clause 9.1.25.3.

If CRS muting is enabled in a cell for which the UE performs UE Rx-Tx time difference measurement, the UE capable of supporting CRS muting [31] shall perform the UE Rx-Tx time difference measurements and meet all the requirements in this section, provided the CRS are available within UE bandwidth in the serving cell during the UE Rx-Tx time difference measurement period.

##### 8.16.2.2.1 UE Rx-Tx Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.25.5.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive ECID-RequestLocationInformation message and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeA* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeA* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode A provided that *pusch-maxNumRepetitionCEmodeA >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than the physical layer measurement period defined in Clause 8.16.2.2.

#### 8.16.2.2a E-UTRAN HD-FDD UE Rx-Tx Time Difference Measurements for UE category M2 in CEModeA

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands.

The requirements defined in clause 8.16.2.1 also apply for this section except the measurement reporting requirements provided the following conditions are met:

- At least one downlink and one uplink subframes per radio frame are available for the UE Rx-Tx time difference measurement in the measured cell.

- at least downlink subframe # 0 or downlink subframe # 5 per radio frame of an intra-frequency cell to be identified by the UE is available at the UE;

- SCH\_RP and SCH Ês/Iot according to Annex Table B.2.14-2 for a corresponding Band

If CRS muting is enabled in a cell for which the UE performs UE Rx-Tx time difference measurement, the UE capable of supporting CRS muting [31] shall perform the UE Rx-Tx time difference measurements and meet all the requirements in this section, provided the CRS are available within UE bandwidth in the serving cell during the UE Rx-Tx time difference measurement period.

##### 8.16.2.2a.1 UE Rx-Tx Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.25.5.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive ECID-RequestLocationInformation message and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *pusch-maxNumRepetitionCEmodeA* x TTIDCCH, where *pusch-maxNumRepetitionCEmodeA* [2] is the maximum number of PUSCH repetitions configured for the UE in CE Mode A provided that *pusch-maxNumRepetitionCEmodeA >1*, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than the physical layer measurement period defined in Clause 8.16.2.2a.

#### 8.16.2.3 E-UTRAN OTDOA Intra-Frequency RSTD Measurements for Cat-M2 UE in CEModeA

All intra-frequency RSTD measurement requirements specified in Sections 8.16.2.3 shall apply without DRX as well as for any DRX and eDRX\_CONN cycles specified in TS 36.331 [2].

All the measurement requirements specified in Sections 8.16.2.3 shall apply provided that the UE is configured:

- with the single PRS configuration for the reference cell and all the neighbour cells and

- with either the measurement gap pattern ID #0 specified in Clause 8.1.2.1 or any applicable measurement gap pattern specified in Table 8.1.2.1-3 for cat M2 RSTD measurements if the PRS bandwidth is less than the bandwidth of the cell used for the RSTD measurement in which case gaps are required.

If CRS muting is enabled in a cell for which the UE performs RSTD measurements, the UE capable of supporting CRS muting [31] shall perform RSTD measurements and meet all the requirements in this section, provided the CRS are available within at least the PRS bandwidth in the subframes with PRS during all positioning occasions within the RSTD measurement period.

##### 8.16.2.3.1 E-UTRAN FDD Intra-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below (see also Figure 8.16.2.3.1-1):

+ TMIB ms,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] for UE not configured with measurement gaps for intra-frequency RSTD. For UE configured with measurement gaps for intra-frequency RSTD measurements,  = max(, MGRP), where MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1.

 is the number of PRS positioning occasions as defined in Table 8.16.2.3.1-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355 [24],

 is the number of PRS subframes within a PRS occasion available at the UE; = when the measurement gaps are not required for the intra-frequency RSTD measurements; for UE configured with measurement gaps for intra-frequency RSTD measurements  is the number of PRS subframes which can be measured by UE within MGL, where  = (MGL-2) if MGRP≥>(MGL-2),  = if >MGRP, and = if ≤(MGL-2).

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.25.4.

, ,  and ,  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

Table 8.16.2.3.1-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f1 Note1 | f1 and f2 Note2 |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.23 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE as illustrated in Figure 8.16.2.3.1-1.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.25.4.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

is the number of times the intra-frequency handover occurs during.

is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover.



Figure 8.16.2.3.1-1: Illustration of the RSTD reporting time requirement in an FDD system.

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

8.16.2.3.1.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.25.4.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.16.2.3.1.

##### 8.16.2.3.2 E-UTRAN TDD Intra-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

+ TMIB,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] for UE not configured with measurement gaps for intra-frequency RSTD. For UE configured with measurement gaps for intra-frequency RSTD measurements,  = max(, MGRP), where MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1.

 is the number of PRS positioning occasions as defined in Table 8.16.2.3.1-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355 [24],

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.25.4.

 is the number of PRS subframes within a PRS occasion available at the UE; = when the measurement gaps are not required for the intra-frequency RSTD measurements; for UE configured with measurement gaps for intra-frequency RSTD measurements  is the number of PRS subframes which can be measured by UE within MGL, where  = (MGL-2) if MGRP≥>(MGL-2),  = if >MGRP, and = if ≤(MGL-2).

, ,  and ,  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

Table 8.16.2.3.1-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f1 Note1 | f1 and f2 Note2 |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.23 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.25.4.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the intra-frequency handover occurs during,

 is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover.

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

The intra-frequency requirements in this clause (8.16.2.3.2) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.16.2.3.2-2.

Table 8.16.2.3.2-2: TDD uplink-downlink subframe configurations applicable for TDD intra-frequency requirements

|  |  |
| --- | --- |
| PRS Transmission Bandwidth [RB] | Applicable TDD uplink-downlink configurations |
| 6, | 1, 2, 3, 4 and 5 |
| 25 | 0, 1, 2, 3, 4, 5 and 6 |
| Note: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.16.2.3.2.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.25.4.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.16.2.3.2.

##### 8.16.2.3.3 E-UTRAN HD-FDD Intra-Frequency OTDOA Measurements

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.16.2.3.1 also apply for this section except the reporting delay requirement provided the following conditions are met:

- all positioning subframes indicated in the OTDOA assistance data and specified in Section 9.1.25.4 are available for RSTD measurements in the measured and reference cells.

8.16.2.3.3.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.25.4.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than measurement perioddefined in Clause 8.16.2.3.3.

#### 8.16.2.4 E-UTRAN OTDOA Inter-Frequency RSTD Measurements for Cat-M2 UE in CEModeA

All inter-frequency RSTD measurement requirements specified in Sections 8.16.2.4 shall apply, provided that

- the UE is capable of inter-frequency RSTD measurements for OTDOA [24], and

- either the measurement gap pattern ID # 0 specified in Table 8.1.2.1-1 or any applicable measurement gap pattern specified in Table 8.1.2.1-3 is used or the UE supports capability of conducting inter-frequency measurements without gaps.

All inter-frequency RSTD measurement requirements specified in Sections 8.16.2.4 shall apply without DRX as well as for any DRX and eDRX\_CONN cycles specified in TS 36.331 [2].

All positioning subframes indicated in the OTDOA assistance data and specified in sub-clause 9.1.25.1 are available for RSTD measurements in the measured and reference cell.

All the measurement requirements specified in Sections 8.16.2.4 shall apply provided that the UE is configured with the single PRS configuration for the reference cell and all the neighbour cells.

If CRS muting is enabled in a cell for which the UE performs RSTD measurements, the UE capable of supporting CRS muting [31] shall perform RSTD measurements and meet all the requirements in this section, provided the CRS are available within at least the PRS bandwidth in the subframes with PRS during all positioning occasions within the RSTD measurement period.

##### 8.16.2.4.1 E-UTRAN FDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

+ TMIB ms,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] ; if <MGRP,  equals to MGRP; MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1,

 is the number of PRS positioning occasions as defined in Table 8.16.2.4.1-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355 [24];

 is the number of PRS subframes within a PRS occasion that can be measured by UE within MGL; if MGRP>=>(MGL-2ms), =(MGL-2ms); if >MGRP, =; = if ≤(MGL-2);

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.25.3.

, ,  and  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

Table 8.16.2.4.1-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f2 Note1 | f1 and f2 Note2 |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the FDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving FDD carrier frequency f1 and the FDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.21 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.25.1.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

is the number of times the inter-frequency handover occurs during.

is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

8.16.2.4.1.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.25.1.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.16.2.4.1.

##### 8.16.2.4.2 E-UTRAN TDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

+ TMIB ms ,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] ; if <MGRP,  equals to MGRP; MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1,

 is the number of PRS positioning occasions as defined in Table 8.16.2.4.2-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355[24];

 is the number of PRS subframes within a PRS occasion that can be measured by UE within MGL; if MGRP>=>(MGL-2ms), =(MGL-2ms); if >MGRP, =; = if ≤(MGL-2);

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.25.3.

, ,  and  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

Table 8.16.2.4.2-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f2 Note1 | f1 and f2 Note2 |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the TDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving TDD carrier frequency f1 and the TDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.21 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.25.1.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

The inter-frequency requirements in this clause (8.16.2.4.2) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.16.2.4.2-2.

Table 8.16.2.4.2-2: TDD uplink-downlink subframe configurations applicable for TDD inter-frequency requirements

|  |  |
| --- | --- |
| PRS Transmission Bandwidth [RB] | Applicable TDD uplink-downlink configurations |
| 6 | 1, 2, 3, 4 and 5 |
| 24 | 0, 1, 2, 3, 4, 5 and 6 |
| Note: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.16.2.4.2.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.25.1.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.16.2.4.2.

##### 8.16.2.4.3 E-UTRAN HD-FDD Inter-Frequency OTDOA Measurements

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.16.2.4.1 also apply for this section except reporting delay requirement provided the following conditions are met:

- all positioning subframes indicated in the OTDOA assistance data and specified in Section 9.1.25.1 are available for RSTD measurements in the measured and reference cells.

8.16.2.4.3.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.25.1.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than measurement period as defined in Clause 8.16.2.4.3.

### 8.16.3 Requirements for UE category M2 with CE mode B

#### 8.16.3.1 E-UTRAN OTDOA Intra-Frequency RSTD Measurements for Cat-M2 UE in CEModeB

All intra-frequency RSTD measurement requirements specified in Sections 8.16.3.1 shall apply without DRX as well as for any DRX and eDRX\_CONN cycles specified in TS 36.331 [2].

All the measurement requirements specified in Sections 8.16.3.1 shall apply provided that the UE is configured:

- with the single PRS configuration for the reference cell and all the neighbour cells and

- with either the measurement gap pattern ID #0 specified in Clause 8.1.2.1 or any applicable measurement gap pattern specified in Table 8.1.2.1-3 for cat M2 RSTD measurements if the PRS bandwidth is less than the bandwidth of the cell used for the RSTD measurement in which case gaps are required.

If CRS muting is enabled in a cell for which the UE performs RSTD measurements, the UE capable of supporting CRS muting [31] shall perform RSTD measurements and meet all the requirements in this section, provided the CRS are available within at least the PRS bandwidth in the subframes with PRS during all positioning occasions within the RSTD measurement period.

##### 8.16.3.1.1 E-UTRAN FDD Intra-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below (see also Figure 8.16.3.1.1-1):

+ TMIB ms,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] for UE not configured with measurement gaps for intra-frequency RSTD. For UE configured with measurement gaps for intra-frequency RSTD measurements,  = max(, MGRP), where MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1.

 is the number of PRS positioning occasions as defined in Table 8.16.3.1.1-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355 [24],

 is the number of PRS subframes within a PRS occasion available at the UE; = when the measurement gaps are not required for the intra-frequency RSTD measurements; for UE configured with measurement gaps for intra-frequency RSTD measurements  is the number of PRS subframes which can be measured by UE within MGL, where  = (MGL-2) if MGRP≥>(MGL-2),  = if >MGRP, and = if ≤(MGL-2).

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.25.5.

, ,  and ,  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

Table 8.16.3.1.1-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f1 Note1 | f1 and f2 Note2 |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-15 dB for all Frequency Bands for the reference cell,

≥-15 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.23 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE as illustrated in Figure 8.16.3.1.1-1.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.25.5.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

is the number of times the intra-frequency handover occurs during.

is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover.



Figure 8.16.3.1.1-1: Illustration of the RSTD reporting time requirement in an FDD system.

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

8.16.3.1.1.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.25.5.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.16.3.1.1.

##### 8.16.3.1.2 E-UTRAN TDD Intra-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure intra-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

+ TMIB,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] for UE not configured with measurement gaps for intra-frequency RSTD. For UE configured with measurement gaps for intra-frequency RSTD measurements,  = max(, MGRP), where MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1.

 is the number of PRS positioning occasions as defined in Table 8.16.3.1.1-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355[24],

 is the number of PRS subframes within a PRS occasion available at the UE; = when the measurement gaps are not required for the intra-frequency RSTD measurements; for UE configured with measurement gaps for intra-frequency RSTD measurements  is the number of PRS subframes which can be measured by UE within MGL, where  = (MGL-2) if MGRP≥>(MGL-2),  = if >MGRP, and = if ≤(MGL-2).

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.25.5.

, ,  and ,  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

Table 8.16.3.1.2-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f1 Note1 | f1 and f2 Note2 |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When only intra-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1.  Note 2: When intra-frequency RSTD and inter-frequency RSTD measurements are performed over cells belonging to the serving FDD carrier frequency f1 and one inter-frequency carrier frequency f2, respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-15 dB for all Frequency Bands for the reference cell,

≥-15 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.23 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.25.5.

If the intra-frequency handover occurs while intra-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the intra-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the intra-frequency handover occurs during,

 is the time during which the intra-frequency RSTD measurement may not be possible due to intra-frequency handover.

Furthermore, due to the intra-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

The intra-frequency requirements in this clause (8.16.3.1.2) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.16.3.1.2-2.

Table 8.16.3.1.2-2: TDD uplink-downlink subframe configurations applicable for TDD intra-frequency requirements

|  |  |
| --- | --- |
| PRS Transmission Bandwidth [RB] | Applicable TDD uplink-downlink configurations |
| 6 | 1, 2, 3, 4 and 5 |
| 25 | 0, 1, 2, 3, 4, 5 and 6 |
| Note: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.16.3.1.2.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.25.5.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.16.3.1.2.

##### 8.16.3.1.3 E-UTRAN HD-FDD Intra-Frequency OTDOA Measurements

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.16.3.1.1 also apply for this section except the reporting delay requirement provided the following conditions are met:

- all positioning subframes indicated in the OTDOA assistance data and specified in Section 9.1.25.5 are available for RSTD measurements in the measured and reference cells.

8.16.3.1.3.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.25.5.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than measurement perioddefined in Clause 8.16.3.1.3.

#### 8.16.3.2 E-UTRAN OTDOA Inter-Frequency RSTD Measurements for Cat-M2 UE in CEModeB

All inter-frequency RSTD measurement requirements specified in Sections 8.16.3.2 shall apply, provided that

- the UE is capable of inter-frequency RSTD measurements for OTDOA [24], and

- either the measurement gap pattern ID # 0 specified in Table 8.1.2.1-1 or any applicable measurement gap pattern specified in Table 8.1.2.1-3 is used or the UE supports capability of conducting inter-frequency measurements without gaps.

All inter-frequency RSTD measurement requirements specified in Sections 8.16.3.2 shall apply without DRX as well as for any DRX and eDRX\_CONN cycles specified in TS 36.331 [2].

All positioning subframes indicated in the OTDOA assistance data and specified in sub-clause 9.1.25.2 are available for RSTD measurements in the measured and reference cell.

All the measurement requirements specified in Sections 8.16.3.2 shall apply provided that the UE is configured with the single PRS configuration for the reference cell and all the neighbour cells.

If CRS muting is enabled in a cell for which the UE performs RSTD measurements, the UE capable of supporting CRS muting [31] shall perform RSTD measurements and meet all the requirements in this section, provided the CRS are available within at least the PRS bandwidth in the subframes with PRS during all positioning occasions within the RSTD measurement period.

##### 8.16.3.2.1 E-UTRAN FDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

+ TMIB  ms,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] ; if <MGRP,  equals to MGRP; MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1,

 is the number of PRS positioning occasions as defined in Table 8.16.3.2.1-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355 [24];

 is the number of PRS subframes within a PRS occasion that can be measured by UE within MGL; if MGRP>=>(MGL-2ms), =(MGL-2ms); if >MGRP, =; = if ≤(MGL-2);

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.25.2.

, ,  and  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

Table 8.16.3.2.1-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f2 Note1 | f1 and f2 Note2 |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the FDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving FDD carrier frequency f1 and the FDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-15 dB for all Frequency Bands for the reference cell,

≥-15 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.21 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.25.2.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

is the number of times the inter-frequency handover occurs during.

is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

8.16.3.2.1.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.25.2.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.16.3.2.1.

##### 8.16.3.2.2 E-UTRAN TDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, on the same carrier frequency f1 as that of the reference cell within  ms as given below:

+ TMIB ms ,

where

is the total time for detecting and measuring at least *n* cells,

 is the cell-specific positioning subframe configuration period as defined in TS 36.355 [24] ; if <MGRP,  equals to MGRP; MGRP is the Measurement Gap Repetition Period as defined in section 8.1.2.1,

 is the number of PRS positioning occasions as defined in Table 8.16.3.2.2-1, where downlink positioning subframes defined in TS 36.211 [16], and

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time,

is the cell-specific number of PRS subframes within a PRS occasion as defined in TS 36.355[24];

 is the number of PRS subframes within a PRS occasion that can be measured by UE within MGL; if MGRP>=>(MGL-2ms), =(MGL-2ms); if >MGRP, =; = if ≤(MGL-2);

 is the minimum number of PRS subframes per cell measurement as specified in Section 9.1.25.2.

, ,  and  are the parameters of the same cell, for which  is the largest among all the measured cells.

TMIB is the time required for acquiring the MIB information of the target cell. TMIB = 0 if the SFN of at least one cell in OTDOA assistance data is known to the UE.

Table 8.16.3.2.2-1: Number of PRS positioning occasions within 

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period | Number of PRS positioning occasions | |
| f2 Note1 | f1 and f2 Note2 |
| 160 ms |  |  |
| >160 ms |  |  |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the TDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving TDD carrier frequency f1 and the TDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-15 dB for all Frequency Bands for the reference cell,

≥-15 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.21 for a corresponding Band

 is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.25.2.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed then the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of all the PCells during the RSTD measurement period.

The inter-frequency requirements in this clause (8.16.3.2.2) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.16.3.2.2-2.

Table 8.16.3.2.2-2: TDD uplink-downlink subframe configurations applicable for TDD inter-frequency requirements

|  |  |
| --- | --- |
| PRS Transmission Bandwidth [RB] | Applicable TDD uplink-downlink configurations |
| 6 | 1, 2, 3, 4 and 5 |
| 24 | 0, 1, 2, 3, 4, 5 and 6 |
| Note: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

8.16.3.2.2.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.25.2.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than  defined in Clause 8.16.3.2.2.

##### 8.16.3.2.3 E-UTRAN HD-FDD Inter-Frequency OTDOA Measurements

The requirements in this section are applicable for the UE which supports half duplex operation on one or more supported frequency bands [2].

The requirements defined in clause 8.16.3.2.1 also apply for this section except reporting delay requirement provided the following conditions are met:

- all positioning subframes indicated in the OTDOA assistance data and specified in Section 9.1.25.2 are available for RSTD measurements in the measured and reference cells.

8.16.3.2.3.1 RSTD Measurement Reporting Delay

Reported measurement contained in event triggered measurement reports shall meet the requirements in sections 9.1.25.2.

The UE shall not send any measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between the point when UE receive both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: *Nrep*x TTIDCCH, where *Nrep* [21] is the maximum number of PUSCH repetitions configured for the UE, othwerwise uncertainty is defined as 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement report.

The measurement reporting delay shall be less than measurement period asdefined in Clause 8.16.3.2.3.

## 8.17 Measurements for E-UTRA – NR Dual Connectivity

### 8.17.1 Introduction

This clause contains requirements for UE supporting dual connectivity with E-UTRA PCell and NR PSCell.

Requirements in this clause are applicable to UEs which have been configured with EN-DC. Requirements in this clause are applicable to both E-UTRA FDD and E-UTRA TDD PCell in combination with an NR PSCell.

#### 8.17.1.1 Measurement Gap Sharing

For UE configured with per-UE measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on NR intra-frequency carriers or when SMTC configured for NR intra-frequency measurement are fully overlapping with per-UE measurement gaps, and when UE is configured to identify and measure cells on E-UTRA gap-needed inter-frequency carriers, NR inter-frequency carriers including SSB and CSI-RS, inter-RAT UTRAN carriers and/or inter-RAT GSM carriers.

For UE configured with per-FR1 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on NR FR1 intra-frequency carriers or when SMTC configured for NR FR1 intra-frequency measurement are fully overlapping with per-FR1 measurement gaps, and when UE is configured to identify and measure cells on E-UTRA gap-needed inter-frequency carriers, NR inter-frequency carriers including SSB and CSI-RS, inter-RAT UTRAN carriers and/or inter-RAT GSM carriers.

In this clause, NR intra-freuqency or NR inter-frequency measurement is defined respective to NR serving carriers as specified in clauses 9.2 and 9.3 of TS 38.133 [50], which is also inter-RAT measurement respective to E-UTRA serving carriers.

When network signals “01”, “10” or “11” with RRC parameter *measGapSharingScheme* [2] and the value of X is defined as in Table 8.17.1.1-1, and Kinter = 1 / (100 – X) \* 100.

When network signals “00” indicating equal splitting gap sharing, X is not applied.

The RRC parameter *MeasGapSharingScheme* shall be applied to the calculation of carrier specific scaling factor as specified in clause 9.1.5.2.1 of TS 38.133 [50]

Table 8.17.1.1-1: Value of parameter X for EN-DC measurement gap sharing

|  |  |
| --- | --- |
| *measGapSharingScheme* | Value of X (%) |
| ‘00’ | Equal splitting |
| ‘01’ | 25 |
| ‘10’ | 50 |
| ‘11’ | 75 |
| Note: It is left to UE implementation to determine which measurement gap sharing scheme in the table to be applied, when MeasGapSharingScheme is absent and there is no stored value in the field. | |

### 8.17.1A Intrafrequency Measurements

PCC intra-frequency measurements shall meet all applicable requirements in clause 8.1.2.2. If MCG DRX is in use, then the PCell intra-frequency requirements for when DRX is in use in clause 8.1.2.2 shall apply and shall depend on the MCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply. The applicable measurement accuracy requirements are in clause 9.1.

SCC intra-frequency measurements shall meet all applicable requirements in clause 8.3.3. If MCG DRX is in use, then the PCell intra-frequency requirements for when DRX is in use in clause 8.1.2.2 shall apply and shall depend on the MCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply. The applicable measurement accuracy requirements are in clause 9.1.

### 8.17.2 SFTD Measurements

#### 8.17.2.1 Introduction

This clause contains SFTD measurement requirements on UE capabilities for support of EN-DC in RRC\_CONNECTED state. The overall delay includes RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2], and SFTD measurement reporting delay in clause 8.17.2.3.

#### 8.17.2.2 SFTD Measurement requirements

When no DRX is used in either of PCell and PSCell, the physical layer measurement period of the SFTD measurement shall be Tmeasure\_SFTD1 = max(200, 5 x SMTC period) ms.

When DRX is used in either of the E-UTRA PCell or the NR PSCell, or in both PCell and PSCell, the physical layer measurement period (Tmeasure\_SFTD1) of the SFTD measurement shall be as specified in table 8.17.2.2-1.

Table 8.17.2.2-1: SFTD measurement requirement when DRX is used

|  |  |
| --- | --- |
| DRX cycle length (s) Note 3 | Tmeasure\_SFTD1 (s) |
| ≤0.04 | max(0.2,5 x SMTC period) (Note1) |
| 0.04<DRX cycle≤0.32 | 8 x max(DRX cycle, SMTC period) |
| 0.32<DRX cycle≤10.24 | 5 x DRX cycle |
| Note 1: Number of DRX cycles depends upon the DRX cycle in use  Note 2: (Void)  Note 3: DRX cycle length in this table refers to the DRX cycle length configured for PCell or PSCell. When DRX is used in both PCell and PSCell, DRX cycle length in this table refers to the longer of the DRX cycle lengths for PCell and PSCell. | |

If PSCell is changed without changing carrier frequency of PSCell, while the UE is performing SFTD measurements, the UE shall still meet SFTD measurement and accuracy requirements for the new PSCell. In this case the UE shall restart the SFTD measurement, and the total physical layer measurement period shall not exceed Tmeasure\_SFTD2 as defined by the following expression:

Tmeasure\_SFTD2 = (M+1)\*(Tmeasure\_SFTD1) + M\*TPSCell\_change\_ENDC

where:

M is the number of times the NR PSCell is changed over the measurement period (Tmeasure\_SFTD2), and

TPSCell\_change\_ENDC is the time necessary to change the PSCell; it can be up to 25 ms.

If PCell is changed, or if PSCell is changed with different carrier frequency from PSCell, the UE shall terminate SFTD measurements.

The measurement accuracy for the SFTD measurement when DRX is used as well as when no DRX is used shall be as specified in the sub-clause 9.1.27.

#### 8.17.2.2.a SFTD Measurement requirements with CCA on target frequency

When no DRX is used in either of PCell and PSCell, the physical layer measurement period of the SFTD measurement shall be Tmeasure\_SFTD1 = max(200 ms, (5 + L) x SMTC period), where L is the number of SSBs (or DRSs) blocked by unsuccessful CCA. Lmax is the maximum value of L (i.e., L≤Lmax) and is defined in Table 8.17.2.2.a-2.

When DRX is used in either of the E-UTRA PCell or the NR PSCell, or in both PCell and PSCell, the physical layer measurement period (Tmeasure\_SFTD1) of the SFTD measurement shall be as specified in table 8.17.2.2.a-1.

In the requirements of clause 8.17.2.2.a, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SS/PBCH block index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding period; otherwise the SMTC occasion is considered as available at the UE.

Table 8.17.2.2.a-1: SFTD measurement requirement when DRX is used

|  |  |
| --- | --- |
| DRX cycle length (s) Note 3 | Tmeasure\_SFTD1 (s) |
| ≤0.04 | max(0.2,(5 + L) x SMTC period) (Note1) |
| 0.04<DRX cycle≤0.32 | (8 + L) x max(DRX cycle, SMTC period) |
| 0.32<DRX cycle≤10.24 | (5 + L) x DRX cycle |
| Note 1: Number of DRX cycles depends upon the DRX cycle in use.  Note 2: DRX cycle length in this table refers to the DRX cycle length configured for PCell or PSCell. When DRX is used in both PCell and PSCell, DRX cycle length in this table refers to the longer of the DRX cycle lengths for PCell and PSCell.  Note 3: L is the total number of SMTC occasions not available at the UE. The maximum value of L, Lmax, is defined in Table 8.17.2.2.a-2. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. | |

Table 8.17.2.2.a-2: Maximum number of missed DRS occasions

|  |  |
| --- | --- |
| Condition | Lmax |
| max(DRX cycle, SMTC period) ≤ 40 ms | 7 |
| 40 ms < max(DRX cycle, SMTC period) ≤ 320 ms | 5 |
| DRX cycle > 320 ms | 3 |
| Note 1: DRX cycle length in this table refers to the DRX cycle length configured for PCell or PSCell. When DRX is used in both PCell and PSCell, DRX cycle length in this table refers to the longer of the DRX cycle lengths for PCell and PSCell. When no DRX is used in both PCell and PSCell, DRX cycle = 0.  Note 2: The SMTC period is the one used by PSCell. | |

If PSCell is changed without changing carrier frequency of PSCell, while the UE is performing SFTD measurements, the UE shall still meet SFTD measurement and accuracy requirements for the new PSCell. In this case the UE shall restart the SFTD measurement, and the total physical layer measurement period shall not exceed Tmeasure\_SFTD2 as defined by the following expression:

Tmeasure\_SFTD2 = (M+1)\*(Tmeasure\_SFTD1) + M\*TPSCell\_change\_ENDC

where:

M is the number of times the NR PSCell is changed over the measurement period (Tmeasure\_SFTD2), and

TPSCell\_change\_ENDC is the time necessary to change the PSCell; it can be up to 25 ms.

If PCell is changed, or if PSCell is changed with different carrier frequency from PSCell, the UE shall terminate SFTD measurements.

When Lexceeds Lmax, the UE shall terminate the SFTD measurement.

The time difference between frame timing acquisition for PCell and PSCell, t1 and t2 respectively, shall fulfill |t1-t2| < max(200 ms, 5\*TSMTC), where TSMTC is the SMTC period of PSCell. Otherwise the UE shall invalidate the SFTD measurement.

The measurement accuracy for the SFTD measurement when DRX is used as well as when no DRX is used shall be as specified in the sub-clause 9.1.28.

#### 8.17.2.3 SFTD Measurement Reporting Delay

The SFTD measurement reporting delay is defined as the time between a command that will trigger an SFTD measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report. When the UE is configured to perform LTE SRS carrier-based switching or NR SRS carrier based switching in FR1 if the UE is capable of per-FR gap, or NR SRS carrier based switching in either FR1 or FR2 if the UE is not capable of per-FR gap, an additional delay can be expected.

The SFTD measurement reporting delay shall be less than measurement period defined in clause 8.17.2.2.

### 8.17.3 E-UTRA Inter-frequency Measurements when Configured with E-UTRA-NR Dual Connectivity Operation

#### 8.17.3.1 Introduction

The E-UTRAN inter frequency measurement requirements defined in section 8.17.3 shall apply when the UE capable of EN-DC is operating in EN-DC mode. The requiremenents in section 8.17.3 are applicable for gap pattern id # 0, 1, 2, 3, 4, 6, 7, 8, 10 as defined specified in Table 8.1.2.1-1.

When per-UE measurement gap is configured, the scaling factor CSSFE-UTRA, NSA used in the E-UTRAN inter frequency measurement requirements for the UE configured with EN-DC mode is determined according to CSSFwithin\_gap,i as specified in clause 9.1.5.2.1 of TS 38.133 [50]. When per-FR gap is configured, the scaling factor CSSFE-UTRA, NSA shall exclude the frequencies not on the corresponding frequency range. When the UE is not configured with EN-DC mode then the E-UTRAN inter frequency measurement requirements defined in section 8.1.2.3 shall apply.

The requirements in this section shall also apply, when the UE is configured to perform NR SRS carrier based switching and using measurement gaps.

#### 8.17.3.2 E-UTRAN FDD inter frequency measurements

##### 8.17.3.2.1 E-UTRAN FDD inter frequency measurements when no DRX is used

8.17.3.2.1.1 Introduction

The requirements in this section shall apply for E-UTRAN FDD-FDD inter frequency measurements and for E-UTRAN TDD-FDD inter frequency measurements when the UE is operating in EN-DC mode.

8.17.3.2.1.2 Requirements

When measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, then the UE shall be able to identify a new FDD inter-frequency within TIdentify\_Inter according to the following expression:



Where:

TBasic\_Identify\_Inter = 480 ms. It is the time period used in the inter frequency equation where the maximum allowed time for the UE to identify a new FDD inter-frequency cell is defined.

Tinter1 is defined in clause 8.1.2.1.

A cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Sections 9.1.3.1 and 9.1.3.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.1 and 9.1.6.2 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Sections 9.1.17.3.1 and 9.1.17.3.2 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

When measurement gaps are scheduled for FDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively, with measurement period given by table 8.17.3.2.1.2-1.

Table 8.17.3.2.1.2-1: Measurement period and measurement bandwidth

|  |  |  |
| --- | --- | --- |
| Configuration | Physical Layer Measurement period: TMeasurement\_Period \_Inter\_FDD [ms] | Measurement bandwidth [RB] |
| 0 | 480 x CSSFE-UTRA, NSA | 6 |
| 1 (Note 1) | 240 x CSSFE-UTRA, NSA | 50 |
| Note 1: This configuration is optional | | |

The UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements of at least 4 inter-frequency cells per FDD inter-frequency for up to 6 FDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period defined in Table 8.17.3.2.2-1.

8.17.3.2.1.3 Measurement Reporting Requirements

8.17.3.2.1.3.1 Periodic Reporting

Reported RSRP, RSRQ and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

8.17.3.2.1.3.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.17.3.2.1.3.3.

8.17.3.2.1.3.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The UE shall not send any event triggered measurement reports as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T Identify Inter defined in clause 8.17.3.2.1When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform LTE SRS carrier based switching or NR SRS carrier-based switching in FR1 if the UE is capable of per-FR gap, or NR SRS carrier-based switching in either FR1 or FR2 if the UE is not capable of per-FR gap, an additional delay can be expected.

If a cell which has been detectable at least for the time period, TIdentify Inter defined in clause 8.17.3.2.1 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_Inter\_FDD defined in clause 8.17.3.2.1 provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform LTE SRS carrier based switching or NR SRS carrier-based switching in FR1 if the UE is capable of per-FR gap, or NR SRS carrier-based switching in either FR1 or FR2 if the UE is not capable of per-FR gap, an additional delay can be expected.

##### 8.17.3.2.2 E-UTRAN FDD inter frequency measurements when DRX is used

8.17.3.2.2.1 Introduction

The requirements in this section shall apply for E-UTRAN FDD-FDD inter frequency measurements and for E-UTRAN TDD-FDD inter frequency measurements when the UE is operating in EN-DC mode.

8.17.3.2.2.2 Requirements

When DRX or eDRX\_CONN is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable E-UTRAN FDD inter frequency cell within TIdentify Inter. When DRX is in use, Tidentify\_inter is as defined in Table 8.17.3.2.2.2-1, and when eDRX\_CONN is in use, TIdentify Inter is as defined in Table 8.17.3.2.2.2-1A. When MCG DRX is in use the applicable DRX cycle is the MCG DRX cycle.

Table 8.17.3.2.2.2-1: Requirement to identify a newly detectable FDD interfrequency cell

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | Tidentify\_inter (s) (DRX cycles) | |
|  | **Gap period = 40 ms, 20 ms** | **Gap period = 80 ms** |
| ≤ 0.16 | Non DRX Requirements in clause 8.17.3.1 are applicable | Non DRX Requirements in clause 8.17.3.1 are applicable |
| 0.256 | 5.12\* CSSFE-UTRA, NSA  (20\* CSSFE-UTRA, NSA) | 7.68\* CSSFE-UTRA, NSA (30\* CSSFE-UTRA, NSA) |
| 0.32 | 6.4\* CSSFE-UTRA, NSA (20\* CSSFE-UTRA, NSA) | 7.68\* CSSFE-UTRA, NSA (24\* CSSFE-UTRA, NSA) |
| 0.32< DRXcycle ≤2.56 | Note (20\* CSSFE-UTRA, NSA) | Note (20\* CSSFE-UTRA, NSA) |
| Note: Time depends upon the DRX cycle in use | | |

Table 8.17.3.2.2.2-1A: Requirement to identify a newly detectable FDD inter-frequency cell when eDRX\_CONN cycle is used

|  |  |  |
| --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_inter (s) (eDRX\_CONN cycles) | |
|  | **Gap period = 40 ms, 20 ms** | **Gap period = 80 ms** |
| 2.56< eDRX\_CONN cycle≤10.24 | Note (20\* CSSFE-UTRA, NSA) | Note (20\* CSSFE-UTRA, NSA) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

A cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Clause 9.1.3.1 and 9.1.3.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.1 and 9.1.6.2 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Sections 9.1.17.3.1 and 9.1.17.3.2 are fulfilled for a corresponding Band,

- SCH\_RP|dBm SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements of at least 4 inter-frequency cells per FDD inter-frequency and the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period Tmeasure\_inter, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is used, Tmeasure\_inter is as defined in Table 8.17.3.2.2.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter is as defined in Table 8.17.3.2.2.2-3. When MCG DRX is in use the applicable DRX cycle is the MCG DRX cycle.

Table 8.17.3.2.2.2-2: Requirement to measure FDD interfrequency cells

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_inter (s) (DRX cycles) |
| ≤ 0.08 | Non DRX Requirements in clause 8.17.3.1 are applicable |
| 0.08<DRX-cycle≤2.56 | Note (5\* CSSFE-UTRA, NSA) |
| Note: Time depends upon the DRX cycle in use | |

Table 8.17.3.2.2.2-3: Requirement to measure FDD inter-frequency cells when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_inter (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\* CSSFE-UTRA, NSA) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.3.1 and 9.1.3.2, the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.6.1 and 9.1.6.2, and the RS-SINR measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.17.3.1 and 9.1.17.3.2.

8.17.3.3.2.3 Measurement Reporting Requirements

8.17.3.3.2.3.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

8.17.3.3.2.3.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.17.3.3.2.3.3.

8.17.3.3.2.3.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_inter defined in clause 8.17.3.2.2.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period TIdentify Inter defined in clause 8.17.3.2.2 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TMeasure\_Inter defined in clause 8.17.3.2.2 provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

#### 8.17.3.3 E-UTRAN TDD inter frequency measurements

##### 8.17.3.3.1 E-UTRAN TDD inter frequency measurements when no DRX is used

8.17.3.3.1.1 Introduction

The requirements in this section shall apply for E-UTRAN TDD-TDD inter frequency measurements and for E-UTRAN FDD-TDD inter frequency measurements when the UE is operating in EN-DCmode.

8.17.3.3.1.2 Requirements

When measurement gaps are scheduled, or the UE supports capability of conducting such measurements without gaps, then the UE shall be able to identify a new TDD inter-frequency within TIdentify\_Inter according to the following expression:



Where:

TBasic\_Identify\_Inter = 480 ms. It is the time period used in the inter frequency equation where the maximum allowed time for the UE to identify a new TDD inter-frequency cell is defined.

Tinter1 is defined in clause 8.1.2.1.

A cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Sections 9.1.3.1 and 9.1.3.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.1 and 9.1.6.2 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Sections 9.1.17.3.1 and 9.1.17.3.2 are fulfilled for a corresponding Band,

- SCH\_RP|dBm and SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

When measurement gaps are scheduled for TDD inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with measurement accuracy as specified in sub-clauses 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively, with measurement period given by table 8.17.3.3.1.2-1.

Table 8.17.3.3.1.2-1: TMeasurement\_Period\_TDD\_Inter for different configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Configuration | Measurement bandwidth [RB] | Number of UL/DL sub-frames per half frame (5 ms) | | DwPTS | | TMeasurement\_Period\_TDD\_Inter [ms] |
|  | DL | UL | Normal CP | Extended CP |
| 0 | 6 | 2 | 2 |  |  | 480 x CSSFE-UTRA, NSA |
| 1 (Note 1) | 50 | 2 | 2 |  |  | 240 x CSSFE-UTRA, NSA |
| 2 | 6 | 1 | 3 |  |  | 720 x CSSFE-UTRA, NSA |
| 3 (Note 1) | 50 | 1 | 3 |  |  | 480 x CSSFE-UTRA, NSA |
| Note 1: This configuration is optional  Note 2: *T*s is defined in TS 36.211 [16] | | | | | | |

The UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements of at least 4 inter-frequency cells per TDD inter-frequency for up to 6 TDD inter-frequencies and the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period defined in Table 8.17.3.3.1.2-1.

8.17.3.3.1.3 Measurement Reporting Requirements

8.17.3.3.1.3.1 Periodic Reporting

Reported RSRP, RSRQ and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

8.17.3.3.1.3.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.17.3.3.1.3.3.

8.17.3.3.1.3.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The UE shall not send any event triggered measurement reports as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than T Identify Inter defined in clause 8.17.3.3.1.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform LTE SRS carrier based switching or NR SRS carrier-based switching in FR1 if the UE is capable of per-FR gap, or NR SRS carrier-based switching in either FR1 or FR2 if the UE is not capable of per-FR gap, an additional delay can be expected.

If a cell which has been detectable at least for the time period, TIdentify Inter defined in clause 8.17.3.3.1 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TMeasurement\_Period\_Inter\_TDD defined in clause 8.17.3.3.1 provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform LTE SRS carrier based switching or NR SRS carrier-based switching in FR1 if the UE is capable of per-FR gap, or NR SRS carrier-based switching in either FR1 or FR2 if the UE is not capable of per-FR gap,, an additional delay can be expected.

##### 8.17.3.3.2 E-UTRAN TDD inter frequency measurements when DRX is used

8.17.3.3.2.1 Introduction

The requirements in this section shall apply for E-UTRAN TDD-TDD inter frequency measurements and for E-UTRAN FDD-TDD inter frequency measurements when the UE is operating in EN-DCmode. If the UE is not yet configured with the EN-DC operation then the UE shall meet the E-UTRAN TDD-TDD inter frequency measurement requirements and E-UTRAN FDD-TDD inter frequency measurement requirements defined in section 8.1.2.3.2 and 8.1.2.3.4 respectively.

8.17.3.3.2.2 Requirements

When DRX or eDRX\_CONN is in use, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable E-UTRAN TDD inter frequency cell within TIdentify Inter. When DRX is in use, Tidentify\_inter is as defined in Table 8.17.3.3.2.2-1, and when eDRX\_CONN is in use, TIdentify Inter is as defined in Table 8.17.3.3.2.2-1A. When MCG DRX is in use the applicable DRX cycle is the MCG DRX cycle.

Table 8.17.3.3.2.2-1: Requirement to identify a newly detectable TDD interfrequency cell

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | TIdentify Inter (s) (DRX cycles) | |
|  | **Gap period = 40 ms, 20 ms** | **Gap period = 80 ms** |
| ≤ 0.16 | Non DRX Requirements in clause 8.17.3.1 are applicable | Non DRX Requirements in clause 8.17.3.1 are applicable |
| 0.256 | 5.12\*CSSFE-UTRA, NSA  (20\*CSSFE-UTRA, NSA) | 7.68\*CSSFE-UTRA, NSA (30\*CSSFE-UTRA, NSA) |
| 0.32 | 6.4\*CSSFE-UTRA, NSA (20\*CSSFE-UTRA, NSA) | 7.68\*CSSFE-UTRA, NSA (24\*CSSFE-UTRA, NSA) |
| 0.32< DRXcycle ≤2.56 | Note (20\* CSSFE-UTRA, NSA) | Note (20\*CSSFE-UTRA, NSA) |
| Note: Time depends upon the DRX cycle in use | | |

Table 8.17.3.3.2.2-1A: Requirement to identify a newly detectable TDD inter-frequency cell when eDRX\_CONN cycle is used

|  |  |  |
| --- | --- | --- |
| eDRX\_CONN cycle length (s) | TIdentify Inter (s) (eDRX\_CONN cycles) | |
|  | Gap period = 40 ms, 20 ms | Gap period = 80 ms |
| 2.56< eDRX\_CONN cycle≤10.24 | Note (20\*CSSFE-UTRA, NSA) | Note (20\*CSSFE-UTRA, NSA) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

A cell shall be considered detectable provided following conditions are fulfilled:

- RSRP|dBm and RSRP Ês/Iot according to Annex B.2.3 for a corresponding Band,

- other RSRP related side conditions given in Clause 9.1.3.1 and 9.1.3.2 are fulfilled for a corresponding Band,

- RSRQ related side conditions given in Sections 9.1.6.1 and 9.1.6.2 are fulfilled for a corresponding Band,

- RS-SINR related side conditions given in Sections 9.1.17.3.1 and 9.1.17.3.2 are fulfilled for a corresponding Band,

- SCH\_RP|dBm SCH Ês/Iot according to Annex B.2.3 for a corresponding Band.

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing RSRP, RSRQ, and RS-SINR measurements of at least 4 inter-frequency cells per TDD inter-frequency and the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period Tmeasure\_inter, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. When DRX is used, Tmeasure\_inter is as defined in Table 8.17.3.3.2.2-2, and when eDRX\_CONN is in use, Tmeasure\_inter is as defined in Table 8.17.3.3.2.2-3. When MCG DRX is in use the applicable DRX cycle is the MCG DRX cycle.

Table 8.17.3.3.2.2-2: Requirement to measure TDD interfrequency cells

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure\_inter (s) (DRX cycles) |
| ≤ 0.08 | Non DRX Requirements in clause 8.17.3.1 are applicable |
| 0.08<DRX-cycle≤2.56 | Note (5\*CSSFE-UTRA, NSA) |
| Note: Time depends upon the DRX cycle in use | |

**Table 8.17.3.3.2.2-3: Requirement to measure TDD inter-frequency cells when eDRX\_CONN cycle is used**

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_inter (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\*CSSFE-UTRA, NSA) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The RSRP measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.3.1 and 9.1.3.2, the RSRQ measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.6.1 and 9.1.6.2, and the RS-SINR measurement accuracy for all measured cells shall be as specified in the sub-clauses 9.1.17.3.1 and 9.1.17.3.2.

8.17.3.3.2.3 Measurement Reporting Requirements

8.17.3.3.2.3.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

8.17.3.3.2.3.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.17.3.3.2.3.3.

8.17.3.3.2.3.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 9.1.3.1, 9.1.3.2, 9.1.6.1, 9.1.6.2, 9.1.17.3.1 and 9.1.17.3.2, respectively.

The UE shall not send any event triggered measurement reports as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_inter defined in clause 8.17.3.3.2.3.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform LTE SRS carrier based switching or NR SRS carrier-based switching in FR1 if the UE is capable of per-FR gap, or NR SRS carrier-based switching in either FR1 or FR2 if the UE is not capable of per-FR gap, an additional delay can be expected.

If a cell which has been detectable at least for the time period TIdentify Inter defined in clause 8.17.3.3.2.3 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TMeasure\_Inter defined in clause 8.17.3.3.2.3 provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform LTE SRS carrier based switching or NR SRS carrier-based switching in FR1 if the UE is capable of per-FR gap, or NR SRS carrier-based switching in either FR1 or FR2 if the UE is not capable of per-FR gap, an additional delay can be expected.

### 8.17.4 E-UTRA Inter-RAT NR Measurements when Configured with E-UTRA-NR Dual Connectivity Operation

#### 8.17.4.1 E-UTRAN FDD – NR measurements when configured with E-UTRA-NR Dual connectivity

Requirements in this clause apply for the NR capable UE configured with inter-RAT measurement on NR. For UE supporting EN-DC operation, the requirements in this clause shall apply when NR PSCell is configured. When the UE is not configured with E-UTRA-NR dual connectivity mode then the E-UTRAN FDD - NR measurement requirements defined in section 8.1.2.4.21 shall apply. When the E-UTRAN FDD-NR measurement object configured by E-UTRA PCell is on an NR serving frequency carrier, then the NR intra-frequency measurements requirements defined in clause 9.2 of TS 38.133 [50] shall apply. The requirements in this section shall also apply, when the UE is configured to perform NR SRS carrier based switching and using measurement gaps.

The UE shall be able to identify new inter-RAT NR cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified inter-RAT NR cells if carrier frequency information is provided by the PCell, even if no explicit neighbour list with physical layer cell identities is provided.

An NR cell is considered detectable when:

- NR SS-RSRP related conditions in the accuracy requirements in clause 9.11.1 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 of TS 38.133 [50],

- NR SS-RSRQ related conditions in the accuracy requirements in clause 9.11.2 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 of TS 38.133 [50],

- NR SS-SINR related conditions in the accuracy requirements in clause 9.11.3 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 of TS 38.133 [50].

The NR SS-RSRP measurement accuracy for all measured NR cells shall be as specified in clause 9.11.1, the NR SS-RSRQ measurement accuracy for all measured NR cells shall be as specified in clause 9.11.2, and NR SS-SINR measurement accuracy for all measured NR cells shall be as specified in clause 9.11.3.

##### 8.17.4.1.1 NR Inter-RAT cell identification

When measurement gaps are provided, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable inter-RAT NR cell within Tidentify\_NR\_without\_index if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise UE shall be able to identify a new detectable inter-RAT NR cell within Tidentify\_NR\_with\_index. The UE shall be able to identify a new detectable inter-RAT NR SS block of an already detected cell within Tidentify\_inter\_without\_index.

Tidentify\_NR\_without\_index = (TPSS/SSS\_sync\_NR + TSSB\_measurement\_period\_NR) ms

Tidentify\_NR\_with\_index = (TPSS/SSS\_sync\_NR+ TSSB\_measurement\_period\_NR+ TSSB\_time\_index\_NR) ms

Where:

TPSS/SSS\_sync\_NR: it is the time period used in PSS/SSS detection given in table 8.17.4.1.1-1 and table 8.17.4.1.1-2.

TSSB\_time\_index\_NR: it is the time period used to acquire the index of the SSB being measured given in table 8.17.4.1.1-3 and table 8.17.4.1.1-4.

TSSB\_measurement\_period\_NR: equal to a measurement period of SSB based measurement given in table 8.17.4.1.2-1 and table 8.17.4.1.2-2.

Mpss/sss\_sync\_NR: For a UE supporting FR2 power class 1 or 5, Mpss/sss\_sync\_NR=64 samples. For a UE supporting FR2 power class 2 (vehicle mounted), Mpss/sss\_sync\_NR=40 samples. For a UE supporting FR2 power class 3 (handheld), Mpss/sss\_sync\_NR=40 samples. For a UE supporting FR2 power class 4, Mpss/sss\_sync\_NR = 40 samples.

MSSB\_index\_NR: For a UE supporting FR2 power class 1 or 5, MSSB\_index\_NR = 40 samples. For a UE supporting FR2 power class 2 (vehicle mounted), Mpss/sss\_sync\_NR = 24 samples. For a UE supporting FR2 power class 3 (handheld), MSSB\_index\_NR = 24 samples. For a UE supporting FR2 power class 4, Mmeas\_period\_NR = 24 samples.

Mmeas\_period\_NR: For a UE supporting FR2 power class 1 or 5, Mmeas\_period\_NR=64 samples. For a UE supporting FR2 power class 2 (vehicle mounted), Mpss/sss\_sync\_NR=40 samples. For a UE supporting FR2 power class 3 (handheld), Mmeas\_period\_NR=40 samples. For a UE supporting FR2 power class 4, Mmeas\_period\_NR = 40 samples.

CSSFNR,EN-DC: it is a carrier specific scaling factor and is determined according to CSSFwithin\_gap,i defined in clause 9.1.5.2.1 of TS 38.133 [50] for measurement conducted within measurement gaps in EN-DC mode.

Table 8.17.4.1.1-1: Time period for PSS/SSS detection (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TPSS/SSS\_sync\_NR |
| No DRX | Max(600ms, 8 × Max(MGRP, SMTC period)) × CSSFNR,EN-DC |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(8×1.5) × Max(MGRP, SMTC period, DRX cycle)) × CSSFNR,EN-DC |
| DRX cycle > 320ms | 8 × DRX cycle × CSSFNR,EN-DC |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50].  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

Table 8.17.4.1.1-2: Time period for PSS/SSS detection (Frequency range FR2)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TPSS/SSS\_sync\_NR |
| No DRX | Max(600ms, Mpss/sss\_sync\_NR × Max(MGRP, SMTC period)) × CSSFNR,EN-DC |
| DRX cycle ≤ 320ms | Max(600ms, (1.5 × Mpss/sss\_sync\_NR) × Max(MGRP, SMTC period, DRX cycle)) × CSSFNR,EN-DC |
| DRX cycle > 320ms | Mpss/sss\_sync\_NR × DRX cycle × CSSFNR,EN-DC |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50].  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

Table 8.17.4.1.1-3: Time period for time index detection (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TSSB\_time\_index\_NR |
| No DRX | Max(120ms, 3 × Max(MGRP, SMTC period)) × CSSFNR,EN-DC |
| DRX cycle ≤ 320ms | Max(120ms, Ceil(3 × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × CSSFNR,EN-DC |
| DRX cycle > 320ms | 3 × DRX cycle × CSSFNR,EN-DC |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50].  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

Table 8.17.4.1.1-4: Time period for time index detection (Frequency range FR2)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TSSB\_time\_index\_NR |
| No DRX | Max(200ms, MSSB\_index\_NR × Max(MGRP, SMTC period)) × CSSFNR,EN-DC |
| DRX cycle ≤ 320ms | Max(200ms, (1.5 × MSSB\_index\_NR) × Max(MGRP, SMTC period, DRX cycle)) × CSSFNR,EN-DC |
| DRX cycle > 320ms | MSSB\_index\_NR × DRX cycle × CSSFNR,EN-DC |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50].  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

When SCG DRX is in use the applicable DRX cycle is the SCG DRX cycle.

##### 8.17.4.1.2 NR Inter-RAT measurement

When measurement gaps are provided for inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting NR SS-RSRP, NR SS-RSRQ and NR SS-SINR measurements to higher layers with measurement accuracy as specified in sub-clauses 9.11.1, 9.11.2 and 9.11.3, respectively, with a measurement period given by:

Table 8.17.4.1.2-1: Measurement period for NR inter-RAT measurements with gaps (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TSSB\_measurement\_period\_NR |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × CSSFNR,EN-DC |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(8 × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × CSSFNR,EN-DC |
| DRX cycle > 320ms | 8 × DRX cycle × CSSFNR,EN-DC |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50].  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

Table 8.17.4.1.2: Measurement period for NR inter-RAT measurements with gaps (Frequency range FR2)

|  |  |
| --- | --- |
| Condition NOTE1,2 | TSSB\_measurement\_period\_NR |
| No DRX | Max(400ms, Mmeas\_period\_NR × Max(MGRP, SMTC period)) × CSSFNR,EN-DC |
| DRX cycle ≤ 320ms | Max(400ms, (1.5 × Mmeas\_period\_NR) × Max(MGRP, SMTC period, DRX cycle)) × CSSFNR,EN-DC |
| DRX cycle > 320ms | Mmeas\_period\_NR × DRX cycle × CSSFNR,EN-DC |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50].  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

When SCG DRX is in use the applicable DRX cycle is the SCG DRX cycle.

##### 8.17.4.1.3 NR Inter-RAT measurement reporting

8.17.4.1.3.1 Periodic Reporting

Reported NR SS-RSRP, NR SS-RSRQ and NR SS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 9.11.1, 9.11.2 and 9.11.3, respectively.

8.17.4.1.3.2 Event-triggered Periodic Reporting

Reported NR SS-RSRP, NR SS-RSRQ and NR SS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in clauses 9.11.1, 9.11.2 and 9.11.3, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.17.4.1.3.3.

8.17.4.1.3.3 Event-triggered Reporting

Reported NR SS-RSRP, NR SS-RSRQ and NR SS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 9.11.1, 9.11.2 and 9.11.3, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 × TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be within Tidentify\_NR\_without\_index if UE is not indicated to report SSB based RRM measurement result with the associated SSB index. Otherwise UE shall be able to identify a new detectable NR cell within Tidentify\_NR\_with\_index. Both Tidentify\_inter\_without\_index and Tidentify\_inter\_with\_index are defined in clause 8.17.4.1.1.When L3 filtering is used an additional delay can be expected.

If an NR cell which has been detectable at least for the time period Tidentify\_NR\_without\_index or Tidentify\_NR\_with\_index defined in clause 8.17.4.1.1 and then triggers the measurement report as per TS 38.331 [38], the event triggered measurement reporting delay shall be less than TSSB\_measurement\_period\_NR defined in clause 8.17.4.1.2 provided the timing to that cell has not changed more than ± 3200 Tc while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used an additional delay can be expected.

#### 8.17.4.2 E-UTRAN TDD – NR measurements when configured with E-UTRA-NR Dual connectivity

The requirements in clause 8.17.4.1 also apply for this section.

### 8.17.4A E-UTRA Inter-RAT NR Measurements when CCA is used when Configured with E-UTRA-NR Dual Connectivity Operation

#### 8.17.4A.1 E-UTRAN FDD – NR measurements when configured with E-UTRA-NR Dual connectivity

Requirements in this clause apply for the NR capable UE configured with inter-RAT measurement on NR, when NR is in carrier frequencies with CCA. For UE supporting EN-DC operation, the requirements in this clause shall apply when NR PSCell is configured. When the UE is not configured with E-UTRA-NR dual connectivity mode then the E-UTRAN FDD-NR measurement requirements defined in section 8.1.2.4.21A shall apply.

In the requirements of clause 8.17.4A, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but *N* candidate SSB positions for the same SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding period, where:

* For the cell detection procedure: *N* is at least one candidate SSB position (NOTE: the one candidate SSB position for the cell detection shall not be impacted by the set of candidate SSB positions which are already being measured by the UE within the current measurement period of the on-going measurements), and
* For other procedures in clause 8.17.4A: *N* are the first two successive candidate SSB positions when two or more candidate SSB positions are configured for this SSB index in one discovery burst transmission window, otherwise N is one candidate SSB position;

otherwise the SMTC occasion is considered as available at the UE.

The UE shall be able to identify new inter-RAT NR cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified inter-RAT NR cells if carrier frequency information is provided by the PCell, even if no explicit neighbour list with physical layer cell identities is provided.

An NR cell is considered detectable when:

- NR SS-RSRP related conditions in the accuracy requirements in clause TBD are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex TBD of TS 38.133 [50],

- NR SS-RSRQ related conditions in the accuracy requirements in clause TBD are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex TBD of TS 38.133 [50],

- NR SS-SINR related conditions in the accuracy requirements in clause TBD are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex TBD of TS 38.133 [50].

The NR SS-RSRP measurement accuracy for all measured NR cells shall be as specified in clause TBD, the NR SS-RSRQ measurement accuracy for all measured cells shall be as specified in clause TBD, and NR SS-SINR measurement accuracy for all measured cells shall be as specified in clause TBD.

##### 8.17.4A.1.1 NR Inter-RAT cell identification

When measurement gaps are provided, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable inter-RAT NR cell within Tidentify\_NR\_cca\_without\_index if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise UE shall be able to identify a new detectable inter-RAT NR cell within Tidentify\_NR\_cca\_with\_index. The UE shall be able to identify a new detectable inter-RAT NR SSB of an already detected cell within Tidentify\_NR\_cca\_without\_index.

Tidentify\_NR\_cca\_without\_index = (TPSS/SSS\_sync\_NR\_cca + TSSB\_measurement\_period\_NR\_cca) ms

Tidentify\_NR\_cca\_with\_index = (TPSS/SSS\_sync\_NR\_cca + TSSB\_measurement\_period\_NR\_cca + TSSB\_time\_index\_NR\_cca) ms

Where:

TPSS/SSS\_sync\_NR\_cca: it is the time period used in PSS/SSS detection given in table 8.17.4A.1.1 -1

TSSB\_time\_index\_NR\_cca: it is the time period used to acquire the index of the SSB being measured given in table 8.17.4A.1.1-2

TSSB\_measurement\_period\_NR\_cca: equal to a measurement period of SSB based measurement given in table 8.17.4A.1.2-1

CSSFNR,EN-DC: it is a carrier specific scaling factor and is determined according to CSSFwithin\_gap,i defined in clause 9.1.5.2.1 of TS 38.133 [50] for measurement conducted within measurement gaps in EN-DC mode.

Table 8.17.4A.1.1-1: Time period for PSS/SSS detection

|  |  |
| --- | --- |
| Condition NOTE1,2,3,4 | TPSS/SSS\_sync\_NR\_cca |
| No DRX | Max(600ms, (8 +LPSS/SSS,gaps) × Max(MGRP, SMTC period)) × CSSFNR,EN-DC |
| DRX cycle ≤ 320ms | Max(600ms, ceil((8+LPSS/SSS,gaps) × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × CSSFNR,EN-DC |
| DRX cycle > 320ms | (8 +LPSS/SSS,gaps) × DRX cycle × CSSFNR,EN-DC |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50]  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 of TS 38.133 [50]  are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: LPSS/SSS,gaps is the number of SMTC occasion not available at the UE during TPSS/SSS\_sync\_NR\_cca, where LPSS/SSS,gaps ≤ LPSS/SSS,gaps,max. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement gaps, the UE is not required to determine the availability of SMTC occasions more frequent than once during MGRP.  NOTE 4:   LPSS/SSS,gaps = 12 for max(DRX cycle, SMTC period, MGRP) ≤ 40 ms LPSS/SSS,gaps = 8 for 40 ms < max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and LPSS/SSS,gaps = 5 for DRX cycle > 320 ms. | |

Upon exceeding LPSS/SSS,gaps,max, the UE is not required to meet the corresponding PSS/SSS detection requirement. The requirements apply provided that any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

Table 8.17.4A.1.1-2: Time period for time index detection

|  |  |
| --- | --- |
| Condition NOTE1,2,3,4 | TSSB\_time\_index\_NR\_cca |
| No DRX | Max(120ms, (3 + Lind,gaps)  × max(MGRP, SMTC period)) × CSSFNR,EN-DC |
| DRX cycle ≤ 320ms | Max(120ms, ceil((3 + Lind,gaps)  × 1.5) × max(MGRP, SMTC period, DRX cycle)) × CSSFNR,EN-DC |
| DRX cycle > 320ms | (3 + Lind,gaps) × DRX cycle × CSSFNR,EN-DC |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50]  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: Lind,gaps is the number of SMTC occasions not available at the UE during TSSB\_time\_index\_NR\_cca, where Lind,gaps ≤ Lind,gaps,max. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement gaps, the UE is not required to determine the availability of SMTC occasions more frequent than once during MGRP.  NOTE 4: Lind,gaps,max = 5 for max(DRX cycle, SMTC period, MGRP) ≤ 40 ms, Lind,gaps,max = 3 for max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and Lind,gaps,max = 2 for DRX cycle > 320 ms. | |

The UE shall restart the time index detection upon exceeding Lind,gaps,max. The requirements apply provided that any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

When the time period of unsuccessful measurement attemps due to exceeding the maximum number of unavailable at the UE SMTC occasions of an already identified cell exceeds the maximum time requirement for the cell to remain known defined in clause 9.3A.6.3, the UE shall stop the measurement attempts on this SSB and perform the detection procedure again, like for any other SSB.

When SCG DRX is in use the applicable DRX cycle is the SCG DRX cycle.

##### 8.17.4A.1.2 NR Inter-RAT measurement

When measurement gaps are provided for inter-RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in sub-clauses TBD, TBD, and TBD, respectively, with a measurement period given by:

Table 8.17.4A.1.2-1: Measurement period for NR inter-RAT measurements with gaps

|  |  |
| --- | --- |
| Condition NOTE1,2,3,4 | T SSB\_measurement\_period\_NR\_cca |
| No DRX | Max(200ms, (8+ Lmeas) × max(MGRP, SMTC period)) × CSSFNR,EN-DC |
| DRX cycle ≤ 320ms | Max(200ms, ceil((8+ Lmeas) x 1.5) × max(MGRP, SMTC period, DRX cycle)) × CSSFNR,EN-DC |
| DRX cycle > 320ms | (8+ Lmeas) × DRX cycle × CSSFNR,EN-DC |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50]  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: Lmeas is the number of SMTC occasion not available at the UE during T SSB\_measurement\_period\_NR\_cca, where Lmeas ≤ Lmeas,max. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement gaps, the UE is not required to determine the availability of SMTC occasions more frequent than once during MGRP.  NOTE 4:   Lmeas,max = 12 for max(DRX cycle, SMTC period, MGRP) ≤ 40 ms, Lmeas,max = 8 for max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and Lmeas,max = 5 for DRX cycle > 320 ms. | |

The UE shall restart the measurement upon exceeding Lmeas,max. The requirements apply provided that any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

When the time period of unsuccessful measurement attemps due to exceeding the maximum number of unavailable at the UE SMTC occasions of an already identified cell exceeds the maximum time requirement for the cell to remain known defined in clause 9.3A.6.3, the UE shall stop the measurement attempts on this SSB and perform the detection procedure again, like for any other SSB.

When SCG DRX is in use the applicable DRX cycle is the SCG DRX cycle.

##### 8.17.4A.1.3 NR Inter-RAT measurement reporting

8.17.4.1.3.1 Periodic Reporting

Reported NR SS-RSRP, NR SS-RSRQ, and NR SS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses TBD, TBD and TBD, respectively.

8.17.4A.1.3.2 Event-triggered Periodic Reporting

Reported NR SS-RSRP, NR SS-RSRQ, and NR SS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in clauses TBD, TBD and TBD, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.17.4A.1.3.3.

8.17.4A.1.3.3 Event-triggered Reporting

Reported NR SS-RSRP, NR SS-RSRQ, and NR SS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses TBD, TBD and TBD, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report and all delays due to UL CCA failures until the successful transmission of the report.

The event triggered measurement reporting delay, measured without L3 filtering shall be within Tidentify\_NR\_cca\_without\_index if UE is not indicated to report SSB based RRM measurement result with the associated SSB index. Otherwise UE shall be able to identify a new detectable NR cell within Tidentify\_NR\_cca\_with\_index. Both Tidentify\_NR\_cca\_without\_index and Tidentify\_NR\_cca\_with\_index are defined in clause 8.17.4A.1.1.When L3 filtering is used an additional delay can be expected.

If an NR cell which has been detectable at least for the time period Tidentify\_NR\_cca\_without\_index or Tidentify\_NR\_cca\_with\_index defined in clause 8.17.4A.1.1 and then triggers the measurement report as per TS 38.331 [38], the event triggered measurement reporting delay shall be less than TSSB\_measurement\_period\_NR\_cca defined in clause 8.17.4A.1.2 provided the timing to that cell has not changed more than ± 3200 Tc while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used an additional delay can be expected.

##### 8.17.4A.1.4 NR inter-RAT RSSI measurements

The UE physical layer shall be capable of performing the RSSI measurements, defined in TS 38.215 [58], on one or more inter-RAT carriers operating with CCA, TS 37.213 [57], if the carrier(s) are indicated by higher layers [38], and reporting the RSSI measurements to higher layers. The UE physical layer shall provide to higher layers a single RSSI sample for each OFDM symbol within each configured RSSI measurement duration [38] occurring with a configured RSSI measurement timing configuration periodicity, *rmtc-Periodicity,* according to [38].

**Table 8.17.4A.1.4-1: Measurement period for inter-RAT RSSI measurements with gaps**

|  |  |
| --- | --- |
| **Condition NOTE1,2,3,4** | **T RSSI\_measurement\_period\_NR\_cca** |
| No DRX | max(*reportInterval*, max(*rmtc-Periodicity, MGRP*) x CSSFNR,EN-DC) |
| DRX | max(*reportInterval*, max(*rmtc-Periodicity*, MGRP,DRX cycle) x CSSFNR,EN-DC) |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50]. | |

If the UE requires measurement gaps to perform inter-RAT measurements, a single measurement gap pattern is used for all concurrent inter-frequency and inter-RAT measurements, including inter-RAT RSSI measurements. The RSSI measurement duration and the measurement gap should be aligned, and the following additional condition should be fulfilled:

- Entire RSSI measurement duration should be contained in the measurement gap.

When the inter-RAT RSSI measurement object configured by E-UTRA PCell is on an NR serving frequency carrier and RSSI measurement bandwidth is fully within the active DL BWP of the UE, then the NR intra-frequency RSSI measurements requirements without measurement gap defined in clause 9.2A.7.1 of TS 38.133 [50] shall apply.

The RSSI measurement performed and reported according to this section shall meet the RSSI measurement accuracy requirement in Section TBD.

##### 8.17.4A.1.5 NR inter-RAT channel occupancy measurements

The UE shall be capable of estimating the channel occupancy on one or more carrier frequencies indicated by higher layers [2], based on RSSI samples provided by the physical layer.

**8.17.4A.1.5-1: Measurement period for inter-RAT Channel Occupancy measurements with gaps**

|  |  |
| --- | --- |
| **Condition NOTE1,2,3,4** | **T CO\_measurement\_period\_NR\_cca** |
| No DRX | max(*reportInterval*, max(*rmtc-Periodicity, MGRP*) x CSSFNR,EN-DC) |
| DRX | max(*reportInterval*, max(*rmtc-Periodicity*, MGRP,DRX cycle) x CSSFNR,EN-DC) |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50]. | |

If the UE requires measurement gaps to perform inter-RAT measurements, a single measurement gap pattern is used for all concurrent inter-frequency and inter-RAT measurements, including inter-RAT channel occupancy measurements. The RSSI measurement duration used for channel occupancy measurement and the measurement gap should be aligned, and the following additional condition should be fulfilled:

- Entire RSSI measurement duration should be contained in the measurement gap.

When the inter-RAT channel occupancy measurement object configured by E-UTRA PCell is on an NR serving frequency carrier and RSSI measurement bandwidth is fully within the active DL BWP of the UE, then the NR intra-frequency channel occupancy measurements requirements without measurement gap defined in clause 9.2A.7.2 of TS 38.133 [50] shall apply.

The channel occupancy measurement performed and reported according to this section shall meet the channel occupancy measurement accuracy requirements in Section TBD of TS 38.133 [50].

#### 8.17.4A.2 E-UTRAN TDD – NR measurements when configured with E-UTRA-NR Dual connectivity

The requirements in clause 8.17.4A.1 also apply for this section.

### 8.17.5 E-UTRAN FDD – UTRAN FDD measurements when Configured with E-UTRA-NR Dual Connectivity

#### 8.17.5.1 Introduction

The requirements in this clause apply only to UE supporting E-UTRAN FDD and UTRA FDD. The E-UTRAN FDD - UTRAN FDD measurement requirements defined in section 8.17.5 shall apply when the UE capable of E-UTRA-NR dual connectivity is operating in E-UTRA-NR dual connectivity mode. The requiremenents in section 8.17.5 are applicable for gap pattern id # 0 and #1 as specified in Table 8.1.2.1-1.

The scaling factor CSSFUTRA, NSA used in the UTRA FDD measurement requirements in section 8.17.5 for the UE configured with E-UTRA-NR dual connectivity mode is determined according to CSSFwithin\_gap,i as specified in clause 9.1.5.2.1 of TS 38.133 [50]. When the UE is not configured with E-UTRA-NR dual connectivity mode then the E-UTRAN FDD-UTRAN FDD measurement requirements defined in section 8.1.2.4.1 shall apply.

The requirements in this section shall also apply, when the UE is configured to perform NR SRS carrier based switching and using measurement gaps.

#### 8.17.5.2 E-UTRAN FDD – UTRAN FDD measurements when no DRX is used

##### 8.17.5.2.1 Identification of a new UTRA FDD cell

When explicit neighbour list is provided and no DRX is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the monitored set within



A cell shall be considered detectable when

- CPICH Ec/Io > -20 dB,

- SCH\_Ec/Io > -17 dB for at least one channel tap and SCH\_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.

##### 8.17.5.2.2 Enhanced UTRA FDD cell identification requirements

When explicit neighbour list is provided and no DRX is used or when DRX cycle length ≤ 40 ms, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the monitored set within Tidentify, enhanced\_UTRA\_FDD:



A cell shall be considered detectable when:

- CPICH Ec/Io > -15 dB,

- SCH\_Ec/Io > -15 dB for at least one channel tap and SCH\_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.

##### 8.17.5.2.3 UE UTRA FDD CPICH measurement capability

When measurement gaps are scheduled for UTRA FDD inter RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting measurements to higher layers with measurement accuracy as specified in Clause 9.2 with measurement period given by:



The UE shall be capable of performing UTRA FDD CPICH measurements for Xbasic measurementUTRA\_FDD inter-frequency cells per FDD frequency and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of TMeasurement\_ UTRA\_FDD.

Xbasic measurement UTRA\_FDD = 6

TMeasurement\_Period UTRA\_FDD = 480 ms. The period used for calculating the measurement period Tmeasurement\_UTRA\_FDD for UTRA FDD CPICH measurements.

Tbasic\_identify\_UTRA\_FDD = 300 ms. This is the time period used in the inter RAT equation in clause 8.17.5.2.1 where the maximum allowed time for the UE to identify a new UTRA FDD cell is defined.

Tbasic\_identify\_enhanced\_UTRA\_FDD = 60 ms. This is the time period used in the inter RAT equation in clause 8.17.5.2.2 where the maximum allowed time for the UE to identify a new UTRA FDD cell is defined.

Tbasic\_measurement\_UTRA\_FDD = 50 ms. This is the time period used in the equation for defining the measurement period for inter RAT CPICH measurements.

##### 8.17.5.2.4 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

##### 8.17.5.2.5 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify, UTRA\_FDD defined in Clause 8.17.5.2.1 for the minimum requirements or Tidentify, enhanced\_UTRA\_FDD defined in Clause 8.17.5.2.2 for the enhanced requirementsWhen L3 filtering is used or IDC autonomous denial or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform LTE SRS carrier based switching or NR SRS carrier-based switching in FR1 if the UE is capable of per-FR gap, or NR SRS carrier-based switching in either FR1 or FR2 if the UE is not capable of per-FR gap, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify, UTRA\_FDD defined in clause 8.17.5.2.1 for the minimum requirements or Tidentify, enhanced\_UTRA\_FDD defined in Clause 8.17.5.2.2 for the enhanced requirements and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasurement\_UTRA\_FDD defined in clause 8.17.5.2.3 provided the timing to that cell has not changed more than ± 32 chips while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform LTE SRS carrier based switching or NR SRS carrier-based switching in FR1 if the UE is capable of per-FR gap, or NR SRS carrier-based switching in either FR1 or FR2 if the UE is not capable of per-FR gap, an additional delay can be expected.

##### 8.17.5.2.6 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.17.5.2.5.

#### 8.17.5.3 E-UTRAN FDD – UTRAN FDD measurements when DRX is used

When explicit neighbour list is provided and DRX or eDRX\_CONN is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the neighbour cell list within Tidentify,UTRA\_FDD. When DRX is used, Tidentify,UTRA\_FDD is as defined in table 8.17.5.3-1, and when eDRX\_CONN is used, Tidentify,UTRA\_FDD is as defined in table 8.17.5.3-2. When MCG DRX is in use the applicable DRX cycle is the MCG DRX cycle.

Table 8.17.5.3-1: Requirement to identify a newly detectable UTRA FDD cell

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | Tidentify\_UTRA\_FDD (s) (DRX cycles) | |
| Gap ID # 0 | Gap ID # 1 |
| ≤0.04 | Non DRX Requirements in clause 8.17.5.2 are applicable | Non DRX Requirements in clause 8.17.5.2 are applicable |
| 0.064 | 2.56\*CSSFUTRA,NSA (40\*CSSFUTRA,NSA) | 4.8\*CSSFUTRA,NSA (75\*CSSFUTRA,NSA) |
| 0.08 | 3.2\*CSSFUTRA,NSA (40\*CSSFUTRA,NSA) | 4.8\*CSSFUTRA,NSA (60\*CSSFUTRA,NSA) |
| 0.128 | 3.2\*CSSFUTRA,NSA (25\*CSSFUTRA,NSA) | 4.8\*CSSFUTRA,NSA (37.5\*CSSFUTRA,NSA) |
| 0.16 | 3.2\*CSSFUTRA,NSA (20\*CSSFUTRA,NSA) | 4.8\*CSSFUTRA,NSA (30\*CSSFUTRA,NSA) |
| 0.16<DRX-cycle≤2.56 | Note (20\*CSSFUTRA,NSA) | Note (20\*CSSFUTRA,NSA) |
| Note: Time depends upon the DRX cycle in use | | |

Table 8.17.5.3-2: Requirement to identify a newly detectable UTRA FDD cell when eDRX\_CONN cycle is used

|  |  |  |
| --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_UTRA\_FDD (s) (eDRX\_CONN cycles) | |
| Gap ID # 0 | Gap ID # 1 |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (20\*CSSFUTRA,NSA) | Note (20\*CSSFUTRA,NSA) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

A cell shall be considered detectable provided following conditions are fulfilled: A cell shall be considered detectable when

- CPICH Ec/Io > -20 dB,

- SCH\_Ec/Io > -17 dB for at least one channel tap and SCH\_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.

When DRX or eDRX\_CONN is used, the UE shall be capable of performing RSCP and Ec/Io measurements of at least 6 UTRA cells per UTRA FDD carrier for up to 3 UTRA FDD carriers and the UE physical layer shall be capable of reporting RSCP and Ec/Io measurements to higher layers within the measurement period Tmeasure\_ UTRA\_FDD, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. UE supporting Increased UE carrier monitoring UTRA shall be capable of performing RSCP and Ec/Io measurements of at least 6 UTRA cells per UTRA FDD carrier for up to 6 UTRA FDD carriers with maximum of 80 cells consisting of at most 32 cells per frequency layer in the neighbour cell list. When DRX is used, Tmeasure\_ UTRA\_FDD is defined in Table 8.1.2.3.1.2-3, and when eDRX\_CONN cycle is used, Tmeasure\_ UTRA\_FDD is defined in Table 8.1.2.3.1.2-4. When MCG DRX is in use the applicable DRX cycle is the MCG DRX cycle.

Table 8.17.5.3-3: Requirement to measure UTRA FDD cells

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | Tmeasure\_ UTRA\_FDD (s) (DRX cycles) | |
|  | Gap ID # 0 | Gap ID # 1 |
| ≤0.04 | Non DRX Requirements in clause 8.17.5.2 are applicable | Non DRX Requirements in clause 8.17.5.2 are applicable |
| 0.064 | 0.48\*CSSFUTRA,NSA (7.5\*CSSFUTRA,NSA | 0.8\*CSSFUTRA,NSA (12.5\*CSSFUTRA,NSA) |
| 0.08 | 0.48\*CSSFUTRA,NSA (6\*CSSFUTRA,NSA) | 0. 8\*CSSFUTRA,NSA (10\*CSSFUTRA,NSA) |
| 0.128 | 0.64\*CSSFUTRA,NSA  (5\*CSSFUTRA,NSA) | 0. 8\*CSSFUTRA,NSA (6.25\*CSSFUTRA,NSA) |
| 0.128<DRX-cycle≤2.56 | Note (5\*CSSFUTRA,NSA) | Note (5\*CSSFUTRA,NSA) |
| Note: Time depends upon the DRX cycle in use | | |

Table 8.17.5.3-4: Requirement to measure UTRA FDD cells when eDRX\_CONN cycle is used

|  |  |  |
| --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_ UTRA\_FDD (s) (eDRX\_CONN cycles) | |
|  | Gap ID # 0 | Gap ID # 1 |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\*CSSFUTRA,NSA) | Note (5\*CSSFUTRA,NSA) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

The measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.

##### 8.17.5.3.1 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

##### 8.17.5.3.2 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify,UTRA\_FDD defined in Clause 8.17.5.3.When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform LTE SRS carrier based switching or NR SRS carrier-based switching in FR1 if the UE is capable of per-FR gap, or NR SRS carrier-based switching in either FR1 or FR2 if the UE is not capable of per-FR gap, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify, UTRA\_FDD defined in clause 8.17.5.3and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasurement\_UTRA\_FDD defined in clause 8.17.5.3 provided the timing to that cell has not changed more than ± 32 chips while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform LTE SRS carrier based switching or NR SRS carrier-based switching in FR1 if the UE is capable of per-FR gap, or NR SRS carrier-based switching in either FR1 or FR2 if the UE is not capable of per-FR gap, an additional delay can be expected.

##### 8.17.5.3.3 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.17.5.3.2.

### 8.17.6 E-UTRAN TDD – UTRAN FDD measurements when Configured with E-UTRA-NR Dual Connectivity

The requirements in clause 8.17.5 also apply for this section when the UE is operating in E-UTRA-NR dual connectivity mode. Otherwise when the UE is not configured with E-UTRA-NR dual connectivity mode then the E-UTRAN FDD-UTRAN FDD measurement requirements defined in section 8.1.2.4.2 shall apply. The requirements in this section shall also apply, when the UE is configured to perform NR SRS carrier based switching and using measurement gaps.

### 8.17.7 E-UTRAN FDD – UTRAN FDD measurements for SON when Configured with E-UTRA-NR Dual Connectivity

#### 8.17.7.1 Introduction

The requirements in this clause apply only to UE supporting E-UTRAN FDD and UTRA FDD. The E-UTRAN FDD - UTRAN FDD measurement requirements for SON defined in section 8.17.7 shall apply when the UE capable of E-UTRA-NR dual connectivity is operating in E-UTRA-NR dual connectivity mode. The requiremenents in section 8.17.7 are applicable for gap pattern id # 0 and #1 as specified in Table 8.1.2.1-1.

The scaling factor CSSFUTRA, NSA used in the UTRA FDD measurement requirements for SON in section 8.17.7 for the UE configured with E-UTRA-NR dual connectivity mode is determined according to CSSFwithin\_gap,i as specified in clause 9.1.5.2.1 of TS 38.133 [50]. When the UE is not configured with E-UTRA-NR dual connectivity mode then the E-UTRAN FDD-UTRAN FDD measurement requirements defined in section 8.1.2.4.7 shall apply.

The requirements in this section shall also apply, when the UE is configured to perform NR SRS carrier based switching and using measurement gaps.

#### 8.17.7.2 Identification of a new UTRA FDD cell for SON

No explicit neighbour list is provided to the UE for identifying a UTRA cell for SON. The UE shall identify and report only the strongest cell when requested by the network for the purpose of SON.

##### 8.17.7.2.1 Requirements when no DRX is used

When no DRX is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new cell within:



Tbasic\_identify\_UTRA\_FDD = 300 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new UTRA FDD cell is defined.

A cell shall be considered identifiable following conditions are fulfilled:

- CPICH Ec/Io > -20 dB,

- SCH\_Ec/Io > -17 dB for at least one channel tap and SCH\_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.

If the UE is unable to identify the UTRA cell for SON within 8\*Tidentify, UTRA\_FDD ms, the UE may stop searching UTRA cells for SON.

##### 8.17.7.2.2 Requirements when DRX is used

When DRX or eDRX\_CONN is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new cell within Tidentify, UTRA\_FDD. When DRX is used, Tidentify, UTRA\_FDD is as defined in table 8.17.7.2.2-1, and when eDRX\_CONN is used, Tidentify, UTRA\_FDD is as defined in table 8.17.7.2.2-2. When MCG DRX is in use the applicable DRX cycle is the MCG DRX cycle.

Table 8.17.7.2.2-1: Requirement to identify a new UTRA FDD cell for SON

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | Tidentify, UTRA\_FDD (s) (DRX cycles) | |
|  | Gap ID # 0 | Gap ID # 1 |
| ≤0.04 | Non DRX Requirements in clause 8.17.7.2.1are applicable | Non DRX Requirements in clause 8.17.7.2.1 are applicable |
| 0.04<DRX cycle≤0.08 | Note (45\*CSSFUTRA,NSA) | Note (95\*CSSFUTRA,NSA) |
| 0.128 | 3.84\*CSSFUTRA,NSA (30\*CSSFUTRA,NSA) | 8.0\*CSSFUTRA,NSA (62.5\*CSSFUTRA,NSA) |
| 0.16 | 4.0\*CSSFUTRA,NSA (25\* CSSFUTRA,NSA) | 8.0\*NCSSFUTRA,NSA (50\*CSSFUTRA,NSA) |
| 0.256 | 6.4\*CSSFUTRA,NSA (25\*CSSFUTRA,NSA) | 8.96\*CSSFUTRA,NSA (35\*CSSFUTRA,NSA) |
| 0.32 | 8\*CSSFUTRA,NSA (25\*CSSFUTRA,NSA) | 8.96\*CSSFUTRA,NSA (28\*CSSFUTRA,NSA) |
| 0.32<DRX cycle≤2.56 | Note(25\*CSSFUTRA,NSA) | Note (25\*CSSFUTRA,NSA) |
| Note: Time depends upon the DRX cycle in use | | |

Table 8.17.7.2.2-2: Requirement to identify a new UTRA FDD cell for SON when eDRX\_CONN cycle is used

|  |  |  |
| --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify, UTRA\_FDD (s) (eDRX\_CONN cycles) | |
|  | Gap ID # 0 | Gap ID # 1 |
| 2.56<eDRX\_CONN cycle≤10.24 | Note(25\*CSSFUTRA,NSA) | Note (25\* CSSFUTRA,NSA) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

A cell shall be considered identifiable provided following conditions are fulfilled:

- CPICH Ec/Io > -20 dB,

- SCH\_Ec/Io > -17 dB for at least one channel tap and SCH\_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.

If the UE is unable to identify the UTRA cell for SON within 8\*Tidentify, UTRA\_FDD seconds, the UE may stop searching UTRA cells for SON; when DRX is used Tidentify, UTRA\_FDD is defined in table 8.17.7.2.2-1, and when eDRX\_CONN is used Tidentify, UTRA\_FDD is defined in table 8.17.7.2.2-2.

##### 8.17.7.2.3 Reporting Delay

The UE shall not report the physical cell identity of an identifiable cell for SON as long as the reporting criteria are not fulfilled.

The reporting delay is defined as the time between the identification of the strongest cell for SON until the UE starts to transmit its physical cell identity over the Uu interface. This requirement assumes that the reporting of the physical cell identity is not delayed by other RRC signalling on the DCCH. This reporting delay excludes a delay uncertainty resulted when inserting the physical cell identity of the strongest cell for SON to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This reporting delay excludes any delay caused by unavailability of UL resources for UE sending the physical cell identity of the strongest cell for SON.

The reporting delay of the physical cell identity of the strongest cell for SON without L3 filtering shall be less than Tidentify, UTRA\_FDD defined in clause 8.17.7.2.1 and in clause 8.17.7.2.2 for non DRX and DRX or eDRX\_CONN cases respectively. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform LTE SRS carrier based switching or NR SRS carrier-based switching in FR1 if the UE is capable of per-FR gap, or NR SRS carrier-based switching in either FR1 or FR2 if the UE is not capable of per-FR gap, an additional delay can be expected.

### 8.17.8 E-UTRAN TDD – UTRAN FDD measurements for SON when Configured with E-UTRA-NR Dual Connectivity

The requirements in clause 8.17.7 also apply for this section when the UE is operating in E-UTRA-NR dual connectivity mode. Otherwise when the UE is not configured with E-UTRA-NR dual connectivity mode then the E-UTRAN TDD-UTRAN FDD measurement requirements for SON defined in section 8.1.2.4.8 shall apply.

### 8.17.9 E-UTRAN TDD – UTRAN TDD measurements when Configured with E-UTRA-NR Dual Connectivity

#### 8.17.9.1 Introduction

The requirements in this clause apply only to UE supporting E-UTRAN TDD and UTRA FDD. The E-UTRAN TDD - UTRAN TDD measurement requirements defined in section 8.17.9 shall apply when the UE capable of E-UTRA-NR dual connectivity is operating in E-UTRA-NR dual connectivity mode. The requiremenents in section 8.17.9 are applicable for gap pattern id # 0 and #1 as specified in Table 8.1.2.1-1.

The scaling factor CSSFUTRA, NSA used in the UTRA TDD measurement requirements in section 8.17.9 for the UE configured with E-UTRA-NR dual connectivity mode is determined according to CSSFwithin\_gap,i as specified in clause 9.1.5.2.1 of TS 38.133 [50]. When the UE is not configured with E-UTRA-NR dual connectivity mode then the E-UTRAN TDD-UTRAN TDD measurement requirements defined in section 8.1.2.4.3 shall apply.

The requirements in this section shall also apply, when the UE is configured to perform NR SRS carrier based switching and using measurement gaps.

#### 8.17.9.2 E-UTRAN FDD – UTRAN TDD measurements when no DRX is used

##### 8.17.9.2.1 Identification of a new UTRA FDD cell

When explicit neighbour list is provided and no DRX is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the monitored set within



A cell shall be considered detectable when

- P-CCPCH Ec/Io > -8 dB,

- DwPCH\_Ec/Io > -5 dB.

When L3 filtering is used an additional delay can be expected.

##### 8.17.9.2.2 Enhanced UTRA TDD cell identification requirements

When explicit neighbour list is provided and no DRX is used or when DRX cycle length ≤ 40 ms, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the monitored set within Tidentify, enhanced\_UTRA\_TDD:



A cell shall be considered detectable when:

- P-CCPCH\_Ec/Io > -6 dB,

- DwPCH\_Ec/Io > -1 dB

When L3 filtering is used an additional delay can be expected.

##### 8.17.9.2.3 UE UTRA TDD P-CCPCH RSCP measurement capability

When measurement gaps are scheduled for UTRA TDD inter RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting measurements to higher layers with measurement accuracy as specified in Clause 9.3 with measurement period given by



The UE shall be capable of performing UTRA TDD P-CCPCH RSCP measurements for Xbasic measurementUTRA\_TDD inter-frequency cells per TDD frequency of the monitored set, and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of TMeasurement\_ UTRA\_TDD.

Xbasic measurementUTRA\_TDD = 6

TMeasurement\_Period UTRA\_TDD = 480 ms is the period used for calculating the measurement period Tmeasurement\_UTRA\_TDD for UTRA TDD P-CCPCH RSCP measurements.

Tbasic\_identify\_UTRA\_TDD = 800 ms is the time period used in the inter RAT equation in clause 8.17.9.2.1where the maximum allowed time for the UE to identify a new UTRA TDD cell is defined.

Tbasic\_identify\_enhanced\_UTRA\_TDD  = 80 ms is the time period used in the inter RAT equation in clause 8.17.9.2.2 where the maximum allowed time for the UE to identify a new UTRA TDD cell is defined.

Tbasic\_measurement\_UTRA\_TDD = 50 ms is the time period used in the equation for defining the measurement period for inter RAT P-CCPCH RSCP measurements.

##### 8.17.9.2.4 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

##### 8.17.9.2.5 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify, UTRA\_TDD defined in Clause 8.17.9.2.1 for the minimum requirements or Tidentify, enhanced\_UTRA\_TDD defined in Clause 8.17.9.2.2 for the enhanced requirements. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform LTE SRS carrier based switching or NR SRS carrier-based switching in FR1 if the UE is capable of per-FR gap, or NR SRS carrier-based switching in either FR1 or FR2 if the UE is not capable of per-FR gap, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify, UTRA\_TDD defined in clause 8.17.9.2.1 for the minimum requirements and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasurement\_UTRA\_TDD defined in clause 8.17.9.2.3 provided the timing to that cell has not changed more than ± 10 chips while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform LTE SRS carrier based switching or NR SRS carrier-based switching in FR1 if the UE is capable of per-FR gap, or NR SRS carrier-based switching in either FR1 or FR2 if the UE is not capable of per-FR gap, an additional delay can be expected.

##### 8.17.9.2.6 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.17.9.2.5.

#### 8.17.9.3 E-UTRAN TDD – UTRAN TDD measurements when DRX is used

When explicit neighbour list is provided and DRX or eDRX\_CONN is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the neighbour cell list within Tidentify,UTRA\_TDD. When DRX is used, Tidentify,UTRA\_TDD is as defined in table 8.17.9.3-1, and when eDRX\_CONN is used, Tidentify,UTRA\_TDD is as defined in table 8.17.9.3-2. When MCG DRX is in use the applicable DRX cycle is the MCG DRX cycle.

Table 8.17.9.3-1: Requirement to identify a newly detectable UTRA TDD cell

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | Tidentify\_UTRA\_TDD (s) (DRX cycles) | |
|  | Gap ID # 0 | Gap ID # 1 |
| ≤0.32 | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable |
| 0.32<DRX-cycle≤0.512 | Note (20\*CSSFUTRA,NSA) | Note (25\*CSSFUTRA,NSA) |
| 0.512<DRX-cycle≤2.56 | Note (20\*CSSFUTRA,NSA) | Note (20\*CSSFUTRA,NSA) |
| Note: Time depends upon the DRX cycle in use | | |

Table 8.17.9.3-2: Requirement to identify a newly detectable UTRA TDD cell when eDRX\_CONN cycle is used

|  |  |  |
| --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify\_UTRA\_TDD (s) (eDRX\_CONN cycles) | |
|  | Gap ID # 0 | Gap ID # 1 |
| 2.56<eDRX\_CONN cycle ≤10.24 | Note (20\*CSSFUTRA,NSA) | Note (20\*CSSFUTRA,NSA) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

A cell shall be considered detectable provided following conditions are fulfilled: A cell shall be considered detectable when

- P-CCPCH Ec/Io > -8 dB,

- DwPCH\_Ec/Io > -5 dB.

When L3 filtering is used an additional delay can be expected.

When DRX or eDRX\_CONN is in use, the UE shall be capable of performing UTRA TDD P-CCPCH RSCP measurements of at least 6 UTRA cells per UTRA TDD carrier for up to 3 UTRA TDD carriers and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period Tmeasure\_UTRA\_TDD, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps. UE supporting Increased UE carrier monitoring UTRA shall be capable of performing UTRA TDD P-CCPCH RSCP measurements of at least 6 UTRA cells per UTRA TDD carrier for up to 7 UTRA TDD carriers with maximum of 80 cells consisting of at most 32 cells per frequency layer in the neighbour cell list. When DRX is used, Tmeasure\_UTRA\_TDD is as defined in Table 8.17.9.3-3, and when eDRX\_CONN is used, Tmeasure\_UTRA\_TDD is as defined in Table 8.17.9.3-4. When MCG DRX is in use the applicable DRX cycle is the MCG DRX cycle.

Table 8.17.9.3-3: Requirement to measure UTRA TDD cells

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | Tmeasure\_UTRA\_TDD (s) (DRX cycles) | |
|  | Gap ID # 0 | Gap ID # 1 |
| ≤0.04 | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable |
| 0.064 | 0.48\*CSSFUTRA,NSA (7.5\*CSSFUTRA,NSA) | 0.8\*CSSFUTRA,NSA  (12.5\*CSSFUTRA,NSA) |
| 0.08 | 0.48\*CSSFUTRA,NSA (6\*CSSFUTRA,NSA) | 0. 8\*CSSFUTRA,NSA (10\*CSSFUTRA,NSA) |
| 0.128 | 0.64\*CSSFUTRA,NSA (5\*CSSFUTRA,NSA) | 0. 8\*CSSFUTRA,NSA (6.25\*CSSFUTRA,NSA) |
| 0. 128<DRX-cycle≤2.56 | Note (5\*CSSFUTRA,NSA) | Note (5\*CSSFUTRA,NSA) |
| Note: Time depends upon the DRX cycle in use | | |

Table 8.17.9.3-4: Requirement to measure UTRA TDD cells when eDRX\_CONN cycle is used

|  |  |  |
| --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure\_UTRA\_TDD (s) (eDRX\_CONN cycles) | |
|  | Gap ID # 0 | Gap ID # 1 |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\*CSSFUTRA,NSA) | Note (5\*CSSFUTRA,NSA) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

The measurement accuracy for all measured cells shall be as specified in the sub-clause 9.1.

##### 8.17.9.3.1 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

##### 8.17.9.3.2 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify, UTRA\_TDD defined in Clause 8.17.9.3. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform LTE SRS carrier based switching or NR SRS carrier-based switching in FR1 if the UE is capable of per-FR gap, or NR SRS carrier-based switching in either FR1 or FR2 if the UE is not capable of per-FR gap, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify, UTRA\_TDD defined in clause 8.17.9.3 and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasurement\_UTRA\_TDD defined in clause 8.17.9.3 provided the timing to that cell has not changed more than ± 10 chips while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform LTE SRS carrier based switching or NR SRS carrier-based switching in FR1 if the UE is capable of per-FR gap, or NR SRS carrier-based switching in either FR1 or FR2 if the UE is not capable of per-FR gap, an additional delay can be expected.

##### 8.17.9.3.3 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.17.9.3.2.

### 8.17.10 E-UTRAN FDD – UTRAN TDD measurements when Configured with E-UTRA-NR Dual Connectivity

The requirements in clause 8.17.9 also apply for this section when the UE is operating in E-UTRA-NR dual connectivity mode. Otherwise when the UE is not configured with E-UTRA-NR dual connectivity mode then the E-UTRAN FDD-UTRAN TDD measurement requirements defined in section 8.1.2.4.4 shall apply.

### 8.17.11 E-UTRAN TDD – UTRAN TDD measurements for SON when Configured with E-UTRA-NR Dual Connectivity

#### 8.17.11.1 Introduction

The requirements in this clause apply only to UE supporting E-UTRAN TDD and UTRA TDD. The E-UTRAN TDD - UTRAN TDD measurement requirements for SON defined in section 8.17.11 shall apply when the UE capable of E-UTRA-NR dual connectivity is operating in E-UTRA-NR dual connectivity mode. The requiremenents in section 8.17.11 are applicable for gap pattern id # 0 and #1 as specified in Table 8.1.2.1-1.

The scaling factor CSSFUTRA, NSA used in the UTRA TDD measurement requirements for SON in section 8.17.11 for the UE configured with E-UTRA-NR dual connectivity mode is determined according to CSSFwithin\_gap,i as specified in clause 9.1.5.2.1 of TS 38.133 [50]. When the UE is not configured with E-UTRA-NR dual connectivity mode then the E-UTRAN TDD-UTRAN TDD measurement requirements defined in section 8.1.2.4.13 shall apply.

The requirements in this section shall also apply, when the UE is configured to perform NR SRS carrier based switching and using measurement gaps.

#### 8.17.11.2 Identification of a new UTRA TDD cell for SON

No explicit neighbour list is provided to the UE for identifying a UTRA cell for SON. The UE shall identify and report only the strongest cell when requested by the network for the purpose of SON.

##### 8.17.11.2.1 Requirements when no DRX is used

When no DRX is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new cell within:



Tbasic\_identify\_UTRA\_TDD = 800 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new UTRA TDD cell is defined.

A cell shall be considered identifiable following conditions are fulfilled:

- P-CCPCH Ec/Io > -8 dB,

- DwPCH\_Ec/Io > -5 dB.

When L3 filtering is used an additional delay can be expected.

If the UE is unable to identify the UTRA TDD cell for SON within 8\*Tidentify, UTRA\_TDD ms, the UE may stop searching UTRA TDD cells for SON.

##### 8.17.11.2.2 Requirements when DRX is used

When DRX or eDRX\_CONN is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new cell within Tidentify, UTRA\_TDD. When DRX is used, Tidentify, UTRA\_TDD is as defined in table 8.17.11.2.2-1, and when eDRX\_CONN is used, Tidentify, UTRA\_TDD is as defined in table 8.17.11.2.2-2. When MCG DRX is in use the applicable DRX cycle is the MCG DRX cycle.

Table 8.17.11.2.2-1: Requirement to identify a new UTRA TDD cell for SON

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | Tidentify, UTRA\_TDD (s) (DRX cycles) | |
|  | Gap Id # 0 | Gap Id # 1 |
| ≤0.16 | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable | Non DRX Requirements in clause 8.1.2.4.3.1 are applicable |
| 0.16<DRX cycle≤0.256 | Note (25\*CSSFUTRA,NSA) | Note (50\*CSSFUTRA,NSA) |
| 0.256<DRX cycle≤0.32 | Note (25\*CSSFUTRA,NSA) | Note (45\*CSSFUTRA,NSA) |
| 0.32<DRX cycle≤2.56 | Note(25\*CSSFUTRA,NSA) | Note (25\*CSSFUTRA,NSA) |
| Note: Time depends upon the DRX cycle in use | | |

Table 8.17.11.2.2-2: Requirement to identify a new UTRA TDD cell for SON when eDRX\_CONN cycle is used

|  |  |  |
| --- | --- | --- |
| eDRX\_CONN cycle length (s) | Tidentify, UTRA\_TDD (s) (eDRX\_CONN cycles) | |
|  | Gap Id # 0 | Gap Id # 1 |
| 2.56<eDRX\_CONN cycle≤10.24 | Note(25\*CSSFUTRA,NSA) | Note (25\*CSSFUTRA,NSA) |
| Note: Time depends upon the eDRX\_CONN cycle in use | | |

A cell shall be considered identifiable provided following conditions are fulfilled:

- P-CCPCH Ec/Io > -8 dB,

- DwPCH\_Ec/Io > -5 dB.

When L3 filtering is used an additional delay can be expected.

If the UE is unable to identify the UTRA TDD cell for SON within 8\*Tidentify, UTRA\_TDD seconds, the UE may stop searching UTRA TDD cells for SON; when DRX is used Tidentify, UTRA\_TDD is defined in table 8.17.11.2.2-1, and when eDRX\_CONN is used Tidentify, UTRA\_TDD is defined in table 8.17.11.2.2-2.

##### 8.17.11.2.3 Reporting Delay

The UE shall not report the physical cell identity of an identifiable cell for SON as long as the reporting criteria are not fulfilled.

The reporting delay is defined as the time between the identification of the strongest cell for SON until the UE starts to transmit its physical cell identity over the Uu interface. This requirement assumes that the reporting of the physical cell identity is not delayed by other RRC signalling on the DCCH. This reporting delay excludes a delay uncertainty resulted when inserting the physical cell identity of the strongest cell for SON to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. When the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration, the delay uncertainty is twice the subframe or slot or subslot of the uplink DCCH. This reporting delay excludes any delay caused by unavailability of UL resources for UE sending the physical cell identity of the strongest cell for SON.

The reporting delay of the physical cell identity of the strongest cell for SON without L3 filtering shall be less than Tidentify, UTRA\_TDD defined in clause 8.17.11.2.1 and in clause 8.17.11.2.2 for non DRX and DRX and eDRX\_CONN cases respectively. When L3 filtering is used or IDC autonomous denial is configured, or the UE is configured to perform LTE SRS carrier based switching or NR SRS carrier-based switching in FR1 if the UE is capable of per-FR gap, or NR SRS carrier-based switching in either FR1 or FR2 if the UE is not capable of per-FR gap, an additional delay can be expected.

### 8.17.12 E-UTRAN FDD – UTRAN TDD measurements for SON when Configured with E-UTRA-NR Dual Connectivity

The requirements in clause 8.17.11 also apply for this section when the UE is operating in E-UTRA-NR dual connectivity mode. Otherwise when the UE is not configured with E-UTRA-NR dual connectivity mode then the E-UTRAN FDD-UTRAN FDD measurement requirements for SON defined in section 8.1.2.4.14 shall apply.

### 8.17.13 E-UTRAN FDD – GSM measurements when Configured with E-UTRA-NR Dual Connectivity

#### 8.17.13.1 Introduction

The requirements in this clause apply only to UE supporting E-UTRAN FDD and GSM. The E-UTRAN FDD - GSM measurement requirements defined in section 8.17.13 shall apply when the UE capable of E-UTRA-NR dual connectivity is operating in E-UTRA-NR dual connectivity mode. The requiremenents in section 8.17.13 are applicable for gap pattern id # 0 and #1 as specified in Table 8.1.2.1-1.

The scaling factor CSSFGSM, NSA used in the GSM measurement requirements in section 8.17.13 for the UE configured with E-UTRA-NR dual connectivity mode is determined according to CSSFwithin\_gap,i as specified in clause 9.1.5.2.1 of TS 38.133 [50]. When the UE is not configured with E-UTRA-NR dual connectivity mode then the E-UTRAN FDD-GSM measurement requirements defined in section 8.1.2.4.5 shall apply.

The requirements in this section shall also apply, when the UE is configured to perform NR SRS carrier based switching and using measurement gaps.

#### 8.17.13.2 E-UTRAN FDD – GSM measurements when no DRX is used

Measurements on GSM cells can be requested with BSIC verified. In RRC\_CONNECTED state when a supported measurement gap pattern id # 0 or # 1 according to Table 8.1.2.1-1 is configured by E-UTRAN, or the UE supports capability of conducting such measurements without gaps, the UE shall continuously measure GSM cells, search for new GSM cells given in the monitored set and re-confirm the BSIC for already detected cells.

##### 8.17.13.2.1 GSM carrier RSSI

This measurement shall be based on measurement gaps allocated for GSM carrier RSSI measurement as described in clause 8.1.2.1. A UE supporting GSM measurements shall measure minimum number of 10 GSM carrier RSSI measurement samples (NGSM carrier RSSI) per measurement gap. In RRC\_CONNECTED state the measurement period, TMeasurement Period, GSM, for the GSM carrier RSSI measurement is CSSFGSM, NSA\*480 ms.

The UE shall meet the measurement accuracy requirements stated for RXLEV in TS 45.008 [8], when the given measurement time allows the UE to take at least 3 GSM carrier RSSI samples per GSM carrier in the monitored set during the measurement period.

In case the UE is not able to acquire the required number of samples per GSM carrier during one measurement period, the UE shall measure as many GSM carriers as possible during that measurement period using at least 3 samples per GSM carrier. The GSM carriers that were not measured during that measurement period shall be measured in the following measurement periods.

##### 8.17.13.2.2 BSIC verification

Measurements on a GSM cell can be requested with BSIC verified. The UE shall be able to report the GSM cells with BSIC verified for those cells where the verification of BSIC has been successful.

The procedure for BSIC verification on a GSM cell can be divided into the following two tasks:

**- Initial BSIC identification:** Includes searching for the BSIC and decoding the BSIC for the first time when there is no knowledge about the relative timing between the E-UTRAN FDD and GSM cells. The UE shall trigger the initial BSIC identification within the available measurement gap pattern sequence. The requirements for BSIC re-confirmation can be found in clause 8.17.13.2.2.1.

**- BSIC re-confirmation:** Tracking and decoding the BSIC of a GSM cell after initial BSIC identification is performed. The UE shall trigger the BSIC re-confirmation within the available measurement gap pattern. The requirements for BSIC re-confirmation can be found in clause 8.17.13.2.2.2.

If the network requests measurements on a GSM cell the UE shall behave as follows:

- The UE shall perform GSM carrier RSSI measurements according to clause 8.17.13.2 when a measurement gap pattern sequence is activated, or the UE supports capability of conducting such measurements without gaps.

The UE shall perform measurement reporting as defined in TS 36.331 [2].

- The UE shall perform BSIC identification. The UE shall use the most recently available GSM carrier RSSI measurement results for arranging GSM cells in signal strength order for performing BSIC identification.

- The UE shall perform BSIC re-confirmation on all the GSM cells that have been successfully identified.

- The UE shall perform all configured event evaluation for event-triggered reporting after the BSIC has been verified for a GSM cell. The UE shall use the most recently available GSM carrier RSSI measurement results in event evaluation and event-triggered reporting.

- Event-triggered and periodic reports shall be triggered according to TS 36.331 [2].

The BSIC of a GSM cell is considered to be “verified” if the UE has decoded the SCH of the BCCH carrier and identified the BSIC at least one time (initial BSIC identification). Once a GSM cell has been identified the BSIC shall be re-confirmed at least once every 8\*Tre-confirm,GSM seconds. Otherwise the BSIC of the GSM cell is considered as "non-verified". If a measurement gap pattern sequence is deactivated by the network after BSIC has been identified or verified, the UE shall consider the BSIC as non-verified.

Tidentify,GSM indicates the maximum time allowed for the UE to decode the unknown BSIC of the GSM cell in one GSM BCCH carrier in the initial BSIC identification procedure.

Tre-confirm,GSM indicates the maximum time allowed for the re-confirmation of the BSIC of one GSM cell in the BSIC re-confirmation procedure.

The UE shall be able to decode a BSIC within a measurement gap when the time difference between the middle of the received GSM synchronisation burst at the UE and the middle of the effective measurement gap is within the limits specified in table 8.17.13.2.2-1.

Table 8.17.13.2.2-1: The gap length and maximum time difference for BSIC verification

|  |  |
| --- | --- |
| Gap length  [ms] | Maximum time difference [μs] |
| 6 | ± 2350 µs |

The UE shall be able to perform BSIC verification at levels down to the reference sensitivity level or reference interference levels as specified in TS 45.005 [9].

8.17.13.2.2.1 Initial BSIC identification

This measurement shall be based on the measurement gaps used for Initial BSIC identification as described in clause 8.17.13.2.2.

The UE shall continuously attempt to decode the BSIC of SCH on the BCCH carrier of the 8 strongest BCCH carriers of the GSM cells indicated in the Inter-RAT cell info list. The UE shall give priority for BSIC decoding attempts in decreasing signal strength order to BCCH carriers with unknown BSIC. The strongest BCCH carrier is defined as the BCCH carrier having the highest measured GSM carrier RSSI value.

If the BSIC of the GSM BCCH carrier has been successfully decoded the UE shall immediately continue BSIC identification with the next GSM BCCH carrier, in signal strength order, with unknown BSIC. The GSM cell for which the BSIC has been successfully identified shall be moved to the BSIC re-confirmation procedure.

If the UE has not successfully decoded the BSIC of the GSM BCCH carrier within Tidentify,GSM ms, the UE shall abort the BSIC identification attempts for that GSM BCCH carrier. The UE shall continue to try to perform BSIC identification of the next GSM BCCH carrier in signal strength order. The GSM BCCH carrier for which the BSIC identification failed shall not be re-considered for BSIC identification until BSIC identification attempts have been made for all the rest of the 8 strongest GSM BCCH carriers in the monitored set with unknown BSIC.

Tidentify,GSM values are given for a set of reference gap patterns in table 8.17.13.2.2.1-1. The requirements in the table represent the time required to guarantee at least two attempts to decode the BSIC for one GSM BCCH carrier. If inter-frequency RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, then Tidentify,GSM shall be based on the 80ms gap configuration.

Table 8.17.13.2.2.1-1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ceil(CSSFGSM, NSA\*Kn –Mgsm) | Tidentify,gsm(ms) | | Treconfirm,gsm(ms) | |
| 40ms gap configuration (ID 0) | 80ms gap configuration (ID 1) | 40ms gap configuration (ID 0) | 80ms gap configuration (ID 1) |
| 0 | 2160 | 5280 | 1920 | 5040 |
| 1 | 5280 | 21760 | 5040 | 17280 |
| 2 | 5280 | 31680 | 5040 | 29280 |
| 3 | 19440 | No requirement | 13320 | No requirement |
| 4 | 31680 | No requirement | 29280 | No requirement |
| 5 | 31680 | No requirement | 29280 | No requirement |

8.17.13.2.2.2 BSIC re-confirmation

The UE shall maintain the timing information of up to 8 identified GSM cells. Initial timing information is obtained from the initial BSIC identification. The timing information shall be updated every time the BSIC is decoded.

For each measurement gap used for GSM BSIC reconfirmation as described in clause 8.17.13.2.2, the UE shall attempt to decode the BSIC falling within the measurement gap according to table 8.17.13.2.2.1-1. If more than one BSIC can be decoded within the same measurement gap, priority shall be given to the least recently decoded BSIC. If inter-frequency RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, then Tre-confirm,GSM shall be based on the 80ms gap configuration.

If the UE fails to decode the BSIC after two successive attempts or if the UE has not been able to re-confirm the BSIC for a GSM cell within Tre-confirm,GSM seconds, the UE shall abort the BSIC re-confirmation attempts for that GSM cell. The GSM cell shall be treated as a new GSM cell with unidentified BSIC and the GSM cell shall be moved to the initial BSIC identification procedure, see clause 8.17.13.2.2.1.

##### 8.17.13.2.3 Enhanced BSIC verification

In addition to the BSIC verification requirements in clause 8.17.13.2.2, when the UE receives the GSM cell at levels down to 10 dB + the reference sensitivity level or reference interference levels as specified in TS 45.005 [9] the BSIC identification requirement in table 8.17.13.2.3-1 applies. The BSIC verification requirements in table 8.17.13.2.3-1 shall apply when no DRX is used or when DRX cycle length ≤ 40 ms.

Table 8.17.13.2.3-1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ceil(CSSFGSM, NSA\*Kn –Mgsm) | Tenhanced\_identify,gsm(ms) | | Tenhanced\_reconfirm,gsm(ms) | |
| 40ms gap configuration (ID 0) | 40ms gap configuration when interfrequency RSTD measurement is also configured and the UE requires measurement gaps for performing such measurements | 40ms gap configuration (ID 0) | 40ms gap configuration when interfrequency RSTD measurement is also configured and the UE requires measurement gaps for performing such measurements |
| 0 | 1320 | 2160 | 1080 | 1920 |

##### 8.17.13.2.4 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

##### 8.17.13.2.5 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH.

The event triggered reporting delay requirement is valid when the UE for each GSM carrier in the monitored set can take the required number of samples during the measurement period TMeasurement Period, GSM (see clause 8.17.13.2).

The event triggered measurement reporting delay for a GSM cell with verified BSIC, measured without L3 filtering shall be less than 2\*TMeasurement Period, GSM, where TMeasurement Period, GSM is defined in clause 8.17.13.2. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform LTE SRS carrier based switching or NR SRS carrier-based switching in FR1 if the UE is capable of per-FR gap, or NR SRS carrier-based switching in either FR1 or FR2 if the UE is not capable of per-FR gap, an additional delay can be expected.

##### 8.17.13.2.6 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.17.13.2.5.

#### 8.17.13.3 E-UTRAN FDD – GSM measurements when DRX is used

Measurements on GSM cells can be requested with BSIC verified. In RRC\_CONNECTED state when a supported measurement gap pattern id # 0 or # 1 according to Table 8.1.2.1-1 is configured by E-UTRAN, or the UE supports capability of conducting such measurements without gaps, the UE shall continuously measure GSM cells, search for new GSM cells given in the monitored set and re-confirm the BSIC for already detected cells. During DRX or eDRX\_CONN periods the UE may use other periods of time outside the specified measurement gap patterns. The UE is not required to make measurements of GSM cells during DRX or eDRX\_CONN periods if a measurement gap pattern has not been configured, unless the UE supports capability of conducting such measurements without gaps.

##### 8.17.13.3.1 GSM carrier RSSI

This measurement shall be based on measurement gaps allocated for GSM carrier RSSI measurement as described in clause 8.1.2.1. A UE supporting GSM measurements shall measure minimum number of 10 GSM carrier RSSI measurement samples (NGSM carrier RSSI) per DRX or eDRX\_CONN cycle. When DRX is used in RRC\_CONNECTED state, the measurement period, TMeasurement Period, GSM, for the GSM carrier RSSI measurement is shown in table 8.17.13.3.1-1. When eDRX\_CONN is used in RRC\_CONNECTED state, the measurement period, TMeasurement Period, GSM, for the GSM carrier RSSI measurement is shown in table 8.17.13.3.1-2. When MCG DRX is in use the applicable DRX cycle is the MCG DRX cycle.

Table 8.17.13.3.1-1: GSM measurement period for large DRX

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure,GSM (s) (DRX cycles) |
| ≤0.064 | Non DRX Requirements are applicable |
| 0.064<DRX-cycle≤ 0.08 | Note (6\*CSSFGSM, NSA) |
| 0.08<DRX-cycle≤ 2.56 | Note (5\*CSSFGSM, NSA) |
| Note: Time depends upon the DRX cycle in use | |

Table 8.17.13.3.1-2: GSM measurement period for large DRX when eDRX\_CONN cycle is used

|  |  |
| --- | --- |
| eDRX\_CONN cycle length (s) | Tmeasure,GSM (s) (eDRX\_CONN cycles) |
| 2.56<eDRX\_CONN cycle≤10.24 | Note (5\*CSSFGSM, NSA) |
| Note: Time depends upon the eDRX\_CONN cycle in use | |

The UE shall meet the measurement accuracy requirements stated for RXLEV in TS 45.008 [8], when the given measurement time allows the UE to take at least 3 GSM carrier RSSI samples per GSM carrier in the monitored set during the measurement period.

In case the UE is not able to acquire the required number of samples per GSM carrier during one measurement period, the UE shall measure as many GSM carriers as possible during that measurement period using at least 3 samples per GSM carrier. The GSM carriers that were not measured during that measurement period shall be measured in the following measurement periods.

##### 8.17.13.3.2 BSIC verification

Measurements on a GSM cell can be requested with BSIC verified. The UE shall be able to report the GSM cells with BSIC verified for those cells where the verification of BSIC has been successful.

The procedure for BSIC verification on a GSM cell can be divided into the following two tasks:

**- Initial BSIC identification:** Includes searching for the BSIC and decoding the BSIC for the first time when there is no knowledge about the relative timing between the E-UTRAN FDD and GSM cells.

**- BSIC re-confirmation:** Tracking and decoding the BSIC of a GSM cell after initial BSIC identification is performed. The UE shall trigger the BSIC re-confirmation within the available measurement gap pattern

If the network requests measurements on a GSM cell, the UE shall behave as follows:

- The UE shall perform GSM carrier RSSI measurements according to clause 8.17.13.3.1 when a measurement gap pattern sequence is activated, or the UE supports capability of conducting such measurements without gaps.

The UE shall perform measurement reporting as defined in TS 36.331 [2].

- The UE shall perform BSIC identification. The UE shall use the most recently available GSM carrier RSSI measurement results for arranging GSM cells in signal strength order for performing BSIC identification.

- The UE shall perform BSIC re-confirmation on all the GSM cells that have been successfully identified.

- The UE shall perform all configured event evaluation for event-triggered reporting after the BSIC has been verified for a GSM cell. The UE shall use the most recently available GSM carrier RSSI measurement results in event evaluation and event-triggered reporting.

- Event-triggered and periodic reports shall be triggered according to TS 36.331 [2].

The BSIC of a GSM cell is considered to be “verified” if the UE has decoded the SCH of the BCCH carrier and identified the BSIC at least one time (initial BSIC identification). Once a GSM cell has been identified the BSIC shall be re-confirmed at least once every 30 seconds. Otherwise the BSIC of the GSM cell is considered as "non-verified".

The UE shall be able to perform BSIC verification at levels down to the reference sensitivity level or reference interference levels as specified in TS 45.005 [9].

8.17.13.3.2.1 Initial BSIC identification

This measurement shall be made on GSM cells that are requested with BSIC verified.

For DRX cycle length ≤ 40 ms, the initial GSM BSIC identification requirements corresponding to the non DRX requirements as specified in clause 8.17.13.2.2.1 shall apply.

For DRX cycle length > 40 ms and any eDRX\_CONN cycle, the UE shall make at least one attempt every CSSFGSM, NSA\*30s to decode the BSIC of SCH on the BCCH carrier of the 8 strongest BCCH carriers of the GSM cells indicated in the Inter-RAT cell info list. If the UE has not successfully decoded the BSIC of the GSM BCCH carrier within CSSFGSM, NSA\*60 s, the UE shall abort the BSIC identification attempts for that GSM BCCH carrier. The UE shall give priority for BSIC decoding attempts in decreasing signal strength order to BCCH carriers with unknown BSIC. The strongest BCCH carrier is defined as the BCCH carrier having the highest measured GSM carrier RSSI value.

If the BSIC of the GSM BCCH carrier has been successfully decoded the UE shall continue BSIC identification with the next GSM BCCH carrier, in signal strength order, with unknown BSIC. The GSM cell for which the BSIC has been successfully identified shall be moved to the BSIC re-confirmation procedure.

8.17.13.3.2.2 BSIC re-confirmation

The UE shall maintain the timing information of up to 8 identified GSM cells. Initial timing information is obtained from the initial BSIC identification. The timing information shall be updated every time the BSIC is decoded.

For DRX cycle length ≤ 40 ms, the GSM BSIC re-conformation requirements corresponding to the non DRX requirements as specified in clause 8.17.13.2.2.2 shall apply.

For DRX cycle length > 40 ms and any eDRX\_CONN cycle, at least every CSSFGSM, NSA\*30 seconds, the UE shall attempt to decode the BSIC of each identified GSM cell.If the UE fails to decode the BSIC after two successive attempts or if the UE has not been able to re-confirm the BSIC for a GSM cell within CSSFGSM, NSA\*60 seconds, the UE shall abort the BSIC re-confirmation attempts for that GSM cell. The GSM cell shall be treated as a new GSM cell with unidentified BSIC and the GSM cell shall be moved to the initial BSIC identification procedure, see clause 8.17.13.3.2.1.

##### 8.17.13.3.3 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

##### 8.17.13.3.4 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH.

The event triggered reporting delay requirement is valid when the UE for each GSM carrier in the monitored set can take the required number of samples during the measurement period TMeasurement Period, GSM (see clause 8.17.13.3.1).

The event triggered measurement reporting delay for a GSM cell with verified BSIC , measured without L3 filtering shall be less than 2\*TMeasurement Period, GSM, where TMeasurement Period, GSM is defined in clause 8.17.13.3.1. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform LTE SRS carrier based switching or NR SRS carrier-based switching in FR1 if the UE is capable of per-FR gap, or NR SRS carrier-based switching in either FR1 or FR2 if the UE is not capable of per-FR gap, an additional delay can be expected.

##### 8.17.13.3.5 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.17.13.3.4.

### 8.17.14 E-UTRAN TDD – GSM measurements when Configured with E-UTRA-NR Dual Connectivity

The requirements in clause 8.17.13 also apply for this section when the UE is operating in E-UTRA-NR dual connectivity mode. Otherwise when the UE is not configured with E-UTRA-NR dual connectivity mode then the E-UTRAN FDD-GSM measurement requirements defined in section 8.1.2.4.6 shall apply.

### 8.17.15 E-UTRAN Inter-Frequency RSTD measurements when configured with E-UTRA-NR Dual Connectivity

All inter-frequency RSTD measurement requirements specified in Sections 8.17.15.1-8.17.15.4 shall apply without DRX as well as for any DRX or eDRX\_CONN cycles specified in TS 36.331 [2].

The applicability of the requirements in clause 8.17.15 is same as defined in 8.1.2.6.

#### 8.17.15.1 E-UTRAN FDD-FDD Inter-Frequency RSTD measurements when configured with E-UTRA-NR Dual Connectivity

The requirements for inter-frequency RSTD measurements in clause 8.1.2.6.1 shall apply, except that the number of PRS positioning occasions within measurement period of TRSTD InterFreqFDD, EN-DC is as specified in Table 8.17.15.1-1:

Table 8.17.15.1-1: Number of PRS positioning occasions within TRSTD InterFreqFDD, EN-DC

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period TPRS | Number of PRS positioning occasions M | |
| f2 Note1 | f1 and f2 Note2 |
| 160 ms | 16 × CSSFinterFreq | 32 × CSSFinterFreq |
| >160 ms | 8 × CSSFinterFreq | 16 × CSSFinterFreq |
| NOTE 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the FDD inter-frequency carrier frequency f2.  NOTE 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving FDD carrier frequency f1 and the FDD inter-frequency carrier frequency f2 respectively. | | |

Where:

*M* is the number of PRS positioning occasions as defined in Table 8.17.15.1-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

CSSFinterFreq is the carrier-specific scaling factor for the inter-frequency RSTD measurements and is determined according to CSSFwithin\_gap,i defined in TS 38.133 [50] clause 9.1.5.2.

##### 8.17.15.1.1 RSTD Measurement Reporting Delay

The requirements in clause 8.1.2.6.1.1 shall apply.

#### 8.17.15.2 E-UTRAN TDD-FDD Inter-Frequency RSTD measurements when configured with E-UTRA-NR Dual Connectivity

The requirements for inter-frequency RSTD measurements in clause 8.1.2.6.2 shall apply, except that the number of PRS positioning occasions within measurement period of TRSTD InterFreqTDDFDD, EN-DC is as specified in Table 8.17.15.2-1:

Table 8.17.15.2-1: Number of PRS positioning occasions within TRSTD InterFreqTDDFDD, EN-DC

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period TPRS | Number of PRS positioning occasions M | |
| f2 Note1 | f1 and f2 Note2 |
| 160 ms | 16 × CSSFinterFreq | 32 × CSSFinterFreq |
| >160 ms | 8 × CSSFinterFreq | 16 × CSSFinterFreq |
| NOTE 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the FDD inter-frequency carrier frequency f2.  NOTE 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving TDD carrier frequency f1 and the FDD inter-frequency carrier frequency f2 respectively. | | |

Where:

*M* is the number of PRS positioning occasions as defined in Table 8.17.15.2-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

CSSFinterFreq is the carrier-specific scaling factor for the inter-frequency RSTD measurements and is determined according to CSSFwithin\_gap,i defined in TS 38.133 [50] clause 9.1.5.2.

##### 8.17.15.2.1 RSTD Measurement Reporting Delay

The requirements in clause 8.17.15.1.1 also apply for this section.

#### 8.17.15.3 E-UTRAN TDD-TDD Inter-Frequency RSTD measurements when configured with E-UTRA-NR Dual Connectivity

The requirements for inter-frequency RSTD measurements in clause 8.1.2.6.3 shall apply, except that the number of PRS positioning occasions within measurement period of TRSTD InterFreqTDD, EN-DC is as specified in Table 8.17.15.3-1:

Table 8.17.15.3-1: Number of PRS positioning occasions within TRSTD InterFreqTDD, EN-DC

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period TPRS | Number of PRS positioning occasions M | |
| f2 Note1 | f1 and f2 Note2 |
| 160 ms | 16 × CSSFinterFreq | 32 × CSSFinterFreq |
| >160 ms | 8 × CSSFinterFreq | 16 × CSSFinterFreq |
| NOTE 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the TDD inter-frequency carrier frequency f2.  NOTE 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving TDD carrier frequency f1 and the TDD inter-frequency carrier frequency f2 respectively. | | |

Where:

*M* is the number of PRS positioning occasions as defined in Table 8.17.15.3-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

CSSFinterFreq is the carrier-specific scaling factor for the inter-frequency RSTD measurements and is determined according to CSSFwithin\_gap,i defined in TS 38.133 [50] clause 9.1.5.2,

##### 8.17.15.3.1 RSTD Measurement Reporting Delay

The requirements in clause 8.17.15.1.1 also apply for this section.

#### 8.17.15.4 E-UTRAN FDD-TDD Inter-Frequency RSTD measurements when configured with E-UTRA-NR Dual Connectivity

The requirements for inter-frequency RSTD measurements in clause 8.1.2.6.4 shall apply, except that the number of PRS positioning occasions within measurement period of TRSTD InterFreqFDDTDD, EN-DC is as specified in Table 8.17.15.4-1:

Table 8.17.15.4-1: Number of PRS positioning occasions within TRSTD InterFreqFDDTDD, EN-DC

|  |  |  |
| --- | --- | --- |
| Positioning subframe configuration period TPRS | Number of PRS positioning occasions M | |
| f2 Note1 | f1 and f2 Note2 |
| 160 ms | 16 × CSSFinterFreq | 32 × CSSFinterFreq |
| >160 ms | 8 × CSSFinterFreq | 16 × CSSFinterFreq |
| NOTE 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the TDD inter-frequency carrier frequency f2.  NOTE 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving FDD carrier frequency f1 and the TDD inter-frequency carrier frequency f2 respectively. | | |

Where:

*M* is the number of PRS positioning occasions as defined in Table 8.17.15.4-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

CSSFinterFreq is the carrier-specific scaling factor for the inter-frequency RSTD measurements and is determined according to CSSFwithin\_gap,i defined in TS 38.133 [50] clause 9.1.5.2,

##### 8.17.15.4.1 RSTD Measurement Reporting Delay

The requirements in clause 8.17.15.1.1 also apply for this section.

### 8.17.16 E-UTRAN intra-frequency measurement with autonomous gaps when configured with E-UTRA-NR Dual Connectivity

#### 8.17.16.1 Introduction

The requirements for E-UTRAN intra-frequency measurement with autonomous gaps defined in section 8.17.16 shall apply when the UE capable of EN-DC is operating in EN-DC mode, and the UE is configured by PCell to identify CGI of an E-UTRA FDD or E-UTRA TDD cell on an E-UTRA serving frequency carrier.

#### 8.17.16.2 E-UTRAN FDD intra frequency measurements with autonomous gaps

The requirements defined in 8.1.2.2.3 shall apply.

#### 8.17.16.3 E-UTRAN TDD intra frequency measurements with autonomous gaps

The requirements defined in 8.1.2.2.4 shall apply.

### 8.17.17 E-UTRAN inter-frequency measurement with autonomous gaps when configured with E-UTRA-NR Dual Connectivity

#### 8.17.17.1 Introduction

The requirements for E-UTRAN inter-frequency measurement with autonomous gaps defined in section 8.17.17 shall apply when the UE capable of EN-DC is operating in EN-DC mode, and the UE is configured by PCell to identify CGI of an E-UTRA FDD or E-UTRA TDD cell on an E-UTRA non-serving frequency carrier.

#### 8.17.17.2 E-UTRAN FDD-FDD inter frequency measurements with autonomous gaps

The requirements defined in 8.1.2.3.5 shall apply.

#### 8.17.17.3 E-UTRAN TDD-FDD inter frequency measurements using autonomous gaps

The requirements defined in 8.1.2.3.6 shall apply.

#### 8.17.17.4 E-UTRAN TDD-TDD inter frequency measurements with autonomous gaps

The requirements defined in 8.1.2.3.7 shall apply.

#### 8.17.17.5 E-UTRAN FDD-TDD inter frequency measurements using autonomous gaps

The requirements defined in 8.1.2.3.8 shall apply.

### 8.17.18 E-UTRA FDD - NR CGI measurements with autonomous gaps

The requirements in clause 8.1.2.4.27 also apply in EN-DC operation with E-UTRA FDD PCell when the UE is configured by the E-UTRA PCell to identify CGI of an NR cell. The UE shall fulfil interruption requirements specified in Clause 7.32.2.15 for E-UTRA serving cells.

### 8.17.19 E-UTRA TDD - NR CGI measurements with autonomous gaps

The requirements in clause 8.1.2.4.28 also apply in EN-DC operation with E-UTRA TDD PCell when the UE is configured by the E-UTRA PCell to identify CGI of an NR cell. The UE shall fulfil interruption requirements specified in Clause 7.32.2.15 for E-UTRA serving cells.

## 8.18 Measurements for non-BL/CE UE

### 8.18.1 Introduction

The non-BL/CE UE applicability of the requirements in subclause 8.18 is defined in Section 3.6. The requirements defined in Section 8.18 do not apply when the UE is of category 1bis.

### 8.18.2 Requirements for non-BL/CE UE with CE Mode B

#### 8.18.2.1 E-UTRAN intra frequency measurements

##### 8.18.2.1.1 E-UTRAN FDD intra frequency measurements with autonomous gaps for non-BL/CE with CE Mode B

The requirements defined in this subclause 8.18.2.1.4 apply provided the following condition is met:

- Tx diversity or transmission using multiple antennas are supported in the target cell to be detected.

- Repetitions of MIB/SIB1-BRare supported in the target cell to be detected.

8.18.2.1.1.1 Identification of a new CGI of E-UTRA cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose ‘reportCGI’. The UE may make autonomous gaps in downlink reception and uplink transmission for receiving MIB and SIB1-BRmessage according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI\_non-BL/CE, intra = 2640 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of an E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.14 for a corresponding Band

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI\_ non-BL/CE,.intra is applicable when no DRX is used as well as when any of DRX and eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the PBCH repetition and SIB1-BR repetition level in the target cell shall be as specified in Table 8.18.2.1.1.1-1.

Table 8.18.2.1.1.1-1: Conditions in target cell during Tbasic\_identify\_CGI\_ non-BL/CE, intra.

|  |  |  |  |
| --- | --- | --- | --- |
| Target cell | | | |
| Ês/Iot [dB] | PBCH repetition | SIB1-BR repetition level | SIB1-BR TBS [bits] |
| ≥ -15 | Configured as specified in TS 36.211 [16] | 16 | 208 |

8.18.2.1.1.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

##### 8.18.2.1.2 E-UTRAN intra frequency measurements with autonomous gaps for HD-FDD non-BL/CE with CE Mode B

The requirements in this section are applicable for the UE which supports half duplex FDD operation on one or more supported frequency bands [2].

The requirements defined in this subclause 8.13.3.1.5 apply provided the following condition is met:

- Tx diversity or transmission using multiple antennas are supported in the target cell to be detected.

- Repetitions of MIB/SIB1-BR are supported in the target cell to be detected.

8.18.2.1.2.1 Identification of a new CGI of E-UTRA cell with autonomous gaps

The CGI requirements defined in clause 8.18.2.1.1.1 also apply for this section.

8.18.2.1.2.2 ECGI Reporting Delay

The ECGI reporting delay defined in clause 8.18.2.1.1.2 also apply for this section

##### 8.18.2.1.3 E-UTRAN TDD intra frequency measurements with autonomous gaps for non-BL/CE with CE Mode B

The requirements defined in this subclause 8.18.2.1.3 apply provided the following condition is met:

- Tx diversity or transmission using multiple antennas are supported in the target cell to be detected.

- Repetitions of MIB/SIB1-BR are supported in the target cell to be detected.

8.18.2.1.3.1 Identification of a new CGI of E-UTRA cell with autonomous gaps

No explicit neighbour list is provided to the UE for identifying a new CGI of E-UTRA cell. The UE shall identify and report the CGI when requested by the network for the purpose ‘reportCGI’. The UE may make autonomous gaps in downlink reception and uplink transmission for receiving MIB and SIB1-BR messages according to clause 5.5.3.1 of TS 36.331 [2]. Note that a UE is not required to use autonomous gap if si-RequestForHO is set to false. If autonomous gaps are used for measurement with the purpose of ‘reportCGI’, regardless of whether DRX or eDRX\_CONN is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within:



Where

Tbasic\_identify\_CGI\_non-BL/CE, intra = 2640 ms. This is the time period used in the above equation where the maximum allowed time for the UE to identify a new CGI of an E-UTRA cell is defined, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable when the following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 are fulfilled for a corresponding Band,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.14 for a corresponding Band

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [5].

The requirement for identifying a new CGI of an E-UTRA cell within Tbasic\_identify\_CGI\_non-BL/CE, intra is applicable when no DRX is used as well as when any of the DRX or eDRX\_CONN cycles specified in TS 36.331 [2] is used.

Within the time, , over which the UE identifies the new CGI of E-UTRA cell, the PBCH repetition and SIB1-BR repetition level in the target cell shall be as specified Table 8.18.2.1.3.1-1.

Table 8.18.2.1.3.1-1: Conditions in target cell during Tbasic\_identify\_CGI\_non-BL/CE, intra.

|  |  |  |  |
| --- | --- | --- | --- |
| Target cell | | | |
| Ês/Iot [dB] | PBCH repetition level | SIB1-BR repetition level | SIB1-BR TBS [bits] |
| ≥ -15 | Configured with repetition, as specified in TS 36.211 [16] | 16 | 208 |

8.18.2.1.3.2 ECGI Reporting Delay

The ECGI reporting delay occurs due to the delay uncertainty when inserting the ECGI measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. In case DRX is used, the ECGI reporting may be delayed until the next DRX cycle. In case eDRX\_CONN is used, the ECGI reporting may be delayed until the next eDRX\_CONN cycle. If IDC autonomous denial is configured, an additional delay can be expected.

## 8.19 Measurements for NR – E-UTRA Dual Connectivity

### 8.19.1 Introduction

This clause contains requirements for UE supporting dual connectivity with NR PCell and E-UTRA PSCell.

Requirements in this clause are applicable to UEs which have been configured with NE-DC. Requirements in this clause are applicable to both E-UTRA FDD and E-UTRA TDD PSCell in combination with an NR PCell.

The application of measurement gap sharing and calculation of carrier specific scaling factor are the same as defined in clause 8.17.1.1 and 8.17.1.2, except that

- The term PCell and PSCell shall be deemed to be swapped, and

- UE is not expected to be configured to identify and measure cells on any of: inter-RAT NR, UTRAN, and GSM carriers.

### 8.19.2 Intra-frequency Measurements

PSCC intra-frequency measurements shall meet all applicable requirements in clause 8.1.2.2. If SCG DRX is in use, then the PCell intra-frequency requirements for when DRX is in use in clause 8.1.2.2 shall apply and shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply. The applicable measurement accuracy requirements are in clause 9.1.

SCC intra-frequency measurements shall meet all applicable requirements in clause 8.3.3. If SCG DRX is in use, then the PCell intra-frequency requirements for when DRX is in use in clause 8.1.2.2 shall apply and shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply. The applicable measurement accuracy requirements are in clause 9.1.

### 8.19.3 Inter-frequency Measurements

The E-UTRAN inter-frequency measurement requirements defined in section 8.19.3 shall apply when the UE capable of NE-DC is operating in NE-DC mode. The requiremenents in section 8.17.3 are applicable for gap pattern id # 0, 1, 2, 3, 4, 6, 7, 8, 10 as specified in Table 8.1.2.1-1.

The same requirements defined in clause 8.17.3 shall apply, except that

- The term EN-DC shall be deemed to be replaced with NE-DC, and

- The MCG DRX shall be deemed to be replaced with SCG DRX.

### 8.19.4 Void

### 8.19.5 Intra-frequency E-CID Measurements

The requirements in this clause shall apply provided the UE has received ECID-RequestLocationInformation message from LMF via LPP requesting the UE to report E-CID UE Rx-Tx Time Difference Measurements and/or E-CID E-UTRAN intra-frequency RSRP and RSRQ measurements [59].

PSCC intra-frequency E-CID measurements shall meet E-UTRAN E-CID intra-frequency measurements requirements in clauses 8.1.2.7.3 and 8.1.2.7.4. If SCG DRX is in use, then the PCell intra-frequency requirements for when DRX is in use in clauses 8.1.2.7.3 and 8.1.2.7.4 shall apply and shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply. The applicable measurement accuracy requirements are in clause 9.1.

SCC intra-frequency E-CID measurements shall meet all applicable requirements in clause 8.3.3. If SCG DRX is in use, then the PCell intra-frequency requirements for when DRX is in use in clause 8.1.2.2 shall apply and shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply. The applicable measurement accuracy requirements are in clause 9.1.

### 8.19.6 Intra-frequency measurements with autonomous gaps

#### 8.19.6.1 Introduction

The requirements for E-UTRAN intra-frequency measurements with autonomous gaps defined in clause 8.19.6 shall apply when the UE is configured with NE-DC operation mode, and the UE is configured by PSCell to identify CGI of an E-UTRA FDD or E-UTRA TDD cell on an E-UTRA serving frequency carrier.

#### 8.19.6.2 E-UTRAN FDD intra frequency measurements with autonomous gaps

The requirements defined in clause 8.1.2.2.3 shall apply.

#### 8.19.6.3 E-UTRAN TDD intra frequency measurements with autonomous gaps

The requirements defined in clause 8.1.2.2.4 shall apply.

### 8.19.7 Inter-frequency measurements with autonomous gaps

#### 8.19.7.1 Introduction

The requirements for E-UTRAN inter-frequency measurement with autonomous gaps defined in section 8.19.7 shall apply when the UE is configured with NE-DC operation mode, and the UE is configured by PSCell to identify CGI of an E-UTRA FDD or E-UTRA TDD cell on an E-UTRA non-serving frequency carrier.

#### 8.19.7.2 E-UTRAN FDD-FDD inter frequency measurements with autonomous gaps

The requirements defined in clause 8.1.2.3.5 shall apply.

#### 8.19.7.3 E-UTRAN TDD-FDD inter frequency measurements with autonomous gaps

The requirements defined in clause 8.1.2.3.6 shall apply.

#### 8.19.7.4 E-UTRAN TDD-TDD inter frequency measurements with autonomous gaps

The requirements defined in clause 8.1.2.3.7 shall apply.

#### 8.19.7.5 E-UTRAN FDD-TDD inter frequency measurements with autonomous gaps

The requirements defined in clause 8.1.2.3.8 shall apply.

## 8.20 Inter-RAT NR Measurements for RedCap UE

### 8.20.1 Introduction

This clause contains requirements on the NR capable E-UTRAN RedCap UE regarding measurement in RRC\_CONNECTED state. The requirements are specified for inter-RAT NR frequency measurements for serving E-UTRAN cell and measurement accuracies are specified in clause 9.

The UE shall be able to identify new inter-RAT NR cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified inter-RAT cells if carrier frequency information is provided by the PCell, even if no explicit neighbour list with physical layer cell identities is provided.

Requirements in this clause are applicable to both E-UTRA FDD and E-UTRA TDD serving cell.

### 8.20.2 E-UTRAN FDD – NR measurements

#### 8.20.2.1 Identification of a new NR cell

When measurement gaps are scheduled, the RedCap UE shall be able to identify a new detectable cell within Tidentify\_irat\_without\_index\_RedCap if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise, UE shall be able to identify a new detectable inter-RAT cell within Tidentify\_irat\_with\_index\_RedCap. The UE shall be able to identify a new detectable inter-RAT SS block of an already detected cell within Tidentify\_irat\_without\_index\_RedCap.

Tidentify\_irat\_without\_index\_RedCap = (TPSS/SSS\_sync\_irat\_RedCap + T SSB\_measurement\_period\_irat\_RedCap) ms

Tidentify\_irat\_with\_index\_RedCap = (TPSS/SSS\_sync\_irat\_RedCap + T SSB\_measurement\_period\_irat\_RedCap + TSSB\_time\_index\_irat\_RedCap) ms

Where:

TPSS/SSS\_sync\_irat\_RedCap: it is the time period used in PSS/SSS detection given in table 8.20.2.1-1 and table 8.20.2.1-2 for 2 Rx RedCap, table 8.20.2.1-1a for 1 Rx RedCap.

TSSB\_time\_index\_irat\_RedCap: it is the time period used to acquire the index of the SSB being measured given in table 8.20.2.1-3 and table 8.20.2.1-4 for 2 Rx RedCap, table 8.20.2.1-3a for 1 Rx RedCap.

TSSB\_measurement\_period\_irat\_RedCap: equal to a measurement period of SSB based measurement given in table 8.20.2.1-5 and table 8.20.2.1-6 for 2 Rx RedCap, table 8.20.2.1-5a for 1 Rx RedCap.

Mpss/sss\_sync\_irat\_RedCap: For a 2 Rx RedCap supporting FR2 power class 7, Mpss/sss\_sync\_irat\_RedCap = 40 samples.

MSSB\_index\_irat\_RedCap: For a 2 Rx RedCap supporting FR2 power class 7, MSSB\_index\_irat\_RedCap = 40 samples.

Mmeas\_period\_irat\_RedCap: For a 2 Rx RedCap supporting FR2 power class 7, Mmeas\_period\_irat = 40 samples.

Nfreq\_RedCap is defined in clause 8.1.2.1.1d.

For per-FR measurement gap capable UE, when serving cell is in E-UTRA and measurement objects are only in FR2,

- UE can perform such measurements without gap, and

- UE fulfils the requirements for FR2 measurement objects based on effective MGRP = 20 ms.

Table 8.20.2.1-1: Time period for PSS/SSS detection for 2 Rx RedCap (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1 | TPSS/SSS\_sync\_irat\_RedCap |
| No DRX | Max(600ms, 8 × Max(MGRP, SMTC period)) × Nfreq\_RedCap |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(8×1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq\_RedCap |
| DRX cycle > 320ms | 8 × DRX cycle × Nfreq\_RedCap |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50]. | |

Table 8.20.2.1-1a: Time period for PSS/SSS detection for 1 Rx RedCap (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1 | TPSS/SSS\_sync\_irat\_RedCap |
| No DRX | Max(600ms, 7 × Max(MGRP, SMTC period)) × Nfreq\_RedCap |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(7 \*1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq\_RedCap |
| DRX cycle > 320ms | 7 × DRX cycle × Nfreq\_RedCap |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50]. | |

Table 8.20.2.1-2: Time period for PSS/SSS detection for 2 Rx RedCap (Frequency range FR2)

|  |  |
| --- | --- |
| **Condition NOTE1** | **TPSS/SSS\_sync\_irat\_RedCap** |
| No DRX | Max(600ms, Mpss/sss\_sync\_irat\_RedCap × Max(MGRP, SMTC period)) × Nfreq\_RedCap |
| DRX cycle ≤ 320ms | Max(600ms, (1.5 × Mpss/sss\_sync\_irat\_RedCap) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq\_RedCap |
| DRX cycle > 320ms | Mpss/sss\_sync\_irat\_RedCap × DRX cycle × Nfreq\_RedCap |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50]. | |

Table 8.20.2.1-3: Time period for time index detection for 2 Rx RedCap (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1 | TSSB\_time\_index\_irat\_RedCap |
| No DRX | Max(120ms, 3 × Max(MGRP, SMTC period)) × Nfreq\_RedCap |
| DRX cycle ≤ 320ms | Max(120ms, Ceil(3 × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq\_RedCap |
| DRX cycle > 320ms | 3 × DRX cycle × Nfreq\_RedCap |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50]. | |

Table 8.20.2.1-3a: Time period for time index detection for 1 Rx RedCap (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1 | TSSB\_time\_index\_irat\_RedCap |
| No DRX | Max(160ms, 6 × Max(MGRP, SMTC period)) × Nfreq\_RedCap |
| DRX cycle ≤ 320ms | Max(160ms, Ceil(6 × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq\_RedCap |
| DRX cycle > 320ms | 6 × DRX cycle × Nfreq\_RedCap |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50]. | |

Table 8.20.2.1-4: Time period for time index detection for 2 Rx RedCap (Frequency range FR2)

|  |  |
| --- | --- |
| Condition NOTE1 | TSSB\_time\_index\_irat\_RedCap |
| No DRX | Max(200ms, MSSB\_index\_irat\_RedCap × Max(MGRP, SMTC period)) × Nfreq\_RedCap |
| DRX cycle ≤ 320ms | Max(200ms, (1.5 × MSSB\_index\_irat\_RedCap) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq\_RedCap |
| DRX cycle > 320ms | MSSB\_index\_irat\_RedCap × DRX cycle × Nfreq\_RedCap |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50]. | |

In the requirements, an NR cell is considered detectable when:

- NR SS-RSRP related conditions in the accuracy requirements in Section 9.11.x are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 of TS 38.133 [50],

- NR SS-RSRQ related conditions in the accuracy requirements in Section 9.11.y are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 of TS 38.133 [50],

- NR SS-SINR related conditions in the accuracy requirements in Section 9.11.z are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 of TS 38.133 [50].

The RedCap UE operating in NR HD-FDD shall meet the current PSS/SSS detection requirements provided that at least 5 SMTC windows are available at the UE during the PSS/SSS detection time.

The RedCap UE operating in NR HD-FDD shall meet the current time index detection requirements provided that at least 3 SMTC windows are available at the UE during the time index detection time.

When measurement gaps are scheduled for NR measurements the UE physical layer shall be capable of reporting NR SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clause 9.11, with measurement period as shown in table 8.20.2.1-5 and 8.20.2.1-6 for 2Rx UE, table 8.20.2.1-5a for 1Rx UE:

Table 8.20.2.1-5: Measurement period for inter-RAT measurements for 2 Rx RedCap (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1 | TSSB\_measurement\_period\_irat\_RedCap |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × Nfreq\_RedCap |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(8 × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq\_RedCap |
| DRX cycle > 320ms | 8 × DRX cycle × Nfreq\_RedCap |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50]. | |

Table 8.20.2.1-5a: Measurement period for inter-RAT measurements for 1 Rx RedCap (Frequency range FR1)

|  |  |
| --- | --- |
| Condition NOTE1 | TSSB\_measurement\_period\_irat\_RedCap |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × Nfreq\_RedCap |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(8 × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq\_RedCap |
| DRX cycle > 320ms | 8 × DRX cycle × Nfreq\_RedCap |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50]. | |

Table 8.20.2.1-6: Measurement period for inter-RAT measurements for 2 Rx RedCap (Frequency range FR2)

|  |  |
| --- | --- |
| Condition NOTE1 | TSSB\_measurement\_period\_irat\_RedCap |
| No DRX | Max(400ms, Mmeas\_period\_irat\_RedCap × Max(MGRP, SMTC period)) × Nfreq\_RedCap |
| DRX cycle ≤ 320ms | Max(400ms, (1.5 × Mmeas\_period\_irat\_RedCap) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq\_RedCap |
| DRX cycle > 320ms | Mmeas\_period\_irat\_RedCap × DRX cycle × Nfreq\_RedCap |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50]. | |

The 2 Rx RedCap UE shall be capable of performing NR SS-RSRP, SS-RSRQ and SS-SINR for up to 7 NR carrier frequencies.

- For each RAT E-UTRAN FDD-NR layer on FR1 or FR2, the UE shall be capable of monitoring at least 4 cells.

- For each RAT E-UTRAN FDD-NR layer on FR1, during each layer 1 measurement period, the UE shall be capable of monitoring at least 7 SSBs with different SSB index and/or PCI on the RAT E-UTRAN FDD-NR layer.

- For each RAT E-UTRAN FDD-NR layer on FR2, during each layer 1 measurement period, the UE shall be capable of monitoring at least 10 SSBs with different SSB index and/or PCI on the RAT E-UTRAN FDD-NR layer. The UE shall be capable of monitoring at least one SSB per cell.

The 1 Rx RedCap UE shall be capable of performing NR SS-RSRP, SS-RSRQ and SS-SINR for up to 6 NR carrier frequencies.

- For each RAT E-UTRAN FDD-NR layer on FR1 or FR2, the UE shall be capable of monitoring at least 4 cells.

- For each RAT E-UTRAN FDD-NR layer on FR1, during each layer 1 measurement period, the UE shall be capable of monitoring at least 7 SSBs with different SSB index and/or PCI on the RAT E-UTRAN FDD-NR layer.

- For each RAT E-UTRAN FDD-NR layer on FR2, during each layer 1 measurement period, the UE shall be capable of monitoring at least 10 SSBs with different SSB index and/or PCI on the RAT E-UTRAN FDD-NR layer. The UE shall be capable of monitoring at least one SSB per cell.

The NR SS-RSRP measurement accuracy for all measured NR cells shall be as specified in clause 9.11.x. The NR SS-RSRQ measurement accuracy for all measured NR cells shall be as specified in clause 9.11.y. The NR SS-SINR measurement accuracy for all measured NR cells shall be as specified in clause 9.11.z.

The RedCap UE operating in NR HD-FDD shall meet the current measurement requirements provided that at least 5 SMTC windows are available at the UE during the measurement period.

#### 8.20.2.2 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

#### 8.20.2.3 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_irat\_without\_index\_RedCap or Tidentify\_irat\_with\_index\_RedCap defined in Clause 8.20.2.1 for the minimum requirements.When L3 filtering is used or IDC autonomous denial or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If an NR cell which has been detectable at least for the time period Tidentify\_irat\_without\_index\_RedCap. or Tidentify\_irat\_with\_index\_RedCap defined in clause 8.20.2.1 for the minimum requirements and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than TSSB\_measurement\_period\_irat\_RedCap defined in clause 8.20.2.1 provided the timing to that cell has not changed more than ±3200 Tc while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

#### 8.20.2.4 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.20.2.3.

### 8.20.3 E-UTRAN TDD – NR measurements

Requirements in this clause shall apply for NR capable E-UTRAN TDD RedCap UE.

The requirements in clause 8.20.2 also apply for this section.

# 9 Measurements performance requirements for UE

One of the key services provided by the physical layer is the measurements used to trigger or perform a multitude of functions. Both the UE and the E-UTRAN are required to perform measurements. The physical layer measurement model and a complete list of measurements are specified in [25] and [22] respectively. The physical layer measurements are described and defined in [4]. In this clause for each measurement the relevant requirements on the measurement period, reporting range, granularity and performance in terms of accuracy are specified.

Since the UE reference sensitivity requirements are different depending on supported band, this is noted in each case with definition of the range Io for each frequency band. Definitions of each frequency bands can be found in [5].

Except for requirements in sections 9.1.2A, 9.1.3A, 9.1.5A and 9.1.6A, the accuracy requirements in this clause are applicable for AWGN radio propagation conditions and assume independent interference (noise) at each receiver antenna port.

## 9.1 E-UTRAN measurements

### 9.1.1 Introduction

The requirements in this clause are applicable for a UE:

- in state RRC\_CONNECTED

- performing measurements with appropriate measurement gaps as defined in Clause 8.1.2.1.

- that is synchronised to the cell that is measured.

The reported measurement result after layer 1 filtering shall be an estimate of the average value of the measured quantity over the measurement period. The reference point for the measurement result after layer 1 filtering is referred to as point B in the measurement model described in [25].

The accuracy requirements in this clause are valid for the reported measurement result after layer 1 filtering. The accuracy requirements are verified from the measurement report at point D in the measurement model having the higher layer filtering disabled.

In the requirements of Section 9 for the UE capable of CA and the UEs configured with up to six downlink SCell(s), the applicable exceptions for side conditions are specified in Annex B, Sections B.4.2 and B.4.3, respectively.

### 9.1.2 Intra-frequency RSRP Accuracy Requirements

#### 9.1.2.1 Absolute RSRP Accuracy

Unless otherwise specified, the requirements for absolute accuracy of RSRP in this clause apply to a cell on the same frequency as that of the serving cell.

The accuracy requirements in Table 9.1.2.1-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

Table 9.1.2.1-1: RSRP Intra frequency absolute accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±4.5 | ±9 | ≥-6 dB | FDD\_A, TDD\_A | -121 | N/A | -70 |
| FDD\_B1, FDD\_B2 | -120.5 | N/A | -70 |
| FDD\_C, TDD\_C | -120 | N/A | -70 |
| FDD\_D | -119.5 | N/A | -70 |
| FDD\_E, TDD\_E | -119 | N/A | -70 |
| FDD\_F | -118.5 | N/A | -70 |
| FDD\_G | -118 | N/A | -70 |
| FDD\_H | -117.5 | N/A | -70 |
| FDD\_N | -114.5 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | FDD\_A, TDD\_A, FDD\_B1, FDD\_B2, FDD\_C, TDD\_C, FDD\_D, FDD\_E, TDD\_E, FDD\_F, FDD\_G, FDD\_H, FDD\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.2.2 Relative Accuracy of RSRP

The relative accuracy of RSRP is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on the same frequency.

The accuracy requirements in Table 9.1.2.2-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.8 for a corresponding Band.

Table 9.1.2.2-1: RSRP Intra frequency relative accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±2 | ±3 | ≥-3 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±3 | ±3 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.2.3 Absolute RSRP Accuracy under Time Domain Measurement Resource Restriction

The requirements for absolute accuracy of RSRP in this clause shall apply to a cell on the same frequency as that of the serving cell when a time domain measurement resource restriction pattern for performing RSRP measurements on this cell is configured by higher layers (TS 36.331 [2]).

The accuracy requirements in Table 9.1.2.3-1 are valid under the following conditions:

Cell specific reference signals in the measured cell are transmitted either from one, two or four antenna ports,

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled,

RSRP|dBm according to Annex B.3.9 for a corresponding Band,

The time domain measurement resource restriction pattern configured for the measured cell indicates at least one subframe per radio frame for performing the RSRP measurement,

Four symbols containing CRS are available in all subframes indicated by the time domain measurement resource restriction pattern.

Table 9.1.2.3-1: RSRP Intra frequency absolute accuracy under time domain measurement resource restriction

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 2 range | | | |
| E-UTRA operating band groups Note 4 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/  15kHz Note 1, 3 | dBm/BWChannel | dBm/BWChannel |
| ±4.5 | ±9 | ≥-4 dB | FDD\_A, TDD\_A | -121 | N/A | -70 |
| FDD\_B1, FDD\_B2 | -120.5 | N/A | -70 |
| FDD\_C, TDD\_C | -120 | N/A | -70 |
| FDD\_D | -119.5 | N/A | -70 |
| FDD\_E, TDD\_E | -119 | N/A | -70 |
| FDD\_F | -118.5 | N/A | -70 |
| FDD\_G | -118 | N/A | -70 |
| FDD\_H | -117.5 | N/A | -70 |
| FDD\_N | -114.5 | N/A | -70 |
| ±8 | ±11 | ≥-4 dB | FDD\_A, TDD\_A, FDD\_B1, FDD\_B2, FDD\_C, TDD\_C, FDD\_D, FDD\_E, TDD\_E, FDD\_F, FDD\_G, FDD\_H, FDD\_N | N/A | -70 | -50 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in that symbol.  NOTE 2: Io is defined in subframes indicated by the time domain measurement resource restriction pattern configured for performing RSRP measurements of this cell. The Io range defined by the minimum and the maximum Io levels applies to CRS and non-CRS symbols. Io may be different in different symbols within a subframe.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

For time domain measurements restriction under colliding CRS with ABS configured in non-MBSFN subframes, requirements in Section 9.1.2.1 apply.

#### 9.1.2.4 Relative Accuracy of RSRP under Time Domain Measurement Resource Restriction

The requirements for relative accuracy of RSRP in this clause shall apply to a cell on the same frequency as that of the serving cell when a time domain measurement resource restriction pattern for performing RSRP measurements for this cell is configured by higher layers (TS 36.331 [2]).

The accuracy requirements in Table 9.1.2.4-1 are valid under the following conditions:

Cell specific reference signals in the measured cell are transmitted either from one, two or four antenna ports,

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled,

RSRP1,2|dBm according to Annex B.3.10 for a corresponding Band,

The time domain measurement resource restriction pattern configured for the measured cell indicates at least one subframe per radio frame for performing the RSRP measurement,

Four symbols containing CRS are available in all subframes indicated by the time domain measurement resource restriction pattern.

Table 9.1.2.4-1: RSRP Intra frequency relative accuracy under time domain measurement resource restriction

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 3 range | | |
| E-UTRA operating band groups Note 6 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/  15kHz Note 1, 5 | dBm/BWChannel |
| ±2 | ±3 | ≥-2 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±3 | ±3 | ≥-4 dB | Note 4 | Note 4 | Note 4 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in that symbol.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: Io is defined in subframes indicated by the time domain measurement resource restriction pattern configured for performing RSRP measurements of this cell. The Io range defined by the minimum and the maximum Io levels applies to CRS and non-CRS symbols. Io may be different in different symbols within a subframe.  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 5: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 6: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

For time domain measurements restriction under colliding CRS with ABS configured in non-MBSFN subframes, requirements in Section 9.1.2.2 apply.

#### 9.1.2.5 Absolute RSRP Accuracy under Time Domain Measurement Resource Restriction with CRS assistance information

The requirements for absolute accuracy of RSRP in this clause shall apply to a cell on the same frequency as that of the serving cell when a time domain measurement resource restriction pattern for performing RSRP measurements on this cell is configured by higher layers (TS 36.331 [2]) and the CRS assistance information is provided. The requirements apply for UEs supporting CRS interference handling.

The accuracy requirements in Table 9.1.2.5-1 are valid under the following conditions:

Cell specific reference signals in the measured cell are transmitted either from one, two or four antenna ports,

Conditions defined in 36.101 Secion 7.3 for reference sensitivity are fulfilled,

RSRP|dBm according to Annex B.3.11 for a corresponding Band,

The time domain measurement resource restriction pattern configured for the measured cell indicates at least one subframe per radio frame for performing the RSRP measurement,

Four symbols containing CRS are available in all subframes indicated by the time domain measurement resource restriction pattern,

The UE is provided with the CRS assistance information (TS 36.331 [2]) and the CRS assistance information is valid throughout the entire evaluation period.

The requirements in this section shall also be met when the number of transmit antenna ports [16] of one or more cells whose CRS assistance information is provided [2] is different from the number of transmit antenna ports of the measured cell.

Table 9.1.2.5-1: RSRP Intra frequency absolute accuracy under Time Domain Measurement Resource Restriction with CRS assistance information

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 2 range | | | |
| E-UTRA operating band groups Note 4 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 1, 3 | dBm/BWChannel | dBm/BWChannel |
| ±4.5 | ±9 | ≥-9.46 | FDD\_A, TDD\_A | -121 | N/A | -70 |
| FDD\_B1, FDD\_B2 | -120.5 | N/A | -70 |
| FDD\_C, TDD\_C | -120 | N/A | -70 |
| FDD\_D | -119.5 | N/A | -70 |
| FDD\_E, TDD\_E | -119 | N/A | -70 |
| FDD\_F | -118.5 | N/A | -70 |
| FDD\_G | -118 | N/A | -70 |
| FDD\_H | -117.5 | N/A | -70 |
| FDD\_N | -114.5 | N/A | -70 |
| ±8 | ±11 | ≥-9.46 | FDD\_A, TDD\_A, FDD\_B1, FDD\_B2, FDD\_C, TDD\_C, FDD\_D, FDD\_E, TDD\_E, FDD\_F, FDD\_G, FDD\_H, FDD\_N | N/A | -70 | -50 |
| NOTE 1: This Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Io is defined in subframes indicated by the time domain measurement resource restriction pattern configured for performing RSRP measurements of this cell. The specified Io range applies to CRS and non-CRS symbols. Io may be different in different symbols within a subframe.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.2.6 Relative Accuracy of RSRP under Time Domain Measurement Resource Restriction with CRS assistance information

The requirements for relative accuracy of RSRP in this clause shall apply to a cell on the same frequency as that of the serving cell when a time domain measurement resource restriction pattern for performing RSRP measurements for this cell is configured by higher layers (TS 36.331 [2]) and the CRS assistance information is provided. The requirements apply for UEs supporting CRS interference handling.

The accuracy requirements in Table 9.1.2.6-1 are valid under the following conditions:

Cell specific reference signals in the measured cell are transmitted either from one, two or four antenna ports,

Conditions defined in 36.101 Section 7.3 for reference sensitivity are fulfilled,

RSRP1,2|dBm according to Annex B.3.12 for a corresponding Band,

The time domain measurement resource restriction pattern configured for the measured cell indicates at least one subframe per radio frame for performing the RSRP measurement,

Four symbols containing CRS are available in all subframes indicated by the time domain measurement resource restriction pattern,

The UE is provided with the CRS assistance information (TS 36.331 [2]) and the CRS assistance information is valid throughout the entire evaluation period.

The requirements in this section shall also be met also when the number of transmit antenna ports [16] of one or more cells whose CRS assistance information is provided [2] is different from the number of transmit antenna ports of the measured cell.

Table 9.1.2.6-1: RSRP Intra frequency relative accuracy under Time Domain Measurement Resource Restriction with CRS assistance information

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2, 6 | Io Note 3 range | | |
| E-UTRA operating band groups Note 7 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 1, 5 | dBm/BWChannel |
| ±2 | ±3 | ≥-6.96 | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±3 | ±3 | ≥-9.46 | Note 4 | Note 4 | Note 4 |
| NOTE 1: This Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: Io is defined in subframes indicated by the time domain measurement resource restriction pattern configured for performing RSRP measurements of this cell. The specified Io range applies to CRS and non-CRS symbols. Io may be different in different symbols within a subframe.  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 5: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 6: The gap between the Es/Iot level in table 9.1.2.6-1 and 9.1.2.4-1 is due to the interference from either PCell or at least one neighbour cell indicated within the CRS assistance information.  NOTE 7: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.2.7 Absolute RSRP Accuracy for UE Category 1bis

Unless otherwise specified, the requirements for absolute accuracy of RSRP in this clause apply to a cell on the same frequency as that of the serving cell.

The accuracy requirements in Table 9.1.2.7-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

Table 9.1.2.7-1: RSRP Intra frequency absolute accuracy for UE category 1bis

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±5.5 | ±10 | ≥-6 dB | FDD\_A, TDD\_A | -121 | N/A | -70 |
| FDD\_B1 | -120.5 | N/A | -70 |
| FDD\_C, TDD\_C | -120 | N/A | -70 |
| FDD\_D | -119.5 | N/A | -70 |
| FDD\_E, TDD\_E | -119 | N/A | -70 |
| FDD\_F | -118.5 | N/A | -70 |
| FDD\_G | -118 | N/A | -70 |
| FDD\_H | -117.5 | N/A | -70 |
| FDD\_N | -114.5 | N/A | -70 |
| ±9 | ±12 | ≥-6 dB | FDD\_A, TDD\_A, FDD\_B1, FDD\_C, TDD\_C, FDD\_D, FDD\_E, TDD\_E, FDD\_F, FDD\_G, FDD\_H, FDD\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.2.8 Relative Accuracy of RSRP for UE Category 1bis

The relative accuracy of RSRP is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on the same frequency.

The accuracy requirements in Table 9.1.2.8-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.8 for a corresponding Band.

Table 9.1.2.8-1: RSRP Intra frequency relative accuracy for UE category 1bis

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±3 | ±4 | ≥-3 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±4 | ±4 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

### 9.1.2A Intra-frequency RSRP Accuracy Requirements in High Doppler Conditions

The accuracy requirements in this clause are applicable for EVA300 and EVA600 propagation conditions and assume independent interference (noise) at each receiver antenna port. The accuracy requirements in this clause are also applicable for EVA875 and HST875 propagation conditions when *highSpeedEnhancedMeasFlag* or highSpeedEnhMeasFlagSCell-r16 is configured or for HST-SFN972 propagation conditions when highSpeedEnhMeasFlag2-r16 is configured and assume independent interference (noise) at each receiver antenna port.

#### 9.1.2A.1 Absolute RSRP Accuracy in high Doppler conditions

The requirements for absolute accuracy of RSRP in this clause apply to a cell on the same frequency as that of the serving cell.

The accuracy requirements in Table 9.1.2A.1-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

Table 9.1.2A1-1: RSRP Intra frequency absolute accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±6 | ±10.5 | ≥-6 dB | FDD\_A, TDD\_A | -121 | N/A | -70 |
| FDD\_B1, FDD\_B2 | -120.5 | N/A | -70 |
| FDD\_C, TDD\_C | -120 | N/A | -70 |
| FDD\_D | -119.5 | N/A | -70 |
| FDD\_E, TDD\_E | -119 | N/A | -70 |
| FDD\_F | -118.5 | N/A | -70 |
| FDD\_G | -118 | N/A | -70 |
| FDD\_H | -117.5 | N/A | -70 |
| FDD\_N | -114.5 | N/A | -70 |
| ±9.5 | ±12.5 | ≥-6 dB | FDD\_A, TDD\_A, FDD\_B1, FDD\_C, TDD\_C, FDD\_D, FDD\_E, TDD\_E, FDD\_F, FDD\_G, FDD\_H, FDD\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.2A.2 Relative Accuracy of RSRP in high Doppler conditions

The relative accuracy of RSRP is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on the same frequency.

The accuracy requirements in Table 9.1.2A.2-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.8 for a corresponding Band.

Table 9.1.2A.2-1: RSRP Intra frequency relative accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±3.3 | ±4.3 | ≥-3 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±4.3 | ±4.3 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

### 9.1.2B Intra-frequency RSRP Accuracy requirements for CA Idle Mode Measurements

#### 9.1.2B.1 Introduction

The requirements in this clause are applicable for a UE:

- in state RRC\_IDLE

- that is synchronised to the cell that is measured.

The requirements are for absolute accuracy of RSRP.

#### 9.1.2B.2 Intra-frequency Absolute RSRP Accuracy for CA Idle Mode Measurements

Unless otherwise specified, the requirements for absolute accuracy of RSRP in this clause apply to the Idle mode serving cell.

The accuracy requirements in Table 9.1.2B.2-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in TS 36.101 [5] Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.1.1 for a corresponding Band

Table 9.1.2B.2-1: RSRP Intra frequency absolute accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±6 | ±10.5 | ≥-4 dB | FDD\_A, TDD\_A | -121 | N/A | -70 |
| FDD\_B1, FDD\_B2 | -120.5 | N/A | -70 |
| FDD\_C, TDD\_C | -120 | N/A | -70 |
| FDD\_D | -119.5 | N/A | -70 |
| FDD\_E, TDD\_E | -119 | N/A | -70 |
| FDD\_F | -118.5 | N/A | -70 |
| FDD\_G | -118 | N/A | -70 |
| FDD\_H | -117.5 | N/A | -70 |
| FDD\_N | -114.5 | N/A | -70 |
| ±9.5 | ±12.5 | ≥-4 dB | FDD\_A, TDD\_A, FDD\_B1, FDD\_B2, FDD\_C, TDD\_C, FDD\_D, FDD\_E, TDD\_E, FDD\_F, FDD\_G, FDD\_H, FDD\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

### 9.1.3 Inter-frequency RSRP Accuracy Requirements

#### 9.1.3.1 Absolute RSRP Accuracy

The requirements for absolute accuracy of RSRP in this clause apply to a cell that has different carrier frequency from the serving cell.

The accuracy requirements in Table 9.1.3.1-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.3 for a corresponding Band

Table 9.1.3.1-1: RSRP Inter frequency absolute accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±4.5 | ±9 | ≥-6 dB | FDD\_A, TDD\_A | -121 | N/A | -70 |
| FDD\_B1, FDD\_B2 | -120.5 | N/A | -70 |
| FDD\_C, TDD\_C | -120 | N/A | -70 |
| FDD\_D | -119.5 | N/A | -70 |
| FDD\_E, TDD\_E | -119 | N/A | -70 |
| FDD\_F | -118.5 | N/A | -70 |
| FDD\_G | -118 | N/A | -70 |
| FDD\_H | -117.5 | N/A | -70 |
| FDD\_N | -114.5 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | FDD\_A, TDD\_A, FDD\_B1, FDD\_B2, FDD\_C, TDD\_C, FDD\_D, FDD\_E, TDD\_E, FDD\_F, FDD\_G, FDD\_H, FDD\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.3.2 Relative Accuracy of RSRP

The relative accuracy of RSRP in inter frequency case is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on a different frequency.

The accuracy requirements in Table 9.1.3.2-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.4 for a corresponding Band



| Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

Table 9.1.3.2-1: RSRP Inter frequency relative accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±4.5 | ±6 | ≥-6 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.3.3 Absolute RSRP Accuracy for UE Category 1bis

The requirements for absolute accuracy of RSRP in this clause apply to a cell that has different carrier frequency from the serving cell.

The accuracy requirements in Table 9.1.3.3-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.3 for a corresponding Band

Table 9.1.3.3-1: RSRP Inter frequency absolute accuracy for UE category 1bis

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±5.5 | ±10 | ≥-6 dB | FDD\_A, TDD\_A | -121 | N/A | -70 |
| FDD\_B1 | -120.5 | N/A | -70 |
| FDD\_C, TDD\_C | -120 | N/A | -70 |
| FDD\_D | -119.5 | N/A | -70 |
| FDD\_E, TDD\_E | -119 | N/A | -70 |
| FDD\_F | -118.5 | N/A | -70 |
| FDD\_G | -118 | N/A | -70 |
| FDD\_H | -117.5 | N/A | -70 |
| FDD\_N | -114.5 | N/A | -70 |
| ±9 | ±12 | ≥-6 dB | FDD\_A, TDD\_A, FDD\_B1, FDD\_C, TDD\_C, FDD\_D, FDD\_E, TDD\_E, FDD\_F, FDD\_G, FDD\_H, FDD\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.3.4 Relative Accuracy of RSRP for UE Category 1bis

The relative accuracy of RSRP in inter frequency case is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on a different frequency.

The accuracy requirements in Table 9.1.3.4-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.4 for a corresponding Band



| Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

Table 9.1.3.4-1: RSRP Inter frequency relative accuracy for UE category 1bis

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±5.5 | ±7 | ≥-6 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

### 9.1.3A Inter-frequency RSRP Accuracy Requirements in High Doppler Conditions

The accuracy requirements in this clause are applicable for [EVA300 and EVA600] propagation conditions and assume independent interference (noise) at each receiver antenna port.

#### 9.1.3A.1 Absolute RSRP Accuracy in high Doppler conditions

The requirements for absolute accuracy of RSRP in this clause apply to a cell that has different carrier frequency from the serving cell.

The accuracy requirements in Table 9.1.3A.1-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.3 for a corresponding Band

Table 9.1.3A.1-1: RSRP Inter frequency absolute accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±6 | ±10.5 | ≥-6 dB | FDD\_A, TDD\_A | -121 | N/A | -70 |
| FDD\_B1, FDD\_B2 | -120.5 | N/A | -70 |
| FDD\_C, TDD\_C | -120 | N/A | -70 |
| FDD\_D | -119.5 | N/A | -70 |
| FDD\_E, TDD\_E | -119 | N/A | -70 |
| FDD\_F | -118.5 | N/A | -70 |
| FDD\_G | -118 | N/A | -70 |
| FDD\_H | -117.5 | N/A | -70 |
| FDD\_N | -114.5 | N/A | -70 |
| ±9.5 | ±12.5 | ≥-6 dB | FDD\_A, TDD\_A, FDD\_B1, FDD\_C, TDD\_C, FDD\_D, FDD\_E, TDD\_E, FDD\_F, FDD\_G, FDD\_H, FDD\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.3A.2 Relative Accuracy of RSRP in high Doppler conditions

The relative accuracy of RSRP in inter frequency case is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on a different frequency.

The accuracy requirements in Table 9.1.3A.2-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.4 for a corresponding Band



| Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

Table 9.1.3A.2-1: RSRP Inter frequency relative accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±5.8 | ±7.3 | ≥-6 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

### 9.1.3B Inter-frequency RSRP Accuracy requirements for CA Idle Mode Measurements

#### 9.1.3B.1 Introduction

The requirements in this clause are applicable for a UE:

- in state RRC\_IDLE

- that is synchronised to the cell that is measured.

The requirements are for absolute accuracy of RSRP for overlapping and non-overlapping carriers.

#### 9.1.3B.2 Inter-frequency Absolute RSRP Accuracy for Overlapping Carrier

The requirements for absolute accuracy of RSRP of an overlapping carrier when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, in this clause, apply to a cell that has different carrier frequency from the serving cell.

The accuracy requirements in Table 9.1.3B.2-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in TS 36.101 [5] Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.1.2 for a corresponding Band

Table 9.1.3B.2-1: RSRP Inter frequency absolute accuracy for overlapping carrier

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±6 | ±10.5 | ≥-4 dB | FDD\_A, TDD\_A | -121 | N/A | -70 |
| FDD\_B1, FDD\_B2 | -120.5 | N/A | -70 |
| FDD\_C, TDD\_C | -120 | N/A | -70 |
| FDD\_D | -119.5 | N/A | -70 |
| FDD\_E, TDD\_E | -119 | N/A | -70 |
| FDD\_F | -118.5 | N/A | -70 |
| FDD\_G | -118 | N/A | -70 |
| FDD\_H | -117.5 | N/A | -70 |
| FDD\_N | -114.5 | N/A | -70 |
| ±9.5 | ±12.5 | ≥-4 dB | FDD\_A, TDD\_A, FDD\_B1, FDD\_B2, FDD\_C, TDD\_C, FDD\_D, FDD\_E, TDD\_E, FDD\_F, FDD\_G, FDD\_H, FDD\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.3B.3 Inter-frequency Absolute RSRP Accuracy for Overlapping and Non-overlapping Carrier

The requirements for absolute accuracy of RSRP of an overlapping carrier when Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, and a non-overlapping carrier in this clause, apply to a cell that has different carrier frequency from the serving cell.

The accuracy requirements in Table 9.1.3B.3-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in TS 36.101 [5] Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.1.2 for a corresponding Band

Table 9.1.3B.3-1: RSRP Inter frequency absolute accuracy for overlapping and non-overlapping carrier

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±7 | ±11.5 | ≥-4 dB | FDD\_A, TDD\_A | -121 | N/A | -70 |
| FDD\_B1, FDD\_B2 | -120.5 | N/A | -70 |
| FDD\_C, TDD\_C | -120 | N/A | -70 |
| FDD\_D | -119.5 | N/A | -70 |
| FDD\_E, TDD\_E | -119 | N/A | -70 |
| FDD\_F | -118.5 | N/A | -70 |
| FDD\_G | -118 | N/A | -70 |
| FDD\_H | -117.5 | N/A | -70 |
| FDD\_N | -114.5 | N/A | -70 |
| ±10.5 | ±13.5 | ≥-4 dB | FDD\_A, TDD\_A, FDD\_B1, FDD\_B2, FDD\_C, TDD\_C, FDD\_D, FDD\_E, TDD\_E, FDD\_F, FDD\_G, FDD\_H, FDD\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

### 9.1.4 RSRP Measurement Report Mapping

The reporting range of RSRP is defined from -156 dBm to -44 dBm with 1 dB resolution.

The mapping of measured quantity is defined in Table 9.1.4-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 9.1.4-1: RSRP measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| RSRP\_-17 | RSRP< -156 | dBm |
| RSRP\_-16 | -156 ≤ RSRP< -155 | dBm |
| … | … | … |
| RSRP\_-03 | -143 ≤ RSRP< -142 | dBm |
| RSRP\_-02 | -142 ≤ RSRP< -141 | dBm |
| RSRP\_-01 | -141 ≤ RSRP< -140 | dBm |
| RSRP\_00 | RSRP < -140 | dBm |
| RSRP\_01 | -140 ≤ RSRP < -139 | dBm |
| RSRP\_02 | -139 ≤ RSRP < -138 | dBm |
| … | … | … |
| RSRP\_95 | -46 ≤ RSRP < -45 | dBm |
| RSRP\_96 | -45 ≤ RSRP < -44 | dBm |
| RSRP\_97 | -44 ≤ RSRP | dBm |

### 9.1.5 Intra-frequency RSRQ Accuracy Requirements

#### 9.1.5.1 Absolute RSRQ Accuracy

The requirements for absolute accuracy of RSRQ in this clause apply to a cell on the same frequency as that of the serving cell.

The accuracy requirements in Table 9.1.5.1-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

Table 9.1.5.1-1: RSRQ Intra frequency absolute accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±2.5 | ±4 | ≥-3 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±3.5 | ±4 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.5.2 Absolute RSRQ Accuracy under Time Domain Measurement Resource Restriction

The requirements for absolute accuracy of RSRQ in this clause shall apply to a cell on the same frequency as that of the serving cell when a time domain measurement resource restriction pattern for performing RSRQ measurements of this cell is configured by higher layers (TS 36.331 [2]).

The accuracy requirements in Table 9.1.5.2-1 are valid under the following conditions:

Cell specific reference signals in the measured cell are transmitted either from one, two or four antenna ports,

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled,

RSRP|dBm according to Annex B.3.9 for a corresponding Band,

The time domain measurement resource restriction pattern configured for the measured cell indicates at least one subframe per radio frame for performing the RSRQ measurement,

The RSRQ measurement is not performed in any subframe other than those indicated by the time domain measurement resource restriction pattern configured for the measured cell,

Four symbols containing CRS are available in all subframes indicated by the time domain measurement resource restriction pattern.

Table 9.1.5.2-1: RSRQ Intra frequency absolute accuracy under time domain measurement resource restriction

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 2 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/  15kHz Note 1, 4 | dBm/BWChannel |
| ±2.5 | ±4 | ≥-2 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±3.5 | ±4 | ≥-4 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in that symbol.  NOTE 2: Io is defined in subframes indicated by the time domain measurement resource restriction pattern configured for performing RSRQ measurements of this cell. The Io range defined by the minimum and the maximum Io levels applies to CRS and non-CRS symbols. Io may be different in different symbols within a subframe.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

For time domain measurements restriction under colliding CRS with ABS configured in non-MBSFN subframes, requirements in Section 9.1.5.1 apply.

#### 9.1.5.3 Absolute RSRQ Accuracy under Time Domain Measurement Resource Restriction with CRS assistance information

The requirements for absolute accuracy of RSRQ in this section shall apply to a cell on the same frequency as that of the serving cell when a time domain measurement resource restriction pattern for performing RSRQ measurements of this cell is configured by higher layers (TS 36.331 [2]) and the CRS assistance information is provided. The requirements apply for UEs supporting CRS interference handling.

The accuracy requirements in Table 9.1.5.3-1 are valid under the following conditions:

Cell specific reference signals in the measured cell are transmitted either from one, two or four antenna ports,

Conditions defined in 36.101 Section 7.3 for reference sensitivity are fulfilled,

RSRP|dBm according to Annex B.3.11 for a corresponding Band,

The time domain measurement resource restriction pattern configured for the measured cell indicates at least one subframe per radio frame for performing the RSRQ measurement,

The RSRQ measurement is not performed in any subframe other than those indicated by the time domain measurement resource restriction pattern configured for the measured cell,

Four symbols containing CRS are available in all subframes indicated by the time domain measurement resource restriction pattern,

The UE is provided with the CRS assistance information (TS 36.331 [2]) and the CRS assistance information is valid throughout the entire evaluation period.

The requirements in this section shall also be met when the number of transmit antenna ports [16] of one or more cells whose CRS assistance information is provided [2] is different from the number of transmit antenna ports of the measured cell.

Table 9.1.5.3-1: RSRQ Intra frequency absolute accuracy under Time Domain Measurement Resource Restriction with CRS assistance information

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 5 | Io Note 2 range | | |
| E-UTRA operating band groups Note 6 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 1, 4 | dBm/BWChannel |
| ±2.5 | ±4 | ≥-6.96 | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±3.5 | ±4 | ≥-9.46 | Note 3 | Note 3 | Note 3 |
| NOTE 1: This Io condition is expressed as the average Io per RE over all REs in that symbol.  NOTE 2: Io is defined in subframes indicated by the time domain measurement resource restriction pattern configured for performing RSRQ measurements of this cell. The specified Io range applies to CRS and non-CRS symbols. Io may be different in different symbols within a subframe.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: The gap between the Es/Iot level in table 9.1.5.3-1 and 9.1.5.2-1 is due to the interference from either PCell or at least one neighbour cell indicated within the CRS assistance information.  NOTE 6: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.5.4 Absolute WB-RSRQ Accuracy

The requirements in this section shall apply when the measurement configuration message received by the UE contains *widebandRSRQ-Meas* parameter in TS 36.331 [2]. The WB-RSRQ accuracy figures in Table 9.1.5.4-1are relative to the value that would be obtained by using the *AllowedMeasBandwidth* in TS 36.331 [2].

The accuracy requirements in Table 9.1.5.4-1 are valid under the following conditions:

The value of the parameter, *AllowedMeasBandwidth* in TS 36.331 [2], is 50 resource blocks or larger

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in TS 36.101 [5] Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band.

Table 9.1.5.4-1: WB-RSRQ Intra frequency absolute accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot  Note 3 | Io1-Io2 Note 2 | Iorange Note 1 | | |
| E-UTRA operating band groups Note 6 | Minimum Io Note 5 | Maximum Io |
| dB | dB | dB | dB |  | dBm/15kHz | dBm/BWChannel |
| ±2.5 | ±4 | ≥-3 dB | 0 ≤Io1-Io2 | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±3.5 | ±4 | ≥-6 dB | Note 4 | Note 4 | Note 4 |
| NOTE 1: Io is the average across all the resource blocks within the *AllowedMeasBandwidth* in TS 36.331 [2].  NOTE 2: Io1 is the Io level in the resource blocks other than central 6 resource blocks within the *AllowedMeasBandwidth* in TS 36.331 [2] and Io2 is the Io level in central 6 resource blocks. The Io1 and Io2 have the same range as defined for Io.  NOTE 3: Iot is the received power spectrum density of total interference and noise for all the resource blocks, other than central 6 resource blocks.  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 5: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 6: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.5.5 Absolute RSRQ Accuracy for UE Category 1bis

The requirements for absolute accuracy of RSRQ in this clause apply to a cell on the same frequency as that of the serving cell.

The accuracy requirements in Table 9.1.5.5-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

Table 9.1.5.5-1: RSRQ Intra frequency absolute accuracy for UE category 1bis

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±3.5 | ±5 | ≥-3 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±4.5 | ±5 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

### 9.1.5A Intra-frequency RSRQ Accuracy Requirements in High Doppler Conditions

The accuracy requirements in this clause are applicable for EVA300 and EVA600 propagation conditions and assume independent interference (noise) at each receiver antenna port. The accuracy requirements in this clause are also applicable for EVA875 and HST875 propagation conditions when *highSpeedEnhancedMeasFlag* or highSpeedEnhMeasFlagSCell-r16 is configured or for HST-SFN972 propagation conditions when *highSpeedEnhMeasFlag2-r16* is configured and assume independent interference (noise) at each receiver antenna port.

#### 9.1.5A.1 Absolute RSRQ Accuracy in high Doppler conditions

The requirements for absolute accuracy of RSRQ in this clause apply to a cell on the same frequency as that of the serving cell.

The accuracy requirements in Table 9.1.5A.1-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

Table 9.1.5A.1-1: RSRQ Intra frequency absolute accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±4 | ±5.5 | ≥-3 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±5 | ±5.5 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

### 9.1.5B Intra-frequency RSRQ Accuracy requirements for CA Idle Mode Measurements

#### 9.1.5B.1 Introduction

The requirements in this clause are applicable for a UE:

- in state RRC\_IDLE

- that is synchronised to the cell that is measured.

The requirements are for absolute accuracy of RSRQ.

#### 9.1.5B.2 Intra-frequency Absolute RSRQ Accuracy for CA Idle Mode Measurements

Unless otherwise specified, the requirements for absolute accuracy of RSRQ in this clause apply to the Idle mode serving cell.

The accuracy requirements in Table 9.1.5B.2-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in TS 36.101 [5] Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.1.1 for a corresponding Band

Table 9.1.5B.2-1: RSRQ Intra frequency absolute accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±4 | ±5.5 | ≥-3 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±5 | ±5.5 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

### 9.1.6 Inter-frequency RSRQ Accuracy Requirements

#### 9.1.6.1 Absolute RSRQ Accuracy

The requirements for absolute accuracy of RSRQ in this clause apply to a cell that has different carrier frequency from the serving cell.

The accuracy requirements in Table 9.1.6.1-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.3 for a corresponding Band

Table 9.1.6.1-1: RSRQ Inter frequency absolute accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±2.5 | ±4 | ≥-3 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±3.5 | ±4 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.6.2 Relative Accuracy of RSRQ

The relative accuracy of RSRQ in inter frequency case is defined as the RSRQ measured from one cell compared to the RSRQ measured from another cell on a different frequency.

The accuracy requirements in Table 9.1.6.2-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.4 for a corresponding Band



| Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

Table 9.1.6.2-1: RSRQ Inter frequency relative accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±3 | ±4 | ≥-3 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±4 | ±4 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.6.3 Absolute WB-RSRQ Accuracy

The requirements in this section shall apply when the measurement configuration message received by the UE contains *widebandRSRQ-Meas* parameter in TS 36.331 [2]. The WB-RSRQ accuracy figures in Table 9.1.6.3-1are relative to the value that would be obtained by using the *AllowedMeasBandwidth* in TS 36.331 [2].

The accuracy requirements in Table 9.1.6.3-1 are valid under the following conditions:

The value of the parameter, *AllowedMeasBandwidth* in TS 36.331 [2], is 50 resource blocks or larger

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in TS 36.101 [5] Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band.

Table 9.1.6.3-1: WB-RSRQ Inter frequency absolute accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot  Note 3 | Io1-Io2 Note 2 | Iorange Note 1 | | |
| E-UTRA operating band groups Note 6 | Minimum Io Note 5 | Maximum Io |
| dB | dB | dB | dB |  | dBm/15kHz | dBm/BWChannel |
| ±2.5 | ±4 | ≥-3 dB | 0 ≤Io1-Io2 | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±3.5 | ±4 | ≥-6 dB | Note 4 | Note 4 | Note 4 |
| NOTE 1: Io is the average across all the resource blocks within the *AllowedMeasBandwidth* in TS 36.331 [2].  NOTE 2: Io1 is the Io level in the resource blocks other than central 6 resource blocks within the *AllowedMeasBandwidth* in TS 36.331 [2] and Io2 is the Io level in central 6 resource blocks. The Io1 and Io2 have the same range as defined for Io.  NOTE 3: Iot is the received power spectrum density of total interference and noise for all the resource blocks, other than central 6 resource blocks.  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 5: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 6: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.6.4 Relative WB-RSRQ Accuracy

The requirements in this section shall apply when the measurement configuration message received by the UE contains *widebandRSRQ-Meas* parameter in TS 36.331 [2]. The WB-RSRQ accuracy figures in Table 9.1.6.4-1are relative to the value that would be obtained by using the *AllowedMeasBandwidth* in TS 36.331 [2].

The accuracy requirements in Table 9.1.6.4-1 are valid under the following conditions:

The value of the parameter, *AllowedMeasBandwidth* in TS 36.331 [2], is 50 resource blocks or larger for the measured cells from different frequencies

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in TS 36.101 [5] Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.4 for a corresponding Band



| Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

Table 9.1.6.4-1: WB-RSRQ Inter frequency relative accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot  Note 3 | Io1-Io2 Note 2 | Iorange Note 1 | | |
| E-UTRA operating band groups Note 6 | Minimum Io Note 5 | Maximum Io |
| dB | dB | dB | dB |  | dBm/15kHz | dBm/BWChannel |
| ±3 | ±4 | ≥-3 dB | 0 ≤Io1-Io2 | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±4 | ±4 | ≥-6 dB | Note 4 | Note 4 | Note 4 |
| NOTE 1: Io is the average across all the resource blocks within the *AllowedMeasBandwidth* in TS 36.331 [2].  NOTE 2: Io1 is the Io level in the resource blocks other than central 6 resource blocks within the *AllowedMeasBandwidth* in TS 36.331 [2] and Io2 is the Io level in central 6 resource blocks. The Io1 and Io2 have the same range as defined for Io.  NOTE 3: Iot is the received power spectrum density of total interference and noise for all the resource blocks, other than central 6 resource blocks. The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 5: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 6: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.6.5 Absolute RSRQ Accuracy for UE Category 1bis

The requirements for absolute accuracy of RSRQ in this clause apply to a cell that has different carrier frequency from the serving cell.

The accuracy requirements in Table 9.1.6.5-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.3 for a corresponding Band

Table 9.1.6.5-1: RSRQ Inter frequency absolute accuracy for UE category 1bis

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±3.5 | ±5 | ≥-3 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±4.5 | ±5 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.6.6 Relative Accuracy of RSRQ for UE Category 1bis

The relative accuracy of RSRQ in inter frequency case is defined as the RSRQ measured from one cell compared to the RSRQ measured from another cell on a different frequency.

The accuracy requirements in Table 9.1.6.6-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.4 for a corresponding Band



| Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

Table 9.1.6.6-1: RSRQ Inter frequency relative accuracy for UE category 1bis

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±4 | ±5 | ≥-3 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±5 | ±5 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

### 9.1.6A Inter-frequency RSRQ Accuracy Requirements in High Doppler Conditions

The accuracy requirements in this clause are applicable for EVA300 and EVA600 propagation conditions and assume independent interference (noise) at each receiver antenna port.

#### 9.1.6A.1 Absolute RSRQ Accuracy in high Doppler conditions

The requirements for absolute accuracy of RSRQ in this clause apply to a cell that has different carrier frequency from the serving cell.

The accuracy requirements in Table 9.1.6A.1-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.3 for a corresponding Band

Table 9.1.6A.1-1: RSRQ Inter frequency absolute accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±4 | ±5.5 | ≥-3 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±5 | ±5.5 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.6A.2 Relative Accuracy of RSRQ in high Doppler conditions

The relative accuracy of RSRQ in inter frequency case is defined as the RSRQ measured from one cell compared to the RSRQ measured from another cell on a different frequency.

The accuracy requirements in Table 9.1.6A.2-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.4 for a corresponding Band



| Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

Table 9.1.6A.2-1: RSRQ Inter frequency relative accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±3.5 | ±5.0 | ≥-3 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±4.5 | ±5.0 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

### 9.1.6B Inter-frequency absolute RSRQ Accuracy requirements for CA Idle Mode Measurements

#### 9.1.6B.1 Introduction

The requirements in this clause are applicable for a UE:

- in state RRC\_IDLE

- that is synchronised to the cell that is measured.

The requirements are for absolute accuracy of RSRQ for overlapping and non-overlapping carriers.

#### 9.1.6B.2 Inter-frequency Absolute RSRQ Accuracy for Overlapping Carrier

The requirements for absolute accuracy of RSRQ for an overlapping carrier when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ in this clause, apply to a cell that has different carrier frequency from the serving cell.

The accuracy requirements in Table 9.1.6B.2-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in TS 36.101 [5] Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.1.2 for a corresponding Band

Table 9.1.6B.2-1: RSRQ Inter frequency absolute accuracy for overlapping carrier

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±4 | ±5.5 | ≥-3 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±5 | ±5.5 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.6B.3 Inter-frequency absolute RSRQ Accuracy for Overlapping and Non-overlapping Carrier

The requirements for absolute accuracy of RSRQ for and overlapping carrier when Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ and a non-overlapping carrier in this clause apply to a cell that has different carrier frequency from the serving cell.

The accuracy requirements in Table 9.1.6B.3-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in TS 36.101 [5] Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.1.2 for a corresponding Band

Table 9.1.6B.3-1: RSRQ Inter frequency absolute accuracy for overlapping and non-overlapping carrier

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±5 | ±6.5 | ≥-3 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±6 | ±6.5 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

### 9.1.7 RSRQ Measurement Report Mapping

The reporting range of RSRQ is defined from -34 dB to 2.5 dB with 0.5 dB resolution.

The mapping of measured quantity is defined in table 9.1.7-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 9.1.7-1: RSRQ measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| RSRQ\_-30 | RSRQ < -34 | dB |
| RSRQ\_-29 | -34 ≤ RSRQ < -33.5 | dB |
| … | … | … |
| RSRQ\_-02 | -20.5 ≤ RSRQ < -20 | dB |
| RSRQ\_-01 | -20 ≤ RSRQ < -19.5 | dB |
| RSRQ\_00 | RSRQ < -19.5 | dB |
| RSRQ\_01 | -19.5 ≤ RSRQ < -19 | dB |
| RSRQ\_02 | -19 ≤ RSRQ < -18.5 | dB |
| … | … | … |
| RSRQ\_32 | -4 ≤ RSRQ < -3.5 | dB |
| RSRQ\_33 | -3.5 ≤ RSRQ < -3 | dB |
| RSRQ\_34 | -3 ≤ RSRQ | dB |
| RSRQ\_35 | -3 ≤ RSRQ < -2.5 | dB |
| RSRQ\_36 | -2.5 ≤ RSRQ < -2 | dB |
| … | … | … |
| RSRQ\_45 | 2 ≤ RSRQ < 2.5 | dB |
| RSRQ\_46 | 2.5 ≤ RSRQ | dB |

Note: The ranges from RSRQ\_-30 to RSRQ\_-01 and from RSRQ\_35 to RSRQ\_46 apply for the UE who can support extended RSRQ range in [31].

### 9.1.8 Power Headroom

The requirements in this clause shall apply for power headroom Type 1 and for power headroom Type 2, which are specified in clause 5.1.1.2 in [3].

For a UE not configured with a secondary cell, the power headroom provides the serving eNB with information about the differences between the UE configured maximum output power (PCMAX,) defined in TS 36.101 [5] and the estimated power for UL-SCH transmission of the serving cell [3]. In this case the UE shall meet requirements for power headroom Type 1.

For a UE configured with a secondary cell, the power headroom provides the serving eNB with information about the differences between the UE configured maximum output power (PCMAX,c) defined in TS 36.101[5] and the estimated power for UL-SCH transmission per activated serving cell c, or the estimated power for simultaneous PUSCH and PUCCH transmission on PCell [3]. In this case the UE shall meet requirements for both power headroom Type 1 and Type 2.

#### 9.1.8.1 Period

The reported power headroom shall be estimated over 1 subframe or 1 slot or subslot in use by the UE for the uplink.

When *extendedPHR* is not configured [17], the Type 1 power headroom shall be estimated for the primary serving cell as defined in clause 5.1.1.2 in TS 36.213 [3].

When *extendedPHR* is configured [17], the Type 1 and Type 2 power headroom shall be estimated for each activated serving cell with configured uplink as defined in clause 5.1.1.2 in TS 36.213 [3].

#### 9.1.8.2 Reporting Delay

The power headroom reporting delay is defined as the time between the beginning of the power headroom reference period and the time when the UE starts transmitting the power headroom over the radio interface. The reporting delay of the power headroom shall be 0 ms, which is applicable for all configured triggering mechanisms for power headroom reporting.

#### 9.1.8.3 Void

#### 9.1.8.4 Report Mapping

The power headroom reporting range is from -23 ...+40 dB. Table 9.1.8.4-1 defines the report mapping.

Table 9.1.8.4-1: Power headroom report mapping

|  |  |
| --- | --- |
| Reported value | Measured quantity value (dB) |
| POWER\_HEADROOM\_0 | -23 ≤ PH < -22 |
| POWER\_HEADROOM\_1 | -22 ≤ PH < -21 |
| POWER\_HEADROOM\_2 | -21 ≤ PH < -20 |
| POWER\_HEADROOM\_3 | -20 ≤ PH < -19 |
| POWER\_HEADROOM\_4 | -19 ≤ PH < -18 |
| POWER\_HEADROOM\_5 | -18 ≤ PH < -17 |
| … | … |
| POWER\_HEADROOM\_57 | 34 ≤ PH < 35 |
| POWER\_HEADROOM\_58 | 35 ≤ PH < 36 |
| POWER\_HEADROOM\_59 | 36 ≤ PH < 37 |
| POWER\_HEADROOM\_60 | 37 ≤ PH < 38 |
| POWER\_HEADROOM\_61 | 38 ≤ PH < 39 |
| POWER\_HEADROOM\_62 | 39 ≤ PH < 40 |
| POWER\_HEADROOM\_63 | PH ≥ 40 |

### 9.1.9 UE Rx – Tx time difference

#### 9.1.9.1 Measurement Requirement

The UE RX-TX time difference is measured from the PCell.

The accuracy requirements in Table 9.1.9.1-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

No changes to the uplink transmission timing are applied during the measurement period.

RSRP|dBm according to Annex B.3.5 for a corresponding Band

Table 9.1.9.1-1: UE Rx – Tx time difference measurement accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | |
| Ês/Iot | Downlink transmission  bandwidth of PCell | Io Note 1 range | | |
| E-UTRA operating band groups Note 6 | Minimum Io | Maximum Io |
| Ts Note 2 | dB | MHz |  | dBm/15kHz Note 5 | dBm/BWChannel |
| ±20 | ≥-3 dB | ≥1.4 MHz | FDD\_A **Note 7**, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G **Note 4** | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±14 | ≥-3 dB | ≥ 3 MHz | Note 3 | Note 3 | Note 3 |
| ±10 | ≥-3 dB | ≥ 5 MHz | Note 3 | Note 3 | Note 3 |
| ±7 | ≥-3 dB | ≥10 MHz | Note 3 | Note 3 | Note 3 |
| NOTE 1: When in dBm/15kHz, the minimum Io condition is expressed as the average Io per RE over all REs in that symbol. Io may be different in different symbols within a subframe.  NOTE 2: Ts is the basic timing unit defined in TS 36.211.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with downlink bandwidth ≥1.4 MHz.  NOTE 4: Except Band 29.  NOTE 5: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 6: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 7: Except Band 32, Band 75, Band 76. | | | | | |

#### 9.1.9.2 Measurement Report mapping

The reporting range of E-UTRAN FDD UE Rx-Tx time difference is defined from 0 to 20472Ts with 2Ts resolution for UE Rx-Tx time difference less than 4096Ts and 8Ts for UE Rx-Tx time difference equal to or greater than 4096Ts.

The mapping of measured quantity is defined in Table 9.1.9.2-1.

Table 9.1.9.2-1: UE Rx-Tx time difference measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| RX-TX\_TIME\_DIFFERENCE\_0000 | TUE Rx-Tx < 2 | Ts |
| RX-TX\_TIME\_DIFFERENCE\_0001 | 2 ≤ TUE Rx-Tx < 4 | Ts |
| RX-TX\_TIME\_DIFFERENCE\_0002 | 4 ≤ TUE Rx-Tx < 6 | Ts |
| … | … | … |
| RX-TX\_TIME\_DIFFERENCE\_2046 | 4092 ≤ TUE Rx-Tx < 4094 | Ts |
| RX-TX\_TIME\_DIFFERENCE\_2047 | 4094 ≤ TUE Rx-Tx < 4096 | Ts |
| RX-TX\_TIME\_DIFFERENCE\_2048 | 4096 ≤ TUE Rx-Tx < 4104 | Ts |
| RX-TX\_TIME\_DIFFERENCE\_2049 | 4104 ≤ TUE Rx-Tx < 4112 | Ts |
| … | … | … |
| RX-TX\_TIME\_DIFFERENCE\_4093 | 20456 ≤ TUE Rx-Tx < 20464 | Ts |
| RX-TX\_TIME\_DIFFERENCE\_4094 | 20464 ≤ TUE Rx-Tx < 20472 | Ts |
| RX-TX\_TIME\_DIFFERENCE\_4095 | 20472 ≤ TUE Rx-Tx | Ts |

The reporting range of E-UTRAN TDD UE Rx-Tx time difference is defined from 624 to 21096Ts with 2Ts resolution for UE Rx-Tx time difference less than 4720Ts and 8Ts for UE Rx-Tx time difference equal to or greater than 4720Ts.

The mapping of measured quantity is defined in Table 9.1.9.2-2.

Table 9.1.9.2-2: EUTRAN TDD UE Rx-Tx time difference measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| RX-TX\_TIME\_DIFFERENCE\_TDD\_0000 | TUE Rx-Tx < 626 | Ts |
| RX-TX\_TIME\_DIFFERENCE\_TDD\_0001 | 626 ≤ TUE Rx-Tx < 628 | Ts |
| RX-TX\_TIME\_DIFFERENCE\_TDD\_0002 | 628 ≤ TUE Rx-Tx < 630 | Ts |
| … | … | … |
| RX-TX\_TIME\_DIFFERENCE\_TDD\_2046 | 4716 ≤ TUE Rx-Tx < 4718 | Ts |
| RX-TX\_TIME\_DIFFERENCE\_TDD\_2047 | 4718 ≤ TUE Rx-Tx < 4720 | Ts |
| RX-TX\_TIME\_DIFFERENCE\_TDD\_2048 | 4720 ≤ TUE Rx-Tx < 4728 | Ts |
| RX-TX\_TIME\_DIFFERENCE\_TDD\_2049 | 4728 ≤ TUE Rx-Tx < 4736 | Ts |
| … | … | … |
| RX-TX\_TIME\_DIFFERENCE\_TDD\_4093 | 21080 ≤ TUE Rx-Tx < 21088 | Ts |
| RX-TX\_TIME\_DIFFERENCE\_TDD\_4094 | 21088 ≤ TUE Rx-Tx < 21096 | Ts |
| RX-TX\_TIME\_DIFFERENCE\_TDD\_4095 | 21096 ≤ TUE Rx-Tx | Ts |

#### 9.1.9.3 Measurement Requirement under Time Domain Measurement Resource Restriction

The requirements in this section apply for UE configured with a time-domain measurement resource restriction pattern for PCell measurements. The UE Rx-Tx time difference is measured from the Pcell.

The accuracy requirements in Table 9.1.9.3-1 are valid under the following conditions:

- Cell specific reference signals are transmitted either from one, two or four antenna ports,

- Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled,

- No changes to the uplink transmission timing are applied during the measurement period,

RSRP|dBm according to Annex B.3.5 for a corresponding Band,

- The time domain measurement resource restriction pattern configured for the PCell indicates at least one subframe per radio frame for performing the PCell measurements [2],

- Four symbols containing CRS are available in all subframes indicated by the time domain measurement resource restriction pattern.

Table 9.1.9.3-1: UE Rx–Tx time difference measurement accuracy under time domain measurement resource restriction

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | |
| Ês/Iot Note 6 | Downlink transmission bandwidth of PCell | Io Note 1, 5 range | | |
| E-UTRA operating band groups Note 8 | Minimum Io | Maximum Io |
| Ts Note 2 | dB | MHz |  | dBm/15kHz Note 7 | dBm/BWChannel |
| ±20 | ≥-3 dB | ≤ 3 MHz | FDD\_A **Note 9**, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G **Note 4** | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±10 | ≥-3 dB | ≥ 5 MHz | Note 3 | Note 3 | Note 3 |
| NOTE 1: When in dBm/15kHz, the minimum Io condition is expressed as the average Io per RE over all REs in that symbol. Io may be different in different symbols within a subframe.  NOTE 2: Ts is the basic timing unit defined in TS 36.211.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with downlink bandwidth ≤ 3 MHz.  NOTE 4: Except Band 29.  NOTE 5: Io is defined for the subframes indicated by the time-domain measurement resource restriction pattern for serving cell measurements. The specified Io range applies to CRS and non-CRS symbols. Io may be different in different symbols within a subframe.  NOTE 6: CRS Ês/Iot is in subframes indicated for PCell measurements by the time-domain measurement resource restriction pattern.  NOTE 7: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 8: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 9: Except Band 32, Band 75, Band 76**.** | | | | | |

NOTE: It is up to the UE implementation whether the UE Rx-Tx time difference measurement is performed in any subframe or in subframes indicated by the time-domain measurement resource restriction pattern.

#### 9.1.9.4 Measurement Requirement when Time Domain Measurement Resource Restriction Pattern is Configured with CRS Assistance Information

The UE Rx-Tx time difference measurement is performed for the PCell.

For UE configured with a time-domain measurement resource restriction pattern for PCell measurements, the accuracy requirements in Table 9.1.9.4-1 apply provided that the following conditions are met for the PCell:

- PCell cell specific reference signals are transmitted from one, two or four antenna ports,

- Conditions defined in 36.101 Section 7.3 for reference sensitivity are fulfilled,

- No changes to the uplink transmission timing are applied during the measurement period,

- RSRP|dBm according to Annex B.3.13 for a corresponding Band,

- The time domain measurement resource restriction pattern configured for the measured cell indicates at least one subframe per radio frame for performing the RSRP measurement,

- Four symbols containing CRS are available in all subframes indicated by the time domain measurement resource restriction pattern, and

- The UE is provided via PCell with the CRS assistance information (TS 36.331 [2]) and the CRS assistance information is valid throughout the entire evaluation period.

The requirements in this section shall also be met when the number of transmit antenna ports [16] of one or more cells whose CRS assistance information is provided [2] is different from the number of transmit antenna ports of the measured cell.

When the CRS assistance information is provided, the transmission bandwidth [30] in all intra-frequency cells in the CRS assistance information [2] is the same or larger than the transmission bandwidth of the PCell for which measurement is performed.

Table 9.1.9.4-1: UE Rx–Tx time difference measurement accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | |
| CRS  Ês/Iot Note 6 | Downlink transmission bandwidth of PCell | Io range Note 5 | | |
| E-UTRA operating band groups Note 8 | Minimum  Io Note 1, 7 | Maximum  Io |
| Ts Note 2 | dB | MHz |  | dBm/15kHz Note 7 | dBm/BWChannel |
| ±20 | ≥-7.76 | ≤ 3 MHz | FDD\_A **Note 9**, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G **Note 4** | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±10 | ≥-7.76 | ≥ 5 MHz | Note 3 | Note 3 | Note 3 |
| NOTE 1: This Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with downlink bandwidth ≤ 3 MHz.  NOTE 4: Except Band 29.  NOTE 5: Io is defined in subframes indicated for PCell measurements by the time domain measurement resource restriction pattern. The specified Io range applies to CRS and non-CRS symbols. Io may be different in different symbols within a subframe.  NOTE 6: CRS Ês/Iot is in subframes indicated for PCell measurements by the time-domain measurement resource restriction pattern.  NOTE 7: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 8: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 9: Except Band 32, Band 75, Band 76**.** | | | | | |

NOTE: It is up to the UE implementation whether the UE Rx-Tx time difference measurement is performed in any subframe or in subframes indicated by the time-domain measurement resource restriction pattern.

### 9.1.10 Reference Signal Time Difference (RSTD)

NOTE: This measurement is used for UE positioning purposes.

#### 9.1.10.1 Intra-Frequency Accuracy Requirement

The accuracy requirements in Table 9.1.10.1-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.6 for a corresponding Band

There are no measurement gaps overlapping with the PRS subframes of the measured serving cell.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

If using CRS, in addition to PRS, is enabled in the OTDOA assistance data, the CRS measurement bandwidth is not smaller than the minimum PRS bandwidth.

Table 9.1.10.1-1: RSTD measurement accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | |
| PRS Ês/Iot | Minimum PRS  bandwidth, which is minimum of serving cell channel bandwidth and the PRS bandwidths of the reference cell and the measured neighbour cell *i* Note 5 | Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i* | Io Note 7 range | | |
| E-UTRA operating band groups Note 8 | Minimum Io Note 1 | Maximum Io |
| Ts Note 2 | dB | RB |  |  | dBm/15kHz Note 6 | dBm/BWChannel |
| ±15 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | 6 | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±10 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 15 | 6 | Note 4 | Note 4 | Note 4 |
| ±6 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 25 | ≥ 2 | Note 4 | Note 4 | Note 4 |
| ±5 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 50 | ≥ 1 | Note 4 | Note 4 | Note 4 |
| ±4 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 75 | ≥ 1 | Note 4 | Note 4 | Note 4 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 6 RB.  NOTE 5: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 6: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 7: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 8: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.10.2 Inter-Frequency Accuracy Requirement

The accuracy requirements in Table 9.1.10.2-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.7 for a corresponding Band

There are no measurement gaps overlapping with the PRS subframes in cells belonging to the serving carrier frequency.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

If using CRS, in addition to PRS, is enabled in the OTDOA assistance data, the CRS measurement bandwidth is not smaller than the minimum PRS bandwidth.

Table 9.1.10.2-1: RSTD measurement accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | |
| PRS Ês/Iot | Minimum PRS  bandwidth which is minimum of serving cell channel bandwidthNote7 and the PRS bandwidths of the reference cell and the measured neighbour cell *i* | Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i* | Io Note 6 range | | |
| E-UTRA operating band groups Note 8 | Minimum Io Note 1 | Maximum Io |
| Ts Note 2 | dB | RB |  |  | dBm/15kHz Note 5 | dBm/BWChannel |
| ±21 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | 4 NOTE 9 | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±16 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 15 | 4 NOTE 9 | Note 4 | Note 4 | Note 4 |
| ±10 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 25 | ≥ 2 NOTE 9 | Note 4 | Note 4 | Note 4 |
| ±9 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 50 | ≥ 1 | Note 4 | Note 4 | Note 4 |
| ±8 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 75 | ≥ 1 | Note 4 | Note 4 | Note 4 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 6 RB.  NOTE 5: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 6: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 7: If a CA capable UE is configured with one or two SCell(s), the serving cell channel bandwidth is the minimum of the serving cell channel bandwidths in the component carriers involved in the RSTD measurement. If any of the serving cells is not involved in this RSTD measurement for CA, the channel bandwidth of that serving cell is not included in the determination of the minimum PRS bandwidth.  NOTE 8: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 9: Requirement is not applicable if gap pattern with ID=2 or ID=3 is in use. | | | | | | |

#### 9.1.10.3 RSTD Measurement Report Mapping

The reporting range of RSTD is defined from -15391Ts to 15391Ts with 1Ts resolution for absolute value of RSTD less or equal to 4096Ts and 5Ts for absolute value of RSTD greater than 4096Ts.

The mapping of measured quantity is defined in Table 9.1.10.3-1.

Table 9.1.10.3-1: RSTD report mapping

|  |  |  |
| --- | --- | --- |
| Reported Value | Measured Quantity Value | Unit |
| RSTD\_0000 | -15391 > RSTD | Ts |
| RSTD\_0001 | -15391 ≤ RSTD < -15386 | Ts |
| … | … | … |
| RSTD\_2258 | -4106 ≤ RSTD < -4101 | Ts |
| RSTD\_2259 | -4101 ≤ RSTD < -4096 | Ts |
| RSTD\_2260 | -4096 ≤ RSTD < -4095 | Ts |
| RSTD\_2261 | -4095 ≤ RSTD < -4094 | Ts |
| … | … | … |
| RSTD\_6353 | -3 ≤ RSTD < -2 | Ts |
| RSTD\_6354 | -2 ≤ RSTD < -1 | Ts |
| RSTD\_6355 | -1 ≤ RSTD ≤ 0 | Ts |
| RSTD\_6356 | 0 < RSTD ≤ 1 | Ts |
| RSTD\_6357 | 1 < RSTD ≤ 2 | Ts |
| RSTD\_6358 | 2 < RSTD ≤ 3 | Ts |
| … | … | … |
| RSTD\_10450 | 4094 < RSTD ≤ 4095 | Ts |
| RSTD\_10451 | 4095 < RSTD ≤ 4096 | Ts |
| RSTD\_10452 | 4096 < RSTD ≤ 4101 | Ts |
| RSTD\_10453 | 4101 < RSTD ≤ 4106 | Ts |
| … | … | … |
| RSTD\_12709 | 15381 < RSTD ≤ 15386 | Ts |
| RSTD\_12710 | 15386 < RSTD ≤ 15391 | Ts |
| RSTD\_12711 | 15391 < RSTD | Ts |

#### 9.1.10.4 Higher-Resolution RSTD Measurement Report Mapping

The reporting range of higher-resolution RSTD is defined from -15391 Ts to 15391 Ts with 0.5 Ts resolution.

The UE shall report a reference quantity based on Table 9.1.10.3-1 and a relative quantity  defined in Table 9.1.10.4-1, so that the difference between the measured RSTD quantity and the lower bound of the corresponding range from Table 9.1.10.3-1 is between  and + *resolutionStep*.

RSTD\_delta\_0 or RSTD\_delta\_1 specified in Table 9.1.10.4-1 can be reported together with any value from Table 9.1.10.3-1 in the range from RSTD\_2260 to RSTD\_10451. In this case, *resolutionStep* is 0.5.

Any relative quantity value from Table 9.1.10.4-1, except RSTD\_delta\_1, can be reported together with any value from Table 9.1.10.3-1 in the range from RSTD\_0000 to RSTD\_2259 or in the range from RSTD\_10452 to RSTD\_12711. In this case, *resolutionStep* is 1.0.

Table 9.1.10.4-1: Relative quantity mapping for higher-resolution RSTD measurement reporting

|  |  |  |
| --- | --- | --- |
| Reported Relative Quantity Value | Measured Relative Quantity Value, | Unit |
| RSTD\_delta\_0 | 0 | Ts |
| RSTD\_delta\_1 | 0.5 | Ts |
| RSTD\_delta\_2 | 1.0 | Ts |
| RSTD\_delta\_3 | 2.0 | Ts |
| RSTD\_delta\_4 | 3.0 | Ts |
| RSTD\_delta\_5 | 4.0 | Ts |

#### 9.1.10.5 Intra-Frequency Accuracy Requirement for UE Category 1bis

The accuracy requirements in Table 9.1.10.5-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.6 for a corresponding Band

There are no measurement gaps overlapping with the PRS subframes of the measured serving cell.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

Table 9.1.10.5-1: RSTD measurement accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | |
| PRS Ês/Iot | Minimum PRS  bandwidth, which is minimum of serving cell channel bandwidth and the PRS bandwidths of the reference cell and the measured neighbour cell *i* Note 5 | Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i* | Io Note 7 range | | |
| E-UTRA operating band groups Note 8 | Minimum Io Note 1 | Maximum Io |
| Ts Note 2 | dB | RB |  |  | dBm/15kHz Note 6 | dBm/BWChannel |
| ±15 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | 6 | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±10 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 15 | 6 | Note 4 | Note 4 | Note 4 |
| ±6 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 25 | ≥ 2 | Note 4 | Note 4 | Note 4 |
| ±5 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 50 | ≥ 1 | Note 4 | Note 4 | Note 4 |
| ±4 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 75 | ≥ 1 | Note 4 | Note 4 | Note 4 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 6 RB.  NOTE 5: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 6: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 7: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.10.6 Inter-Frequency Accuracy Requirement for UE Category 1bis

The accuracy requirements in Table 9.1.10.6-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.7 for a corresponding Band

There are no measurement gaps overlapping with the PRS subframes in cells belonging to the serving carrier frequency.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

Table 9.1.10.6-1: RSTD measurement accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | |
| PRS Ês/Iot | Minimum PRS  bandwidth which is minimum of serving cell channel bandwidthNote7 and the PRS bandwidths of the reference cell and the measured neighbour cell *i* | Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i* | Io Note 6 range | | |
| E-UTRA operating band groups Note 8 | Minimum Io Note 1 | Maximum Io |
| Ts Note 2 | dB | RB |  |  | dBm/15kHz Note 5 | dBm/BWChannel |
| ±21 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | 4 | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±16 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 15 | 4 | Note 4 | Note 4 | Note 4 |
| ±10 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 25 | ≥ 2 | Note 4 | Note 4 | Note 4 |
| ±9 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 50 | ≥ 1 | Note 4 | Note 4 | Note 4 |
| ±8 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 75 | ≥ 1 | Note 4 | Note 4 | Note 4 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 6 RB.  NOTE 5: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 6: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

### 9.1.11 Carrier aggregation measurement accuracy

This clause contains requirements on UE capabilities for support of E-UTRA FDD, TDD and TDD-FDD carrier aggregation. Requirements in this clause are applicable to all carrier aggregation capable UEs which have been configured with up to six downlink SCell(s). Note: This clause covers measurement accuracy requirements for frequencies corresponding to those used for the PCell and SCell(s); measurements of any other frequency are considered to be inter-frequency measurements covered by the accuracy requirements in clause 9.1.3 for inter-frequency RSRP, clause 9.1.6 for inter-frequency RSRQ, and clause 9.1.17.3 for inter-frequency RS-SINR.

The requirements in this clause apply for bandwidths defined in the bandwidth combination set for the CA configurations supported by the UE [5].

#### 9.1.11.1 Primary component carrier accuracy requirement

RSRP measurements of cells on the primary component carrier shall meet the intra-frequency absolute accuracy requirements in section 9.1.2.1.

RSRQ measurements of cells on the primary component carrier shall meet the intra-frequency absolute accuracy requirements in section 9.1.5.1.

RS-SINR measurements of cells on the primary component carrier shall meet the intra-frequency absolute accuracy requirements in section 9.1.17.2.1.

Comparisons between RSRP of cells on the primary component carrier shall also meet the intra-frequency relative accuracy requirements in sections 9.1.2.2.

#### 9.1.11.2 Secondary component carrier accuracy requirement

RSRP measurements of cells on any of the secondary component carrier(s) shall meet the intra-frequency absolute accuracy requirements in section 9.1.2.1.

RSRQ measurements of cells on any of the secondary component carrier(s) shall meet the intra-frequency absolute accuracy requirements in section 9.1.5.1.

RS-SINR measurements of cells on any of the secondary component carrier(s) shall meet the intra-frequency absolute accuracy requirements in section 9.1.17.2.1.

Comparisons between RSRP of cells on the same secondary component carrier shall meet the intra-frequency relative accuracy requirements in sections 9.1.2.2

#### 9.1.11.3 Primary and secondary component carrier relative accuracy requirement

When measurements of cells on the primary component carrier are compared with measurements of cells on any of the secondary component carrier(s), the applicable relative accuracy requirements are:

RSRP inter-frequency accuracy requirements in section 9.1.3.2,

RSRQinter-frequency accuracy requirements in section 9.1.6.2,

RS-SINR inter-frequency accuracy requirements in section 9.1.17.3.2.

#### 9.1.11.4 Secondary component carrier relative accuracy requirement

When measurements of cells on any of the secondary component carrier(s) are compared with measurements of cells on the other secondary component carrier, the applicable relative accuracy requirements are:

RSRP inter-frequency accuracy requirements in section 9.1.3.2,

RSRQ inter-frequency accuracy requirements in section 9.1.6.2,

RS-SINR inter-frequency accuracy requirements in section 9.1.17.3.2.

### 9.1.12 Reference Signal Time Difference (RSTD) Measurement Accuracy Requirements for Carrier Aggregation

This clause contains requirements for E-UTRA FDD, TDD and TDD-FDD carrier aggregation. This clause contains RSTD measurement accuracy requirements for a UE configured with one or two downlink SCell(s). The UE may operate in one of the E-UTRA carrier aggregations listed in clause 8.3.1. The requirements in this clause shall apply regardless whether the configured downlink secondary cell is activated or deactivated by the MAC-CE command [17]. The requirements apply for bandwidths defined in the bandwidth combination set for the CA configurations supported by the UE [5].

The RSTD measurements, which are obtained when both the reference cell and neighbouring cell belong to the primary component carrier, shall meet the intra-frequency RSTD accuracy requirements defined in clause 9.1.10.1.

The RSTD measurements, which are obtained when both the reference cell and neighbouring cell belong to the same secondary component carrier, shall meet the intra-frequency RSTD accuracy requirements defined in clause 9.1.10.1.

The RSTD measurements, which are obtained when the reference cell and neighbouring cell do not belong to the same carrier, shall meet the inter-frequency RSTD accuracy requirements defined in clause 9.1.10.2.

### 9.1.13 Measurement accuracy for UE category 0

#### 9.1.13.1 Intra-frequency Absolute RSRP Accuracy for UE category 0

The requirements for absolute accuracy of RSRP in this clause apply to a cell on the same frequency as that of the serving cell for UE category 0.

The accuracy requirements in Table 9.1.13.1-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.27 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

Table 9.1.13.1-1: RSRP Intra frequency absolute accuracy for UE category 0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±7 | ±10 | ≥-6 dB | FDD-0\_A, TDD-0\_A | -121 | N/A | -70 |
| FDD-0\_B | -120.5 | N/A | -70 |
| FDD-0\_C, TDD-0\_C | -120 | N/A | -70 |
| FDD-0\_D | -119.5 | N/A | -70 |
| FDD-0\_E, TDD-0\_E | -119 | N/A | -70 |
| FDD-0\_F | -118.5 | N/A | -70 |
| FDD-0\_G | -118 | N/A | -70 |
| FDD-0\_H | -117.5 | N/A | -70 |
| FDD-0\_N | -114.5 | N/A | -70 |
| ±9 | ±12 | ≥-6 dB | FDD-0\_A, TDD-0\_A, FDD-0\_B, FDD-0\_C, TDD-0\_C, FDD-0\_D, FDD-0\_E, TDD-0\_E, FDD-0\_F, FDD-0\_G, FDD-0\_H, FDD-0\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.13.2 Intra-frequency Relative Accuracy of RSRP for UE category 0

The relative accuracy of RSRP is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on the same frequency for category 0 UE.

The accuracy requirements in Table 9.1.13.2-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.28 for a corresponding Band.

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

Table 9.1.13.2-1: RSRP Intra frequency relative accuracy for UE category 0

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±3 | ±4 | ≥-3 dB | FDD-0\_A, TDD-0\_A | -121 | -50 |
| FDD-0\_B | -120.5 | -50 |
| FDD-0\_C, TDD-0\_C | -120 | -50 |
| FDD-0\_D | -119.5 | -50 |
| FDD-0\_E, TDD-0\_E | -119 | -50 |
| FDD-0\_F | -118.5 | -50 |
| FDD-0\_G | -118 | -50 |
| FDD-0\_H | -117.5 | -50 |
| FDD-0\_N | -114.5 | -50 |
| ±4 | ±4 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.13.3 Intra-frequency Absolute RSRQ Accuracy for UE category 0

The requirements for absolute accuracy of RSRQ in this clause apply to a cell on the same frequency as that of the serving cell for category 0 UE.

The accuracy requirements in Table 9.1.13.3-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.27 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRQ measurement assuming measured cell is identified cell.

Table 9.1.13.3-1: RSRQ Intra frequency absolute accuracy for UE category 0

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±3.5 | ±5 | ≥-3 dB | FDD-0\_A, TDD-0\_A | -121 | -50 |
| FDD-0\_B | -120.5 | -50 |
| FDD-0\_C, TDD-0\_C | -120 | -50 |
| FDD-0\_D | -119.5 | -50 |
| FDD-0\_E, TDD-0\_E | -119 | -50 |
| FDD-0\_F | -118.5 | -50 |
| FDD-0\_G | -118 | -50 |
| FDD-0\_H | -117.5 | -50 |
| FDD-0\_N | -114.5 | -50 |
| ±4.5 | ±5 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

### 9.1.14 Accuracy requirements for Discovery Signal Measurements

#### 9.1.14.1 Introduction

Discovery signal measurements are performed when higher layers indicate measurements based on discovery signals according to DMTC configuration [2]. The discovery measurement accuracy requirements are defined for the following physical layer measurements performed in discovery signal occasions [16],

RSRP measured in subframes of the configured discovery signal occasions as specified in [4],

CSI-RSRP measurements specified in [4],

RSRQ measured in subframes of the configured discovery signal occasions as specified in [4].

#### 9.1.14.2 RSRP measurements in discovery signal occasions

Intra-frequency absolute RSRP measurement accuracy requirements in discovery signal occasions are the same as specified in Section 9.1.2.1.

Intra-frequency relative RSRP measurement accuracy requirements in discovery signal occasions are the same as specified in Section 9.1.2.2.

Inter-frequency absolute RSRP measurement accuracy requirements in discovery signal occasions are the same as specified in Section 9.1.3.1.

Inter-frequency relative RSRP measurement accuracy requirements in discovery signal occasions are the same as specified in Section 9.1.3.2.

Measurement report mapping for RSRP measurements in discovery signal occasions are the same as specified in Section 9.1.4.

#### 9.1.14.3 CSI-RSRP measurements in discovery signal occasions

##### 9.1.14.3.1 Intra-frequency CSI-RSRP measurements

###### 9.1.14.3.1.1 Absolute CSI-RSRP measurement requirements

In this clause, absolute CSI-RSRP measurement accuracy requirements in discovery signal occasions apply to a cell or TP on the same frequency as that of the serving cell.

The accuracy requirements in Table 9.1.14.3.1.1-1 are valid under the following conditions:

CSI reference signals in discovery signal occasions are transmitted on one antenna port only from each TP,

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

CSI-RSRP is specified in Annex B.3.14 for a corresponding Band.

Table 9.1.14.3.1.1-1: Intra-frequency absolute CSI-RSRP measurement accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | CSI  Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±4.5 | ±9 | ≥ 0 dB | FDD\_A, TDD\_A | -121 | N/A | -70 |
| FDD\_B1, FDD\_B2 | -120.5 | N/A | -70 |
| FDD\_C, TDD\_C | -120 | N/A | -70 |
| FDD\_D | -119.5 | N/A | -70 |
| FDD\_E, TDD\_E | -119 | N/A | -70 |
| FDD\_F | -118.5 | N/A | -70 |
| FDD\_G | -118 | N/A | -70 |
| FDD\_H | -117.5 | N/A | -70 |
| FDD\_N | -114.5 | N/A | -70 |
| ±8 | ±11 | ≥0 dB | FDD\_A, TDD\_A, FDD\_B1, FDD\_B2, FDD\_C, TDD\_C, FDD\_D, FDD\_E, TDD\_E, FDD\_F, FDD\_G, FDD\_H, FDD\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

###### 9.1.14.3.1.2 Relative CSI-RSRP measurement requirements

In this section, the relative CSI-RSRP measurement is defined as the CSI-RSRP measured from one cell or TP compared to the CSI-RSRP measured on the same frequency from another cell or from another TP. If two TPs are compared, they may belong to the same or different cells.

The accuracy requirements in Table 9.1.14.3.1.2-1 are valid under the following conditions:

CSI reference signals in discovery signal occasions are transmitted on one antenna port only from each TP.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

CSI-RSRP is specified in Annex B.3.15 for a corresponding Band.

Table 9.1.14.3.1.2-1: Intra-frequency relative CSI-RSRP measurement accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | CSI  Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±2 | ±3 | ≥0 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter CSI Ês/Iot is the minimum CSI Ês/Iot of the pair of cells or TPs to which the requirement applies.  NOTE 3: Void  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

##### 9.1.14.3.2 Inter-frequency CSI-RSRP measurements

###### 9.1.14.3.2.1 Absolute CSI-RSRP measurement requirements

In this clause, absolute CSI-RSRP measurement accuracy requirements for discovery signal measurements apply to a cell or TP on a different carrier frequency from that of the serving cell.

The accuracy requirements in Table 9.1.14.3.2.1-1 are valid under the following conditions:

CSI reference signals in discovery signal occasions are transmitted on one antenna port only from each TP.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

CSI-RSRP is specified in Annex B.3.16 for a corresponding Band.

Table 9.1.14.3.2.1-1: Inter-frequency absolute CSI-RSRP measurement accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | CSI  Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±4.5 | ±9 | ≥0 dB | FDD\_A, TDD\_A | -121 | N/A | -70 |
| FDD\_B1, FDD\_B2 | -120.5 | N/A | -70 |
| FDD\_C, TDD\_C | -120 | N/A | -70 |
| FDD\_D | -119.5 | N/A | -70 |
| FDD\_E, TDD\_E | -119 | N/A | -70 |
| FDD\_F | -118.5 | N/A | -70 |
| FDD\_G | -118 | N/A | -70 |
| FDD\_H | -117.5 | N/A | -70 |
| FDD\_N | -114.5 | N/A | -70 |
| ±8 | ±11 | ≥0 dB | FDD\_A, TDD\_A, FDD\_B1, FDD\_B2, FDD\_C, TDD\_C, FDD\_D, FDD\_E, TDD\_E, FDD\_F, FDD\_G, FDD\_H, FDD\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

###### 9.1.14.3.2.2 Relative CSI-RSRP measurement requirements

In this section, the relative CSI-RSRP measurement is defined as the CSI-RSRP measured from one cell or TP compared to the CSI-RSRP measured on a different frequency from another cell or from another TP.

The accuracy requirements in Table 9.1.14.3.2.2-1 are valid under the following conditions:

CSI reference signals in discovery signal occasions are transmitted on one antenna port only from each TP.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

CSI-RSRP is specified in Annex B.3.17 for a corresponding Band.



| Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

Table 9.1.14.3.2.2-1: Inter-frequency relative CSI-RSRP measurement accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | CSI  Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±4.5 | ±6 | ≥0 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter CSI Ês/Iot is the minimum CSI Ês/Iot of the pair of cells or TPs to which the requirement applies.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

##### 9.1.14.3.3 CSI-RSRP measurement report mapping

The reporting range of CSI-RSRP is defined from -140 dBm to -44 dBm with 1 dB resolution.

The mapping of measured quantity is defined in Table 9.1.14.3.3-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 9.1.14.3.3-1: CSI-RSRP measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| CSI\_RSRP\_00 | CSI\_RSRP < -140 | dBm |
| CSI\_RSRP \_01 | -140 ≤ CSI\_RSRP < -139 | dBm |
| CSI\_RSRP \_02 | -139 ≤ CSI\_RSRP < -138 | dBm |
| … | … | … |
| CSI\_RSRP \_95 | -46 ≤ CSI\_RSRP < -45 | dBm |
| CSI\_RSRP \_96 | -45 ≤ CSI\_RSRP < -44 | dBm |
| CSI\_RSRP \_97 | -44 ≤ CSI\_RSRP | dBm |

#### 9.1.14.4 RSRQ measurements in discovery signal occasions

Intra-frequency absolute RSRQ measurement accuracy requirements in discovery signal occasions are the same as specified in Section 9.1.5.1.

Inter-frequency absolute RSRQ measurement accuracy requirements in discovery signal occasions are the same as specified in Section 9.1.6.1.

Inter-frequency relative RSRQ measurement accuracy requirements in discovery signal occasions are the same as specified in Section 9.1.6.2.

Measurement report mapping for RSRQ measurements in discovery signal occasions are the same as specified in Section 9.1.7.

### 9.1.15 Discovery signal measurements accuracy for E-UTRAN carrier aggregation

This clause contains requirements on UE capabilities for support of E-UTRA FDD, TDD and TDD-FDD carrier aggregation when discovery signal [16] is configured. Requirements in this clause are applicable to all carrier aggregation capable UEs which have been configured with up to six downlink SCell(s). Note : This clause covers measurement accuracy requirements for frequencies corresponding to those used for the PCell and SCell(s). Measurements of any other frequency are considered to be inter-frequency measurements covered by the accuracy requirements in clause 9.1.14.

The requirements in this clause apply for bandwidths defined in the bandwidth combination set for the CA configurations supported by the UE [5].

#### 9.1.15.1 Requirements for CRS based discovery signal measurements accuracy for E-UTRAN carrier aggregation

##### 9.1.15.1.1 Primary component carrier accuracy requirement

RSRP and RSRQ measurements of cells on the primary component carrier shall meet the intrafrequency absolute accuracy requirements in sections 9.1.14.2 and 9.1.14.4. Comparisons between RSRP of cells on the primary component carrier shall also meet the intra-frequency relative accuracy requirements in sections 9.1.14.2.

##### 9.1.15.1.2 Secondary component carrier accuracy requirement

RSRP and RSRQ measurements of cells on any of the secondary component carrier(s) shall meet the intrafrequency absolute accuracy requirements in sections 9.1.14.2 and 9.1.14.4. Comparisons between RSRP of cells on the same secondary component carrier shall meet the intra-frequency relative accuracy requirements in sections 9.1.14.2.

##### 9.1.15.1.3 Primary and secondary component carrier relative accuracy requirement

When measurements of cells on the primary component carrier are compared with measurements of cells on any of the secondary component carrier(s), the applicable relative accuracy requirements are the RSRP and RSRQ inter-frequency accuracy requirements in sections 9.1.14.2 and 9.1.14.4.

##### 9.1.15.1.4 Secondary component carrier relative accuracy requirement

When measurements of cells on any of the secondary component carrier(s) are compared with measurements of cells on the other secondary component carrier, the applicable relative accuracy requirements are the RSRP and RSRQ inter-frequency accuracy requirements in sections 9.1.14.2 and 9.1.14.4.

#### 9.1.15.2 Requirements for CSI-RS based discovery signal measurements accuracy for E-UTRAN carrier aggregation

##### 9.1.15.2.1 Primary component carrier accuracy requirement

RSRP measurements of cells on the primary component carrier shall meet the intrafrequency absolute accuracy requirements in sections 9.1.14.3.1.1. Comparisons between RSRP of cells on the primary component carrier shall also meet the intra-frequency relative accuracy requirements in sections 9.1.14.3.1.2.

##### 9.1.15.2.2 Secondary component carrier accuracy requirement

RSRP measurements of cells on any of the secondary component carrier(s) shall meet the intrafrequency absolute accuracy requirements in sections 9.1.14.3.1.1. Comparisons between RSRP of cells on the same secondary component carrier shall meet the intra-frequency relative accuracy requirements in sections 9.1.14.3.1.2.

##### 9.1.15.2.3 Primary and secondary component carrier relative accuracy requirement

When measurements of cells on the primary component carrier are compared with measurements of cells on any of the secondary component carrier(s), the applicable relative accuracy requirements are the RSRP inter-frequency accuracy requirements in sections 9.1.14.3.2.2.

##### 9.1.15.2.4 Secondary component carrier relative accuracy requirement

When measurements of cells on any of the secondary component carrier(s) are compared with measurements of cells on the other secondary component carrier, the applicable relative accuracy requirements are the RSRP inter-frequency accuracy requirements in sections 9.1.14.3.2.2.

### 9.1.16 Accuracy requirements for RSRQ measurement on all OFDM symbols

This clause contains requirements for RSRQ measurement when measurement configuration message received by the UE contains *measRSRQ-OnAllSymbols-r12* parameter in TS 36.331 [2].

Intra-frequency absolute RSRQ measurement accuracy requirements when measured on all OFDM symbols are the same as specified in Section 9.1.5.1.

Inter-frequency absolute RSRQ measurement accuracy requirements when measured on all OFDM symbols are the same as specified in Section 9.1.6.1.

Inter-frequency relative RSRQ measurement accuracy requirements when measured on all OFDM symbols are the same as specified in Section 9.1.6.2.

NOTE: The minimum Io condition in Table 9.1.5.1-1, Table 9.1.6.1-1 and Table 9.1.6.2-1 is expressed as the average Io per RE over all REs in that symbol.

NOTE: The Io range defined by the minimum and the maximum Io levels in Table 9.1.5.1-1, Table 9.1.6.1-1 and Table 9.1.6.2-1applies to CRS and non-CRS symbols. Io may be different in different symbols within a subframe.

NOTE: Iot in Table 9.1.5.1-1, Table 9.1.6.1-1 and Table 9.1.6.2-1 is the received power spectrum density of total interference and noise averaged over CRS REs.

Intra-frequency absolute WB-RSRQ measurement accuracy requirements when measured on all OFDM symbols are the same as specified in Section 9.1.5.4.

Inter-frequency absolute WB-RSRQ measurement accuracy requirements when measured on all OFDM symbols are the same as specified in Section 9.1.6.3.

Inter-frequency relative WB-RSRQ measurement accuracy requirements when measured on all OFDM symbols are the same as specified in Section 9.1.6.4.

NOTE: The minimum Io condition in Table 9.1.5.4-1, Table 9.1.6.3-1 and Table 9.1.6.4-1 is expressed as the average Io per RE over all REs in that symbol across all the resource blocks within the *AllowedMeasBandwidth* in TS 36.331 [2].

NOTE: The Io1, Io2 and Io range defined by the minimum and the maximum Io levels in Table 9.1.5.4-1, Table 9.1.6.3-1 and Table 9.1.6.4-1 applies to CRS and non-CRS symbols. Io1, Io2 and Io may be different in different symbols within a subframe.

NOTE: Iot in Table 9.1.5.4-1, Table 9.1.6.3-1 and Table 9.1.6.4-1 is the received power spectrum density of total interference and noise averaged over CRS REs.

### 9.1.17 RS-SINR Measurements

#### 9.1.17.1 Measurement Report Mapping

The reporting range of RS-SINR measurement is defined from -23 dB to 40 dB with 0.5 dB resolution.

The mapping of the measured quantity is defined in table 9.1.17.1 -1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 9.1.17.1-1: RS-SINR measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported Value | Measured Quantity Value | Unit |
| RS-SINR\_000 | RS-SINR < -23 | dB |
| RS-SINR\_001 | -23 ≤ RS-SINR < -22.5 | dB |
| … | … | … |
| RS-SINR\_126 | 39.5 ≤ RS-SINR < 40 | dB |
| RS-SINR\_127 | 40 ≤ RS-SINR | dB |

#### 9.1.17.2 Intra-frequency RS-SINR Measurement Accuracy Requirements

##### 9.1.17.2.1 Absolute RS-SINR Measurement Accuracy Requirements

The requirements for absolute accuracy of intra-frequency RS-SINR in this clause apply to a cell on the same frequency as that of the serving cell.

The accuracy requirements in Table 9.1.17.2.1-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.18 for a corresponding Band.

Table 9.1.17.2.1-1: Intra-frequency RS-SINR absolute accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±3.0 | ±4 | ≥-3 dB Note 5 | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±3.5 | ±4 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 5: The requirements apply for Ês/Iot ≤ 25 dB. | | | | | |

#### 9.1.17.3 Inter-frequency RS-SINR Measurement Accuracy Requirements

##### 9.1.17.3.1 Absolute RS-SINR Measurement Accuracy Requirements

The requirements for absolute accuracy of inter-frequency RS-SINR in this clause apply to a cell that has different carrier frequency from the serving cell.

The accuracy requirements in Table 9.1.17.3-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.19 for a corresponding Band.

Table 9.1.17.3.1-1: Inter-frequency RS-SINR absolute accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±3.0 | ±4 | ≥-3 dB Note 5 | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±3.5 | ±4 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 5: The requirements apply for Ês/Iot ≤ 25 dB. | | | | | |

##### 9.1.17.3.2 Relative RS-SINR Measurement Accuracy Requirements

The relative accuracy of inter-frequency RS-SINR in this clause is defined as the RS-SINR measured from one cell compared to the RS-SINR measured from another cell on a different frequency.

The accuracy requirements in Table 9.1.17.3.2-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.20 for a corresponding Band.



| Channel 1\_Io ‑ Channel 2\_Io | ≤ 20 dB

Table 9.1.17.3.2-1: Inter-frequency RS-SINR relative accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±3.5 | ±4 | ≥-3 dB Note 6 | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±4.0 | ±4 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 6: The requirements apply for Ês/Iot ≤ 25 dB. | | | | | |

### 9.1.18 Accuracy Requirements for Measurements under Operation with Frame Structure 3

#### 9.1.18.1 Introduction

The accuracy requirements in this section are defined for the following physical layer measurements: RSRP, RSRQ, CSI-RSRP, and RSSI, where the measurements are performed on cells of E-UTRA carriers during the configured DMTC occasion [2] under operation with frame structure 3 [16].

#### 9.1.18.2 RSRP measurements

##### 9.1.18.2.1 RSRP measurement report mapping

The measurement report mapping for RSRP measurements is as defined in Section 9.1.4.

##### 9.1.18.2.2 Inter-frequency absolute RSRP measurement accuracy requirements

The requirements for absolute accuracy of RSRP in this clause apply to a cell that has a different carrier frequency from the serving cell.

The accuracy requirements in Table 9.1.18.2.2-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.23.1 for a corresponding Band.

The discovery signal occasion does not contain any MBSFN subframe and contains at least four CRS symbols over two adjacent slots.

Table 9.1.18.2.2-1: RSRP inter-frequency absolute accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±4.5 | ±9 | ≥-6 dB | FS3\_G | -118 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | FS3\_G | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

##### 9.1.18.2.3 Inter-frequency relative RSRP measurement accuracy requirements

The relative accuracy of inter-frequency RSRP measurement is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on a different frequency.

The accuracy requirements in Table 9.1.18.2.3-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.4 for a corresponding Band



| Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

The discovery signal occasion does not contain any MBSFN subframe and contains at least four CRS symbols over two adjacent slots.

Table 9.1.18.2.3-1: RSRP inter-frequency relative accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±4.5 | ±6 | ≥-6 dB | FS3\_G | -118 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

##### 9.1.18.2.4 Intra-frequency absolute RSRP measurement accuracy requirements

NOTE: These requirements are applicable only for CA under operation with frame structure 3 [16].

The requirements for absolute accuracy of RSRP in this clause apply to a cell on a serving carrier frequency.

The accuracy requirements in Table 9.1.18.2.4-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.21.1 for a corresponding Band.

The discovery signal occasion does not contain any MBSFN subframe and contains at least four CRS symbols over two adjacent slots.

Table 9.1.18.2.4-1: RSRP intra frequency absolute accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±4.5 | ±9 | ≥-6 dB | FS3\_G | -118 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | FS3\_G | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

##### 9.1.18.2.5 Intra-frequency relative RSRP measurement accuracy requirements

NOTE: These requirements are applicable only for CA under operation with frame structure 3 [16].

The relative accuracy of RSRP is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on the same carrier frequency.

The accuracy requirements in Table 9.1.18.2.5-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.22.1 for a corresponding Band.

The discovery signal occasion does not contain any MBSFN subframe and contains at least four CRS symbols over two adjacent slots.

Table 9.1.18.2.5-1: RSRP intra frequency relative accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±2 | ±3 | ≥-3 dB | FS3\_G | -118 | -50 |
| ±3 | ±3 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.18.3 RSRQ measurements

##### 9.1.18.3.1 RSRQ measurement report mapping

The measurement report mapping for RSRQ measurements is as defined in Section 9.1.7.

##### 9.1.18.3.2 Inter-frequency absolute RSRQ measurement accuracy requirements

The requirements for absolute accuracy of RSRQ in this clause apply to a cell that has different carrier frequency from the serving cell.

The accuracy requirements in Table 9.1.18.3.2-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.23.2 for a corresponding Band.

The discovery signal occasion does not contain any MBSFN subframe and contains at least four CRS symbols over two adjacent slots.

Table 9.1.18.3.2-1: RSRQ inter-frequency absolute accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±2.5 | ±4 | ≥-3 dB | FS3\_G | -118 | -50 |
| ±3.5 | ±4 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

##### 9.1.18.3.3 Inter-frequency relative RSRQ measurement accuracy requirements

The relative accuracy of RSRQ in inter frequency case is defined as the RSRQ measured from one cell compared to the RSRQ measured from another cell on a different frequency.

The accuracy requirements in Table 9.1.18.3.3-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.24.2 for a corresponding Band.



| Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

The discovery signal occasion does not contain any MBSFN subframe and contains at least four CRS symbols over two adjacent slots.

Table 9.1.18.3.3-1: RSRQ inter-frequency relative accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±3 | ±4 | ≥-3 dB | FS3\_G | -118 | -50 |
| ±4 | ±4 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

##### 9.1.18.3.4 Intra-frequency absolute RSRQ measurement accuracy requirements

NOTE: These requirements are applicable only for CA under operation with frame structure 3 [16].

The requirements for absolute accuracy of RSRQ in this clause apply to a cell on a serving carrier frequency.

The accuracy requirements in Table 9.1.18.3.4-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.21.2 for a corresponding Band.

The discovery signal occasion does not contain any MBSFN subframe and contains at least four CRS symbols over two adjacent slots.

Table 9.1.18.3.4-1: RSRQ intra frequency absolute accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±2.5 | ±4 | ≥-3 dB | FS3\_G | -118 | -50 |
| ±3.5 | ±4 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.18.4 CSI-RSRP measurements

##### 9.1.18.4.1 CSI-RSRP measurement report mapping

The measurement report mapping for CSI-RSRP measurements is as defined in Section 9.1.14.3.3.

##### 9.1.18.4.2 Inter-frequency absolute CSI-RSRP measurement accuracy requirements

In this clause, absolute CSI-RSRP measurement accuracy requirements for discovery signal measurements apply to a cell or TP operating under frame structure 3 [3] on a different carrier frequency from that of the serving cell.

The accuracy requirements in Table 9.1.18.4.2-1 are valid under the following conditions:

CSI reference signals in discovery signal occasions are transmitted on one antenna port only from each TP.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

CSI-RSRP is as specified in Annex B.3.23.3 for a corresponding Band.

The discovery signal occasion does not contain any MBSFN subframe and contains at least two CSI REs per resource block within the measured bandwidth in two adjacent slots.

Table 9.1.18.4.2-1: Inter-frequency absolute CSI-RSRP measurement accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | CSI  Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±4.5 | ±9 | ≥0 dB | FS3\_G | -118 | N/A | -70 |
| ±8 | ±11 | ≥0 dB | FS3\_G | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

##### 9.1.18.4.3 Inter-frequency relative CSI-RSRP measurement accuracy requirements

In this section, the relative CSI-RSRP measurement is defined as the CSI-RSRP measured from one cell or TP compared to the CSI-RSRP measured on a different frequency from another cell or from another TP, where at least one measured cell or TP is operating under frame structure 3 [3].

The accuracy requirements in Table 9.1.18.4.3-1 are valid under the following conditions:

CSI reference signals in discovery signal occasions are transmitted on one antenna port only from each TP.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

CSI-RSRP is as specified in Annex B.3.24.3 for a corresponding Band.



| Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

The discovery signal occasion does not contain any MBSFN subframe and contains at least two CSI REs per resource block within the measured bandwidth in two adjacent slots.

Table 9.1.18.4.3-1: Inter-frequency relative CSI-RSRP measurement accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | CSI  Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±4.5 | ±6 | ≥0 dB | FS3\_G | -118 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter CSI Ês/Iot is the minimum CSI Ês/Iot of the pair of cells or TPs to which the requirement applies.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

##### 9.1.18.4.4 Intra-frequency absolute CSI-RSRP measurement accuracy requirements

NOTE: These requirements are applicable only for CA under operation with frame structure 3 [16].

In this clause, absolute CSI-RSRP measurement accuracy requirements in discovery signal occasions apply to a cell or TP on a serving carrier frequency operating under frame structure 3 [3].

The accuracy requirements in Table 9.1.18.4.4-1 are valid under the following conditions:

CSI reference signals in discovery signal occasions are transmitted on one antenna port only from each TP,

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

CSI-RSRP is as specified in Annex B.3.21.3 for a corresponding Band.

The discovery signal occasion does not contain any MBSFN subframe and contains at least two CSI REs per resource block within the measured bandwidth in two adjacent slots of the same subframe or different subframes.

Table 9.1.18.4.4-1: Intra-frequency absolute CSI-RSRP measurement accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | CSI  Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±4.5 | ±9 | ≥0 dB | FS3\_G | -118 | N/A | -70 |
| ±8 | ±11 | ≥0 dB | FS3\_G | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

##### 9.1.18.4.5 Intra-frequency relative CSI-RSRP measurement accuracy requirements

NOTE: These requirements are applicable only for CA under operation with frame structure 3 [16].

In this section, the relative CSI-RSRP measurement is defined as the CSI-RSRP measured from one cell or TP compared to the CSI-RSRP measured on the same frequency from another cell or from another TP operating under frame structure 3 [16]. If two TPs are compared, they may belong to the same or different cells.

The accuracy requirements in Table 9.1.18.4.5-1 are valid under the following conditions:

CSI reference signals in discovery signal occasions are transmitted on one antenna port only from each TP.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

CSI-RSRP is as specified in Annex B.3.22.3 for a corresponding Band.

The discovery signal occasion does not contain any MBSFN subframe and contains at least two CSI REs per resource block within the measured bandwidth in two adjacent slots of the same subframe or different subframes.

Table 9.1.18.4.5-1: Intra-frequency relative CSI-RSRP measurement accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | CSI  Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±2 | ±3 | ≥ 0 dB | FS3\_G | -118 | -50 |
| ±3 | ±3 | ≥ 0 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter CSI Ês/Iot is the minimum CSI Ês/Iot of the pair of cells or TPs to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.18.5 RSSI measurements

##### 9.1.18.5.1 RSSI measurement report mapping

The reporting range of RSSI measurement is defined from -100 dBm to -25 dBm with 1 dBm resolution.

The mapping of the measured quantity is defined in table 9.1.18.5.1-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 9.1.18.5.1-1: RSSI measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| RSSI\_00 | RSSI < ‑100 | dBm |
| RSSI\_01 | -100 ≤ RSSI < ‑99 | dBm |
| RSSI\_02 | -99 ≤ RSSI < ‑98 | dBm |
| … | … | … |
| RSSI\_74 | -27 ≤ RSSI < -26 | dBm |
| RSSI\_75 | -26 ≤ RSSI < -25 | dBm |
| RSSI\_76 | -25 ≤ RSSI | dBm |

##### 9.1.18.5.2 Intra-frequency absolute RSSI measurement accuracy requirements

NOTE: These requirements are applicable only for CA under operation with frame structure 3 [16].

The intra-frequency RSSI requirements are specified in Table 9.1.18.5.2-1. The requirements apply for any configured RSSI *measDuration* [2], provided that:

- All symbols duing each RSSI measurement duration are available for RSSI sampling within the same reporting interval.

Table 9.1.18.5.2-1: Intra-frequency RSSI accuracy

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | |
| Normal condition | Extreme condition | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±3.5 | ±6.5 | FS3\_G | -118 | -50 |
| ±5.5 | ±8.5 | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | |

The RSSI measurement bandwidth assumed in defining the accuracy requirements in Table 9.1.18.5.2-1 is 6 RB. UE may measure according to *AllowedMeasBandwidth*. UE which measures with a bandwidth other that 6RB shall scale the measured RSSI to report a nominal RSSI equivalent to 6RB measurement.

##### 9.1.18.5.3 Inter-frequency absolute RSSI measurement accuracy requirements

The inter-frequency RSSI requirements are the same as specified in Section 9.1.18.5.2.

#### 9.1.18.6 Channel occupancy measurements

##### 9.1.18.6.1 Intra-frequency channel occupancy measurement accuracy requirements

NOTE: These requirements are applicable only for CA under operation with frame structure 3 [16].

The UE shall be able to correctly evaluate the intra-frequency channel occupancy configured according to 36.331 [2], provided that the following conditions are met:

- All symbols during each RSSI measurement duration are available for RSSI sampling within the same reporting interval,

- RSSI at the UE receiver meets the following condition with respect to the configured *channelOccupancyThreshold* [2]:

RSSI at the UE receiver is below *channelOccupancyThreshold*-, or

RSSI at the UE receiver is above *channelOccupancyThreshold*+,

where  is the applicable RSSI measurement accuracy value from the RSSI measurement accuracy requirements specified in Section 9.1.18.5.2.

The UE expects that *channelOccupancyThreshold* [2] is configured assuming RSSI measurement bandwidth of 6 RB.

##### 9.1.18.6.2 Inter-frequency channel occupancy measurement accuracy requirements

The UE shall be able to correctly evaluate the inter-frequency channel occupancy configured according to 36.331 [2], provided that the following conditions are met:

- All symbols during each RSSI measurement duration are available for RSSI sampling within the same reporting interval,

- RSSI at the UE receiver meets the following condition with respect to the configured *channelOccupancyThreshold* [2]:

RSSI at the UE receiver is below *channelOccupancyThreshold*-, or

RSSI at the UE receiver is above *channelOccupancyThreshold*+,

where  is the applicable RSSI measurement accuracy value from the RSSI measurement accuracy requirements specified in Section 9.1.18.5.3.

The UE expects that *channelOccupancyThreshold* [2] is configured assuming RSSI measurement bandwidth of 6 RB.

### 9.1.19 Accuracy Requirements for Carrier Aggregation for Measurements under Operation with Frame Structure 3

#### 9.1.19.1 Introduction

The accuracy requirements in this section are defined for the following physical layer measurements: RSRP, RSRQ, CSI-RSRP, and RSSI, where the measurements are performed on cells of E-UTRA carriers during the configured DMTC occasion [2] under operation with frame structure 3 [16].

#### 9.1.19.2 Accuracy requirements for measurements on SCC

The requirements in this section are for the measurements on cells of E-UTRA carriers operated under frame structure 3 on one SCC.

Absolute RSRP measurements of cells on SCC shall meet the intra-frequency absolute accuracy requirements in Section 9.1.18.2.4.

Comparisons between RSRP measurements of cells on the same SCC shall meet the intra-frequency relative accuracy requirements in Section 9.1.18.2.5.

Absolute RSRQ measurements of cells on SCC shall meet the intra-frequency absolute accuracy requirements in Section 9.1.18.3.4.

CSI-RSRP measurements of cells on SCC shall meet the intra-frequency absolute accuracy requirements in Section 9.1.18.4.4.

Comparisons between CSI-RSRP measurements of cells on the same SCC shall meet the intra-frequency relative accuracy requirements in Section 9.1.18.4.5.

RSSI measurements on SCC shall meet the intra-frequency absolute accuracy requirements in Section 9.1.18.5.3.

#### 9.1.19.3 Relative accuracy requirements for measurements on different SCCs

The requirements in this section are for the measurements on cells of E-UTRA carriers operated under frame structure 3 on two different SCCs.

When RSRP measurements of cells on any of the SCC are compared with RSRP measurements of cells on the other SCC, the applicable relative accuracy requirements are the inter-frequency relative RSRP measurement accuracy requirements in Section 9.1.18.2.3.

When RSRQ measurements of cells on any of the SCC are compared with RSRQ measurements of cells on the other SCC, the applicable relative accuracy requirements are the inter-frequency relative RSRQ measurement accuracy requirements in Section 9.1.18.3.3.

When CSI-RSRP measurements of cells on any of the SCC are compared with CSI-RSRP measurements of cells on the other SCC, the applicable relative accuracy requirements are the inter-frequency relative CSI-RSRP measurement accuracy requirements in Section 9.1.18.4.3.

#### 9.1.19.4 Relative accuracy requirements for measurements on SCC and PCC

The requirements in this section are for the measurements on cells of an E-UTRA carrier operated under frame structure 3 on SCC and cells on an E-UTRA carrier operated under frame structure 1 or 2 on PCC.

When RSRP measurements of cells on any of the SCC are compared with RSRP measurements of cells on the PCC, the applicable relative accuracy requirements are the inter-frequency relative RSRP measurement accuracy requirements in Section 9.1.18.2.3.

When RSRQ measurements of cells on any of the SCC are compared with RSRQ measurements of cells on the PCC, the applicable relative accuracy requirements are the inter-frequency relative RSRQ measurement accuracy requirements in Section 9.1.18.3.3.

When CSI-RSRP measurements of cells on any of the SCC are compared with CSI-RSRP measurements of cells on the PCC, the applicable relative accuracy requirements are the inter-frequency relative CSI-RSRP measurement accuracy requirements in Section 9.1.18.4.3.

### 9.1.20 SFN and Subframe Time Difference (SSTD)

#### 9.1.20.1 SSTD Accuracy Requirement

The SFN and subframe time difference (SSTD) is measured between MeNB and SeNB.

The accuracy requirements in Table 9.1.20.1-1 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

No changes to the uplink transmission timing are applied during the measurement period.

RSRP|dBm according to Annex B.3.5 for a corresponding Band

Table 9.1.20.1-1: SFN and subframe time difference measurement accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | |
| Ês/Iot | MIN(PCell downlink transmission  Bandwidth, PSCell downlink transmission  Bandwidth) | Io Note 1 range | | |
| E-UTRA operating band groups Note 6 | Minimum Io | Maximum Io |
| Ts Note 2 | dB | MHz |  | dBm/15kHz Note 5 | dBm/BWChannel |
| ±52 | ≥-3 dB | ≥1.4 MHz | FDD\_A **Note 7**, TDD\_A | -121 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G **Note 4** | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±40 | ≥-3 dB | ≥ 3 MHz | Note 3 | Note 3 | Note 3 |
| NOTE 1: When in dBm/15kHz, the minimum Io condition is expressed as the average Io per RE over all REs in that symbol. Io may be different in different symbols within a subframe.  NOTE 2: Ts is the basic timing unit defined in TS 36.211.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with downlink bandwidth ≥1.4 MHz.  NOTE 4: Except Band 29.  NOTE 5: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 6: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 7: Except Band 32, Band 75, Band 76**.** | | | | | |

#### 9.1.20.2 SSTD Measurement Report Mapping

SFN and subframe timing difference (SSTD) measurement report comprises 3 elements:

SFN offset between MeNB and SeNB (ΔX)

Reporting range of ΔX is between frame number # 0 to frame number # 1023 as defined in TS 36.331 [2].

Frame boundary offset between MeNB and SeNB (ΔY)

Reporting range of ΔY is between subfrane number #-5 and subframe number# 4 as defined in TS 36.331 [2].

Subframe boundary offset between MeNB and SeNB (ΔZ)

The reporting range of value of ΔZ is within -1320Ts, -700T] and 700Ts, 1320Ts with reporting granularity of 10Ts.

The mapping of measured Subframe boundary offset (ΔZ) is defined in Table 9.1.20.2-1.

Table 9.1.20.2-1: SSTD report mapping

|  |  |  |
| --- | --- | --- |
| Reported Value | Measured Quantity Value | Unit |
| SUBFRAME\_BOUNDARY\_OFFSET\_00 | ΔZ ≤ -1320 | Ts |
| SUBFRAME\_BOUNDARY\_OFFSET\_01 | -1320 < ΔZ ≤ -1310 | Ts |
| SUBFRAME\_BOUNDARY\_OFFSET\_02 | -1310 < ΔZ ≤ -1300 | Ts |
| … | … | … |
| SUBFRAME\_BOUNDARY\_OFFSET\_62 | -710 < ΔZ ≤ -700 | Ts |
| SUBFRAME\_BOUNDARY\_OFFSET\_63 | -700 < ΔZ ≤ 0 | Ts |
| SUBFRAME\_BOUNDARY\_OFFSET\_64 | 0 < ΔZ ≤ 700 | Ts |
| SUBFRAME\_BOUNDARY\_OFFSET\_65 | 700 < ΔZ ≤ 710 | Ts |
| … | … | … |
| SUBFRAME\_BOUNDARY\_OFFSET\_125 | 1300 < ΔZ ≤ 1310 | Ts |
| SUBFRAME\_BOUNDARY\_OFFSET\_126 | 1310 < ΔZ ≤ 1320 | Ts |
| SUBFRAME\_BOUNDARY\_OFFSET\_127 | 1320 < ΔZ | Ts |

### 9.1.21 Measurement accuracy for UE category M1

The requirements in this clause are applicable for UE category M1. The requirements in clause 9.1.21.1, 9.1.21.2, 9.1.21.6, 9.1.21.9, 9.1.21.10, 9.1.21.13 and 9.1.21.14 are also applicable for ETU220 propagation condition when *highSpeedMeasGapCE-ModeA* is configured.

#### 9.1.21.1 Intra-frequency Absolute RSRP Accuracy for UE category M1 with CE mode A

The requirements for absolute accuracy of RSRP in this clause apply to a cell on the same frequency as that of the serving cell for UE category M1.

The accuracy requirements in Table 9.1.21.1-1 and Table 9.1.21.1-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

For a UE capable RSRP measurement based on RSS [4], provided that RSS configuration *rss-ConfigCarrierInfo* [2] has been indicated by higher layers and measurement conditions as defined in clause 8.13.2.1 are met, the accuracy requirement as specified in Table. 9.1.21.1-3 and Table. 9.1.21.1-4 shall apply. Otherwise, the accuracy requirement as specified in Table 9.1.21.1-1 and Table 9.1.21.1-2 shall apply.

Table 9.1.21.1-1: RSRP Intra frequency absolute accuracy for UE category M1 with CE mode A for FDD and TDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±7 | ±10 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±9 | ±12 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.21.1-2: RSRP Intra frequency absolute accuracy for UE category M1 with CE mode A for HD-FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±7 | ±10 | ≥-6 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±9 | ±12 | ≥-6 dB | FDD-M1\_A, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.21.1-3: RSS based RSRP Intra frequency absolute accuracy for UE category M1 with CE mode A for FDD and TDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±6 | ± 9 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ± 8 | ± 11 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.21.1-4: RSS based RSRP Intra frequency absolute accuracy for UE category M1 with CE mode A for -HD-FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ± 6 | ± 9 | ≥-6 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ± 8 | ± 11 | ≥-6 dB | FDD-M1\_A, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.21.2 Intra-frequency Relative Accuracy of RSRP for UE category M1 with CE mode A

The relative accuracy of RSRP is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on the same frequency for category M1 UE.

The accuracy requirements in Table 9.1. 21.2-1 and Table 9.1. 21.2-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.8 for a corresponding Band.

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

Table 9.1.21.2-1: RSRP Intra frequency relative accuracy for UE category M1 with CE mode A for FDD and TDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±3 | ±4 | ≥-3 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±4 | ±4 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

Table 9.1.21.2-2: RSRP Intra frequency relative accuracy for UE category M1 with CE mode A for HD-FDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±3 | ±4 | ≥-3 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±4 | ±4 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.21.3 Intra-frequency Absolute RSRP Accuracy for UE category M1 with CE mode B

The requirements for absolute accuracy of RSRP in this clause apply to a cell on the same frequency as that of the serving cell for UE category M1.

The accuracy requirements in Table 9.1.21.3-1 and Table 9.1.21.3-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

For a UE capable of RSRP measurement based on RSS[4], provided that RSS configuration *rss-ConfigCarrierInfo* [2] has been indicated by higher layers and measurement conditions as defined in clause 8.13.3.1 are met, the accuracy requirement as specified in Table. 9.1.21.3-3 and Table. 9.1.21.3-4 shall apply. Otherwise, the accuracy requirement as specified in Table 9.1.21.3-1 shall apply.

Table 9.1.21.3-1: RSRP Intra frequency absolute accuracy for UE category M1 with CE mode B for FDD and TDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| ±7 | ±10 | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±10 | ±13 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A, FDD\_M1\_B, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| ±9 | ±12 | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.21.3-2: RSRP Intra frequency absolute accuracy for UE category M1 with CE mode B for HD-FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| ±7 | ±10 | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±10 | ±13 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, FDD\_M1\_B, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| ±9 | ±12 | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.21.3-3: RSS based RSRP Intra frequency absolute accuracy for UE category M1 with CE mode B for FDD and TDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ± 8 | ± 11 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| ± 6.5 | ± 9.5 | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ± 10 | ± 13 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A, FDD\_M1\_B, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| ± 8.5 | ± 11.5 | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.21.3-4: RSS based RSRP Intra frequency absolute accuracy for UE category M1 with CE mode B for HD-FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ± 8 | ± 11 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| ± 6.5 | ± 9.5 | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ± 10 | ± 13 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, FDD\_M1\_B, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| ± 8.5 | ± 11.5 | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.21.4 Intra-frequency Relative Accuracy of RSRP for UE category M1 with CE mode B

The relative accuracy of RSRP is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on the same frequency for category M1 UE.

The accuracy requirements in Table 9.1.21.4-1 and Table 9.1.21.4-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.8 for a corresponding Band.

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

Table 9.1.21.4-1: RSRP Intra frequency relative accuracy for UE category M1 with CE mode B for FDD and TDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±4 | ±4 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5 | ±5 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

Table 9.1.21.4-2: RSRP Intra frequency relative accuracy for UE category M1 with CE mode B for HD-FDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±4 | ±4 | ≥-12 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5 | ±5 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.21.5 RSRP Measurement Report Mapping

The reporting range of RSRP is the same as defined in section 9.1.4.

#### 9.1.21.6 Intra-frequency Absolute Accuracy of RSRQ for UE category M1 with CE mode A

The requirements for absolute accuracy of RSRQ in this clause apply to a cell on the same frequency as that of the serving cell.

The accuracy requirements in Tables 9.1.21.6-1 and 9.1.21.6-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

Table 9.1.21.6-1: RSRQ Intra frequency absolute accuracy UE category M1 with CE mode A for FDD and TDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±4 | ±5.5 | ≥-3 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5 | ±5.5 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

Table 9.1.21.6-2: RSRQ Intra frequency absolute accuracy UE category M1 with CE mode A for HD-FDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±4 | ±5.5 | ≥-3 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5 | ±5.5 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.21.7 Intra-frequency Absolute Accuracy of RSRQ for UE category M1 with CE mode B

The requirements for absolute accuracy of RSRQ in this clause apply to a cell on the same frequency as that of the serving cell.

The accuracy requirements in Tables 9.1.21.7-1 and 9.1.21.7-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

Table 9.1.21.7-1: RSRQ Intra frequency absolute accuracy UE category M1 with CE mode B for FDD and TDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±5 | ±6.5 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

Table 9.1.21.7-2: RSRQ Intra frequency absolute accuracy UE category M1 with CE mode B for HD-FDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±5 | ±6.5 | ≥-12 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.21.8 RSRQ Measurement Report Mapping

The reporting range of RSRQ is the same as defined in section 9.1.7.

#### 9.1.21.9 Inter-frequency Absolute RSRP Accuracy for UE category M1 with CE mode A

The requirements for absolute accuracy of RSRP in this clause apply to a cell on another frequency than that of the serving cell for UE category M1.

The accuracy requirements in Table 9.1.21.9-1 and Table 9.1.21.9-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

Table 9.1.21.9-1: RSRP Inter frequency absolute accuracy for UE category M1 with CE mode A for FDD and TDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±7 | ±10 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±9 | ±12 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.21.9-2: RSRP Inter frequency absolute accuracy for UE category M1 with CE mode A for HD-FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±7 | ±10 | ≥-6 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±9 | ±12 | ≥-6 dB | FDD-M1\_A, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.21.10 Inter-frequency Relative Accuracy of RSRP for UE category M1 with CE mode A

The relative accuracy of RSRP is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on another frequency for category M1 UE.

The accuracy requirements in Table 9.1.21.10-1 and Table 9.1.21.10-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.8 for a corresponding Band.

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

Table 9.1.21.10-1: RSRP Inter frequency relative accuracy for UE category M1 with CE mode A for FDD and TDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±7 | ±8 | ≥-3 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±8 | ±8 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

Table 9.1.21.10-2: RSRP Inter frequency relative accuracy for UE category M1 with CE mode A for HD-FDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±7 | ±8 | ≥-3 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±8 | ±8 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.21.11 Inter-frequency Absolute RSRP Accuracy for UE category M1 with CE mode B

The requirements for absolute accuracy of RSRP in this clause apply to a cell on another frequency than that of the serving cell for UE category M1.

The accuracy requirements in Table 9.1.21.11-1 and Table 9.1.21.11-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

Table 9.1.21.11-1: RSRP Inter frequency absolute accuracy for UE category M1 with CE mode B for FDD and TDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| [±8] | [±11] | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| [±7] | [±10] | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| [±10] | [±13] | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| [±9] | [±12] | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.21.11-2: RSRP Inter frequency absolute accuracy for UE category M1 with CE mode B for HD-FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| ±7 | ±10 | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±10 | ±13 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| ±9 | ±12 | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.21.12 Inter-frequency Relative Accuracy of RSRP for UE category M1 with CE mode B

The relative accuracy of RSRP is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on another frequency for category M1 UE.

The accuracy requirements in Table 9.1.21.12-1 and Table 9.1.21.12-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.8 for a corresponding Band.

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

Table 9.1.21.12-1: RSRP Inter frequency relative accuracy for UE category M1 with CE mode B for FDD and TDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±7 | ±10 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

Table 9.1.21.12-2: RSRP Inter frequency relative accuracy for UE category M1 with CE mode B for HD-FDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±7 | ±10 | ≥-12 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.21.13 Inter-frequency Absolute Accuracy of RSRQ for UE category M1 in CE mode A

The requirements for absolute accuracy of RSRQ in this clause apply to a cell that has different carrier frequency from the serving cell.

The accuracy requirements in Tables 9.1.21.13-1 and 9.1.21.13-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.3 for a corresponding Band

Table 9.1.21.13-1: RSRQ Inter frequency absolute accuracy UE category M1 with CE mode A for FDD and TDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±4 | ±5.5 | ≥-3 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5 | ±5.5 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

Table 9.1.21.13-2: RSRQ Inter frequency absolute accuracy UE category M1 with CE mode A for HD-FDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±4 | ±5.5 | ≥-3 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5 | ±5.5 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.21.14 Inter-frequency Relative Accuracy of RSRQ for UE category M1 in CE mode A

The relative accuracy of RSRQ in inter frequency case is defined as the RSRQ measured from one cell compared to the RSRQ measured from another cell on a different frequency.

The accuracy requirements in Tables 9.1.21.14-1 and 9.1.21.14-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.4 for a corresponding Band



| Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

Table 9.1.21.14-1: RSRQ Inter frequency relative accuracy UE category M1 with CE mode A for FDD and TDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±4.5 | ±5.5 | ≥-3 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5.5 | ±5.5 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

Table 9.1.21.14-2: RSRQ Inter frequency relative accuracy UE category M1 with CE mode A for HD-FDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±4.5 | ±5.5 | ≥-3 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5.5 | ±5.5 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.21.15 Inter-frequency Absolute Accuracy of RSRQ for UE category M1 in CE mode B

The requirements for absolute accuracy of RSRQ in this clause apply to a cell that has different carrier frequency from the serving cell.

The accuracy requirements in Tables 9.1.21.15-1 and 9.1.21.15-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.3 for a corresponding Band

Table 9.1.21.15-1: RSRQ Inter frequency absolute accuracy UE category M1 with CE mode B for FDD and TDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±5 | ±6.5 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

Table 9.1.21.15-2: RSRQ Inter frequency absolute accuracy UE category M1 with CE mode B for HD-FDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±5 | ±6.5 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.21.16 Inter-frequency Relative Accuracy of RSRQ for UE category M1 in CE mode B

The relative accuracy of RSRQ in inter frequency case is defined as the RSRQ measured from one cell compared to the RSRQ measured from another cell on a different frequency.

The accuracy requirements in Tables 9.1.21.16-1 and 9.1.21.16-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.4 for a corresponding Band



| Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

Table 9.1.21.16-1: RSRQ Inter frequency relative accuracy UE category M1 with CE mode B for FDD and TDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±5.5 | ±6.5 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6.5 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

Table 9.1.21.16-2: RSRQ Inter frequency relative accuracy UE category M1 with CE mode B for HD-FDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±5.5 | ±6.5 | ≥-12 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6.5 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.21.17 Inter-Frequency RSTD Accuracy Requirement for UE catergory M1 in CE mode A

The accuracy requirements in Table 9.1.21.17-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.31 for a corresponding Band

There are no measurement gaps overlapping with the PRS subframes of the measured serving cell.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

Table 9.1.21.17-1: RSTD measurement accuracy for CEModeA

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | | |
| PRS Ês/Iot | Minimum PRS  bandwidth, which is minimum of serving cell channel bandwidth and the PRS bandwidths of the reference cell and the measured neighbour cell *i* | Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i* | The number of consecutive downlink subframes NPRS among the reference cell and the measured neighbour cell *i* as defined in [24] | Io Note 4 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io Note 1 | Maximum Io |
| Ts Note 2 | dB | RB |  |  |  | dBm/15kHz | dBm/BWChannel |
| ±21 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | ≥ 12 | ≥4 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | | |

#### 9.1.21.18 Inter-Frequency RSTD Accuracy Requirement for UE catergory M1 in CE mode B

The accuracy requirements in Table 9.1.21.18-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.31 for a corresponding Band

There are no measurement gaps overlapping with the PRS subframes of the measured serving cell.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

Table 9.1.21.18-1: RSTD measurement accuracy for CEModeB

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | | |
| PRS Ês/Iot | Minimum PRS  bandwidth, which is minimum of serving cell channel bandwidth and the PRS bandwidths of the reference cell and the measured neighbour cell *i* | Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i* | The number of consecutive downlink subframes NPRS among the reference cell and the measured neighbour cell *i* as defined in [24] | Io Note 4 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io Note 1 | Maximum Io |
| Ts Note 2 | dB | RB |  |  |  | dBm/15kHz | dBm/BWChannel |
| [±21] | (PRS Ês/Iot)ref ≥-15dB  and  (PRS Ês/Iot)*i* ≥-15dB | ≥ 6 | ≥ 30 | ≥ 4 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | | |

#### 9.1.21.19 UE RX-TX time difference Accuracy Requirement for Cat-M1

The UE RX-TX time difference is measured from the PCell.

The accuracy requirements in Table 9.1.21.19-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

No changes to the uplink transmission timing are applied during the measurement period.

RSRP|dBm according to Annex B.2.14 for a corresponding Band

Table 9.1.21.19-1: UE Rx – Tx time difference measurement accuracy for CEModeA

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | |
| Ês/Iot | Downlink transmission  bandwidth of PCell | Io Note 1 range | | |
| E-UTRA operating band groups Note 3 | Minimum Io | Maximum Io |
| Ts Note 2 | dB | RB |  | dBm/15kHz | dBm/BWChannel |
| ±20 | ≥-3 dB | ≥ 6 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| NOTE 1: When in dBm/15kHz, the minimum Io condition is expressed as the average Io per RE over all REs in that symbol. Io may be different in different symbols within a subframe.  NOTE 2: Ts is the basic timing unit defined in TS 36.211.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.21.20 Intra-Frequency RSTD Accuracy Requirement for UE catergory M1 in CE mode A

The accuracy requirements in Table 9.1.21.20-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.33 for a corresponding Band

For a UE that does not need a measurement gap for intra-frequency RSTD measurement, there are no measurement gaps overlapping with the PRS subframes of the measured serving cell and PRS are available within the UE measurement bandwidth in all PRS subframes

For a UE that needs a measurement gap for intra-frequency RSTD measurement, the measurement gaps are configured to contain PRS subframes

The parameter *expectedRSTDUncertainty* signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

Table 9.1.21.20-1: RSTD measurement accuracy for CEModeA

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | | |
| PRS Ês/Iot | Minimum PRS  bandwidth, which is minimum of serving cell channel bandwidth and the PRS bandwidths of the reference cell and the measured neighbour cell *i* Note 4 | Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i* | The number of consecutive downlink subframes NPRS among the reference cell and the measured neighbour cell *i* as defined in [24] | Io Note 5 range | | |
| E-UTRA operating band groups Note 6 | Minimum Io Note 1 | Maximum Io |
| Ts Note 2 | dB | RB |  |  |  | dBm/15kHz | dBm/BWChannel |
| ±15Note7 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | ≥ 12 | ≥6 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±15 Note8 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | ≥ 12 | ≥4 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 5: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 6: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 7: The requirement applies when PRS are available within the UE measurement bandwidth in all PRS subframes and measurement gaps are not required.  NOTE 8: The requirement applies when measurement gaps are required. | | | | | | | |

#### 9.1.21.21 Intra-Frequency RSTD Accuracy Requirement for UE catergory M1 in CE mode B

The accuracy requirements in Table 9.1.21.21-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.33 for a corresponding Band

For a UE that does not need a measurement gap for intra-frequency RSTD measurement, there are no measurement gaps overlapping with the PRS subframes of the measured serving cell and PRS are available within the UE measurement bandwidth in all PRS subframes

For a UE that needs a measurement gap for intra-frequency RSTD measurement, the measurement gaps are configured to contain PRS subframes

The parameter *expectedRSTDUncertainty* signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

Table 9.1.21.21-1: RSTD measurement accuracy for CEModeB

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | | |
| PRS Ês/Iot | Minimum PRS  bandwidth, which is minimum of serving cell channel bandwidth and the PRS bandwidths of the reference cell and the measured neighbour cell *i* Note 4 | Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i* | The number of consecutive downlink subframes NPRS among the reference cell and the measured neighbour cell *i* as defined in [24] | Io Note 5 range | | |
| E-UTRA operating band groups Note 6 | Minimum Io Note 1 | Maximum Io |
| Ts Note 2 | dB | RB |  |  |  | dBm/15kHz | dBm/BWChannel |
| ±15Note7 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | ≥ 30 | ≥6 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±15 Note8 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | ≥ 30 | ≥4 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 5: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 6: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 7: The requirement applies when PRS are available within the UE measurement bandwidth in all PRS subframes and measurement gaps are not required.  NOTE 8: The requirement applies when measurement gaps are required. | | | | | | | |

#### 9.1.21.22 Downlink Channel Report Mapping for UE Category M1

Table 9.1.21.22-1: Downlink channel quality measurement report mapping when the Downlink Channel Quality Report (DCQR) MAC Control Element is supported [7]

|  |  |  |  |
| --- | --- | --- | --- |
| Codepoint/Index | MPDCCH repetition level | MPDCCH aggregation level | Applicable CE Mode |
| 0000 | No measurement reporting | No measurement reporting | A, B |
| 0001 | 1 | 1 | A |
| 0010 | 1 | 2 | A |
| 0011 | 1 | 4 | A |
| 0100 | 1 | 8 | A |
| 0101 | 1 | 16 | A |
| 0110 | 1 | 24 | A, B |
| 0111 | 2 | 24 | A, B |
| 1000 | 4 | 24 | A, B |
| 1001 | 8 | 24 | A, B |
| 1010 | 16 | 24 | A, B |
| 1011 | 32 | 24 | A, B |
| 1100 | 64 | 24 | A, B |
| 1101 | 128 | 24 | A, B |
| 1110 | 256 | 24 | A, B |

The MPDCCH repetition level for Short Downlink Channel Quality Report (DCQR) MAC Control Element is chosen with regard to the signalled parameter Rmax, the maximum number of repetitions for MPDCCH common search space for random access response (mpdcch-NumRepetition-RA) in SystemInformationBlockType2. The report mapping is defined in Table 9.1.21.22-2.

Table 9.1.21.22-2: Downlink channel quality measurement report mapping when Short Downlink Channel Quality Report (DCQR) MAC Control Element is supported [7]

|  |  |
| --- | --- |
| Reported value | MPDCCH repetition level |
| No short DCQR | No measurement reporting |
| Short DCQR 1 | Rmax/8 (Note 1) |
| Short DCQR 2 | Rmax (Note 3) |
| Short DCQR 3 | 4xRmax (Note 2) |
| Note 1: When Rmax is less than 8, set Short DCQR 1 to 1.  Note 2: When Rmax is more than 32, set Short DCQR 3 to 256.  Note 3: When Rmax is 1, set Short DCQR 2 to 2.  Note 4: Aggregation level (ECCE) is assumed to be L’max = 24. | |

#### 9.1.21.23 Downlink Channel Quality Measurement Accuracy for UE Category M1 with CE Mode A

The requirements for accuracy of downlink channel quality reporting in this clause apply only to the serving cell on the anchor carrier for UE Category M1.

The accuracy requirements in Table 9.1.21.23-1, Table 9.1.21.23-2, Table 9.1.21.23-3, and Table 9.1.21.23-4 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

Table 9.1.21.23-1: Downlink channel quality reporting accuracy for UE Category M1 with CE Mode A for FDD and TDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| MPDCCH Repetition | Pm-Dsg (%) | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
|  |  | dB |  | dBm/15kHz | dBm/BWChannel | dBm/BWChannel |
| R NOTE 1 | ≤1 | -6 dB ≤ Ês/Iot ≤ -3 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| R/4 NOTE 1 | >1 | -6 dB ≤ Ês/Iot ≤ -3 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| NOTE 1: R is the reported MPDCCH repetition level that UE has reported in DCQR MAC CE or Short DCQR MAC CE.  NOTE 2: Io is assumed to have constant EPRE across the bandwidth.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.21.23-2: Downlink channel quality reporting accuracy for UE Category M1 with CE Mode A for HD-FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| MPDCCH Repetition | Pm-Dsg (%) | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
|  |  | dB |  | dBm/15kHz | dBm/BWChannel | dBm/BWChannel |
| R NOTE 1 | ≤1 | -6 dB ≤ Ês/Iot ≤ -3 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| R/4 NOTE 1 | >1 | -6 dB ≤ Ês/Iot ≤ -3 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| NOTE 1: R is the reported MPDCCH repetition level that UE has reported in DCQR MAC CE or Short DCQR MAC CE..  NOTE 2: Io is assumed to have constant EPRE across the bandwidth.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.21.23-3: Downlink channel quality reporting accuracy for UE Category M1 with CE Mode A for FDD and TDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| MPDCCH Aggregation level | Pm-Dsg (%) | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
|  |  | dB |  | dBm/15kHz | dBm/BWChannel | dBm/BWChannel |
| Lk NOTE 1 | ≤1 | ≥ -3 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| Lk-2 NOTE 1 | >1 | ≥ -3 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| NOTE 1: is the reported MPDCCH aggregation level that UE has reported in DCQR MAC CE where k is the index to the aggregation level set and 1 ≤ k ≤ 6.  NOTE 2: Io is assumed to have constant EPRE across the bandwidth.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.21.23-4: Downlink channel quality reporting accuracy for UE Category M1 with CE Mode A for HD-FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| MPDCCH Aggregation level | Pm-Dsg (%) | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
|  |  | dB |  | dBm/15kHz | dBm/BWChannel | dBm/BWChannel |
| Lk NOTE 1 | ≤1 | ≥ -3 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| Lk-2 NOTE 1 | >1 | ≥ -3 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| NOTE 1: is the reported MPDCCH aggregation level that UE has reported in DCQR MAC CE where k is the index to the aggregation level set and 1 ≤ k ≤ 6.  NOTE 2: Io is assumed to have constant EPRE across the bandwidth.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.21.24 Downlink Channel Quality Measurement Accuracy for UE Category M1 with CE Mode B

The requirements for accuracy of downlink channel quality reporting in this clause apply only to the serving cell on the anchor carrier for UE Category M1.

The accuracy requirements in Table 9.1.21.24-1 and Table 9.1.21.24-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

Table 9.1.21.24-1: Downlink channel quality reporting accuracy for UE Category M1 with CE Mode B for FDD and TDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| MPDCCH Repetition | Pm-Dsg (%) | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
|  |  | dB |  | dBm/15kHz | dBm/BWChannel | dBm/BWChannel |
| R NOTE 1 | ≤1 | -15 ≤ Ês/Iot ≤ -6 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| R/8]  NOTE 1 | >1 | -15 ≤ Ês/Iot ≤ -6 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| NOTE 1: R is the reported MPDCCH repetition level that UE has reported in DCQR MAC CE or Short DCQR MAC CE.  NOTE 2: Io is assumed to have constant EPRE across the bandwidth.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.21.24-2: Downlink channel quality reporting accuracy for UE Category M1 with CE Mode B for HD-FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| MPDCCH Repetition | Pm-Dsg (%) | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
|  |  | dB |  | dBm/15kHz | dBm/BWChannel | dBm/BWChannel |
| R NOTE 1 | ≤1 | -15 ≤ Ês/Iot ≤ -6 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| R/8 NOTE 1 | >1 | -15 ≤ Ês/Iot ≤ -6 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_B | -120.5 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| NOTE 1: R is the reported MPDCCH repetition level that UE has reported in DCQR MAC CE or Short DCQR MAC CE.  NOTE 2: Io is assumed to have constant EPRE across the bandwidth.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

### 9.1.22 Measurement accuracy for UE Category NB1

#### 9.1.22.1 Intra-frequency Absolute NRSRP Accuracy for UE Category NB1

The requirements for absolute accuracy of NRSRP in this clause apply to a cell on the same frequency as that of the serving cell for UE Category NB1 for stand-alone, guard-band and in-band deployments. For a UE capable of NSSS-based RRM measurement, provided that *nsss-NumOccDiffPrecoders* value *n1* has been indicated by higher layers, the accuracy requirement as specified in Table. 9.1.22.1-2 shall apply. Otherwise, the accuracy requirement as specified in Table 9.1.22.1-1 shall apply.

The accuracy requirements in Table 9.1.22.1-1 and Table 9.1.22.1-2 are valid under the following conditions:

Narrowband reference signals are transmitted either from one or two ports.

Conditions defined in Clause 7.3 of TS 36.101 [5] for reference sensitivity are fulfilled.

NRSRP|dBm according to Annex B.3.25 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for NRSRP measurement assuming measured cell is identified cell.

Table 9.1.22.1-1: NRSRP Intra frequency absolute accuracy for UE Category NB1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA/NR operating band groups Note 2 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz | dBm/BWChannel | dBm/BWChannel |
| ±6 | ±9 | ≥-6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| ±10.3 | ±13.3 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | - 122.9 | N/A | -70 |
| ±12.3 | ±15.3 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: E-UTRA/NR operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.22.1-2: NRSRP Intra frequency absolute accuracy for UE Category NB1 under NSSS-based measurement

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA/NR operating band groups Note 2 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz | dBm/BWChannel | dBm/BWChannel |
| ±4 | ±7 | ≥-6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±6 | ±9 | ≥-6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| ±6 | ±9 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±8 | ±11 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: E-UTRA/NR operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.22.2 Void

#### 9.1.22.3 Intra-frequency Absolute NRSRQ Accuracy for UE Category NB1

The requirements for absolute accuracy of NRSRQ in this clause apply to a cell on the same frequency as that of the serving cell for NB-IoT UE for stand-alone, guard-band and in-band deployments. For a UE capable of NSSS-based RRM measurement, provided that *nsss-NumOccDiffPrecoders* value *n1* has been indicated by higher layers, the accuracy requirement as specified in Table. 9.1.22.3-2 shall apply. Otherwise, the accuracy requirement as specified in Table 9.1.22.3-1 shall apply.

The accuracy requirements in Table 9.1.22.3-1 and Table 9.1.22.3-2 are valid under the following conditions:

Narrowband reference signals are transmitted either from one or two antenna ports.

Conditions defined in Clause 7.3 of TS 36.101 [5] for reference sensitivity are fulfilled.

NRSRP|dBm according to Annex B.3.25 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for NRSRQ measurement assuming measured cell is identified cell.

Table 9.1.22.3-1: NRSRQ Intra frequency absolute accuracy for UE Category NB1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA/NR operating band groups Note 3 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz | dBm/BWChannel |
| ±5.2 | ±8.2 | ≥-3 dB | NFDD\_G, NTDD\_G | -122.9 | -50 |
| ±7.2 | ±10.2 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| ±9.5 | ±12.5 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | -122.9 | -50 |
| ±11.5 | ±14.5 | -15≤Ês/Iot≤--6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: E-UTRA/NR operating band groups are as defined in Section 3.5 | | | | | |

Table 9.1.22.3-2: NRSRQ Intra frequency absolute accuracy for UE Category NB1 under NSSS-based measurement

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA/NR operating band groups Note 2 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz | dBm/BWChannel | dBm/BWChannel |
| ±3.2 | ±6.2 | ≥-6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±5.2 | ±8.2 | ≥-6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| ±5.2 | ±8.2 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±7.2 | ±10.2 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: E-UTRA/NR operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.22.4 Void

#### 9.1.22.5 Inter-frequency Absolute NRSRP Accuracy for UE Category NB1

The requirements for absolute accuracy of NRSRP in this clause apply to a cell that has different carrier frequency from the serving cell. For a UE capable of NSSS-based RRM measurement, provided that *nsss-NumOccDiffPrecoders* value *n1* has been indicated by higher layers, the accuracy requirement as specified in Table. 9.1.22.5-2 shall apply. Otherwise, the accuracy requirement as specified in Table 9.1.22.5-1 shall apply.

The accuracy requirements in Table 9.1.22.5-1 and Table 9.1.22.5-2 are valid under the following conditions:

Narrowband reference signals are transmitted either from one or two antenna ports.

Conditions defined in Clause 7.3 of TS 36.101 [5] for reference sensitivity are fulfilled.

NRSRP|dBm according to Annex B.3.26 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for NRSRP measurement assuming measured cell is identified cell.

Table 9.1.22.5-1: NRSRP Inter frequency absolute accuracy for UE Category NB1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA/NR operating band groups Note 2 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz | dBm/BWChannel | dBm/BWChannel |
| ±6 | ±9 | ≥-6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| ±10.3 | ±13.3 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±12.3 | ±15.3 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: E-UTRA/NR operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.22.5-2: NRSRP Inter frequency absolute accuracy for UE Category NB1 under NSSS-based measurement

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA/NR operating band groups Note 2 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz | dBm/BWChannel | dBm/BWChannel |
| ±4 | ±7 | ≥-6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±6 | ±9 | ≥-6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| ±6 | ±9 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±8 | ±11 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: E-UTRA/NR operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.22.6 Void

#### 9.1.22.7 Inter-frequency Absolute NRSRQ Accuracy for UE Category NB1

The requirements for absolute accuracy of NRSRQ in this clause apply to a cell that has different carrier frequency from the serving cell. For a UE capable of NSSS-based RRM measurement, provided that *nsss-NumOccDiffPrecoders* value *n1* has been indicated by higher layers, the accuracy requirement as specified in Table. 9.1.22.7-2 shall apply. Otherwise, the accuracy requirement as specified in Table 9.1.22.7-1 shall apply.

The accuracy requirements in Table 9.1.22.7-1 and Table 9.1.22.7-2 are valid under the following conditions:

Narrowband reference signals are transmitted either from one or two antenna ports.

Conditions defined in Clause 7.3 of TS 36.101 [5] for reference sensitivity are fulfilled.

NRSRP|dBm according to Annex B.3.26 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for NRSRQ measurement assuming measured cell is identified cell.

Table 9.1.22.7-1: NRSRQ Inter frequency absolute accuracy for UE Category NB1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA/NR operating band groups Note 3 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz | dBm/BWChannel |
| ±5.2 | ±8.2 | ≥-3 dB | NFDD\_G, NTDD\_G | -122.9 | -50 |
| ±7.2 | ±10.2 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| ±9.5 | ±12.5 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | -122.9 | -50 |
| ±11.5 | ±14.5 | -15≤Ês/Iot≤--6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: E-UTRA/NR operating band groups are as defined in Section 3.5. | | | | | |

Table 9.1.22.7-2: NRSRQ Inter frequency absolute accuracy for UE Category NB1 under NSSS-based measurement

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA/NR operating band groups Note 2 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz | dBm/BWChannel | dBm/BWChannel |
| ±3.2 | ±6.2 | ≥-6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±5.2 | ±8.2] | ≥-6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| ±5.2 | ±8.2 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | -122.9 | N/A | -70 |
| ±7.2 | ±10.2 | -15≤Ês/Iot≤--6 dB | NFDD\_G, NTDD\_G | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: E-UTRA/NR operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.22.8 Void

#### 9.1.22.9 NRSRP Measurement Report Mapping

The reporting range of NRSRP is defined from -156 dBm to -44 dBm with 1 dB resolution.

The mapping of measured quantity is defined in Table 9.1.22.9-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 9.1.22.9-1: NRSRP measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| NRSRP\_00 | NRSRP < -156 | dBm |
| NRSRP\_01 | -156 ≤ NRSRP < -155 | dBm |
| NRSRP\_02 | -155 ≤ NRSRP < -154 | dBm |
| … | … | … |
| NRSRP\_111 | -46 ≤ NRSRP < -45 | dBm |
| NRSRP\_112 | -45 ≤ NRSRP < -44 | dBm |
| NRSRP\_113 | -44 ≤ NRSRP | dBm |

#### 9.1.22.10 Intra-Frequency RSTD Accuracy Requirement for NB1 for normal coverage

The accuracy requirements in Table 9.1.22.10-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

NPRP 1,2|dBm according to Annex B.3.29 for a corresponding Band

There are no measurement gaps overlapping with the NPRS subframes of the measured serving cell.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

UE is configured via LPP with nprsInfo-Type2as specified in TS 36.355 [24] for any cell whose NPRS RE overlaps with the NPRS RE of any other cell in the OTDOA assistance data on the same frequency.

Table 9.1.22.10-1: Intra RSTD measurement accuracy for normal coverage

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | |
| NPRS Ês/Iot | UE NPRS measurement  bandwidth on the reference cell and the measured neighbour cell *i* Note 3 | Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i*, *NNPRS\_total* Note 6 | Io Note 7 range | | |
| E-UTRA/NR operating band groups Note 7 | Minimum Io Note 1 | Maximum Io |
| Ts Note 2 | dB | RB |  |  | dBm/15kHz | dBm/BWChannel |
| ±20 | (NPRS Ês/Iot)ref ≥-6dB  and  (NPRS Ês/Iot)*i* ≥-13dB | 1 | 320 | NFDD\_G, NTDD\_G | -118 | -70 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 4: The Io is defined in NPRS positioning subframes. The same Io range applies to NPRS and non-NPRS symbols. Io levels are different in NPRS and non-NPRS symbols within the same subframe.  NOTE 5: E-UTRA/NR operating band groups are as defined in Section 3.5.  NOTE 6: *NNPRS\_total* can be in one or more NPRS positioning occasions. | | | | | | |

#### 9.1.22.11 Inter-Frequency RSTD Accuracy Requirement for NB1 for normal coverage

The accuracy requirements in Table 9.1.22.11-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

NPRP 1,2|dBm according to Annex B.3.29 for a corresponding Band

There are no measurement gaps overlapping with the NPRS subframes of the measured serving cell.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

UE is configured via LPP with nprsInfo-Type2as specified in TS 36.355 [24] for any cell whose NPRS RE overlaps with the NPRS RE of any other cell in the OTDOA assistance data on the same frequency.

Table 9.1.22.11-1: Inter RSTD measurement accuracy for normal coverage

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | |
| NPRS Ês/Iot | UE NPRS measurement  bandwidth on the reference cell and the measured neighbour cell *i* Note 3 | Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i*, *NNPRS\_total* Note 6 | Io Note 7 range | | |
| E-UTRA/NR operating band groups Note 7 | Minimum Io Note 1 | Maximum Io |
| Ts Note 2 | dB | RB |  |  | dBm/15kHz | dBm/BWChannel |
| ±28 | (NPRS Ês/Iot)ref ≥-6dB  and  (NPRS Ês/Iot)*i* ≥-13dB | 1 | 320 | NFDD\_G, NTDD\_G | -118 | -70 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 4: The Io is defined in NPRS positioning subframes. The same Io range applies to NPRS and non-NPRS symbols. Io levels are different in NPRS and non-NPRS symbols within the same subframe.  NOTE 5: E-UTRA/NR operating band groups are as defined in Section 3.5.  NOTE 6: *NNPRS\_total* can be in one or more NPRS positioning occasions. | | | | | | |

#### 9.1.22.12 Intra-Frequency RSTD Accuracy Requirement for NB1 for enhanced coverage

The accuracy requirements in Table 9.1.22.12-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

NPRP 1,2|dBm according to Annex B.3.29 for a corresponding Band

There are no measurement gaps overlapping with the NPRS subframes of the measured serving cell.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

UE is configured via LPP with nprsInfo-Type2as specified in TS 36.355 [24] for any cell whose NPRS RE overlaps with the NPRS RE of any other cell in the OTDOA assistance data on the same frequency.

Table 9.1.22.12-1: RSTD measurement accuracy for enhanced coverage

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | |
| NPRS Ês/Iot | UE NPRS measurement  bandwidth on the reference cell and the measured neighbour cell *i* Note 3 | Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i* , *NNPRS\_total* Note 6 | Io Note 7 range | | |
| E-UTRA/NR operating band groups Note 7 | Minimum Io Note 1 | Maximum Io |
| Ts Note 2 | dB | RB |  |  | dBm/15kHz | dBm/BWChannel |
| ±32 | (NPRS Ês/Iot)ref ≥-15dB  and  (NPRS Ês/Iot)*i* ≥-15dB | 1 | 320 | NFDD\_G, NTDD\_G | -118 | -70 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 4: The Io is defined in NPRS positioning subframes. The same Io range applies to NPRS and non-NPRS symbols. Io levels are different in NPRS and non-NPRS symbols within the same subframe.  NOTE 5: E-UTRA/NR operating band groups are as defined in Section 3.5.  NOTE 6: *NNPRS\_total* can be in one or more NPRS positioning occasions. | | | | | | |

#### 9.1.22.13 Inter-Frequency RSTD Accuracy Requirement for NB1 for enhanced coverage

The accuracy requirements in Table 9.1.22.13-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

NPRP 1,2|dBm according to Annex B.3.29 for a corresponding Band

There are no measurement gaps overlapping with the NPRS subframes of the measured serving cell.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

UE is configured via LPP with nprsInfo-Type2as specified in TS 36.355 [24] for any cell whose NPRS RE overlaps with the NPRS RE of any other cell in the OTDOA assistance data on the same frequency.

Table 9.1.22.13-1: RSTD measurement accuracy for enhanced coverage

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | |
| NPRS Ês/Iot | UE NPRS measurement  bandwidth on the reference cell and the measured neighbour cell *i* Note 3 | Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i* , *NNPRS\_total* Note 6 | Io Note 7 range | | |
| E-UTRA/NR operating band groups Note 7 | Minimum Io Note 1 | Maximum Io |
| Ts Note 2 | dB | RB |  |  | dBm/15kHz | dBm/BWChannel |
| ±40 | (NPRS Ês/Iot)ref ≥-15dB  and  (NPRS Ês/Iot)*i* ≥-15dB | 1 | 320 | NFDD\_G, NTDD\_G | -118 | -70 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 4: The Io is defined in NPRS positioning subframes. The same Io range applies to NPRS and non-NPRS symbols. Io levels are different in NPRS and non-NPRS symbols within the same subframe.  NOTE 5: E-UTRA/NR operating band groups are as defined in Section 3.5.  NOTE 6: *NNPRS\_total* can be in one or more NPRS positioning occasions. | | | | | | |

#### 9.1.22.14 NRSRQ Measurement Report Mapping

The reporting range of NRSRQ is defined from -34 dB to 2.5 dB with 0.5 dB resolution.

The mapping of measured quantity is defined in table 9.1.22.14-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 9.1.22.14-1: NRSRQ measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| NRSRQ\_-30 | NRSRQ < -34 | dB |
| NRSRQ\_-29 | -34 ≤ NRSRQ < -33.5 | dB |
| … | … | … |
| NRSRQ\_-02 | -20.5 ≤ NRSRQ < -20 | dB |
| NRSRQ\_-01 | -20 ≤ NRSRQ < -19.5 | dB |
| NRSRQ\_00 | NRSRQ < -19.5 | dB |
| NRSRQ\_01 | -19.5 ≤ NRSRQ < -19 | dB |
| NRSRQ\_02 | -19 ≤ NRSRQ < -18.5 | dB |
| … | … | … |
| NRSRQ\_32 | -4 ≤ NRSRQ < -3.5 | dB |
| NRSRQ\_33 | -3.5 ≤ NRSRQ < -3 | dB |
| NRSRQ\_34 | -3 ≤ NRSRQ | dB |
| NRSRQ\_35 | -3 ≤ NRSRQ < -2.5 | dB |
| NRSRQ\_36 | -2.5 ≤ NRSRQ < -2 | dB |
| … | … | … |
| NRSRQ\_45 | 2 ≤ NRSRQ < 2.5 | dB |
| NRSRQ\_46 | 2.5 ≤ NRSRQ | dB |

#### 9.1.22.15 MSG3-based Measurement Report Mapping for UE Category NB1

Table 9.1.22.15-1: Downlink channel quality measurement report mapping of CQI-NPDCCH-NB when the DL channel quality reporting is supported [7]

|  |  |
| --- | --- |
| Reported value | NPDCCH repetition level |
| noMeasurement | No measurement reporting |
| candidateRep-A | 1 |
| candidateRep-B | 2 |
| candidateRep-C | 4 |
| candidateRep-D | 8 |
| candidateRep-E | 16 |
| candidateRep-F | 32 |
| candidateRep-G | 64 |
| candidateRep-H | 128 |
| candidateRep-I | 256 |
| candidateRep-J | 512 |
| candidateRep-K | 1024 |
| candidateRep-L | 2048 |

The NPDCCH repetition level for CQI-NPDCCH-Short-NB is chosen with regard to the signalled parameter Rmax, the maximum number of repetitions for NPDCCH common search space for random access response (npdcch-NumRepetitions-RA) in SystemInformationBlockType2-NB. The report mapping is defined in Table 9.1.22.15-2.

Table 9.1.22.15-2: Downlink channel quality measurement report mapping of CQI-NPDCCH-Short-NB when the DL channel quality reporting is supported [7]

|  |  |
| --- | --- |
| Reported value | NPDCCH repetition level |
| noMeasurements | No measurement reporting |
| candidateRep-1 | Rmax/8 (NOTE 1) |
| candidateRep-2 | Rmax (NOTE 3) |
| candidateRep-3 | 4×Rmax (NOTE 2) |
| NOTE 1: When Rmax is less than 8, set candidateRep-1 to 1.  NOTE 2: When Rmax is more than 512, set candidateRep-3 to 2048.  NOTE 3: When Rmax is 1, set candidateRep-2 to 2. | |

#### 9.1.22.16 Downlink Channel Quality Measurement Accuracy for UE Category NB1

The requirements for accuracy of downlink channel quality reporting in this clause apply to the serving cell on the anchor carrier and non-anchor carrier for UE Category NB1.

The accuracy requirements in Table 9.1.22.16-1 are valid under the following conditions:

- Cell specific reference signals are transmitted either from one or two ports.

- Conditions defined in TS 36.101 [5] Clause 7.3 for reference sensitivity are fulfilled.

- NRSRP|dBm according to Annex B.3.25 for a corresponding Band.

Table 9.1.22.16-1: Downlink channel quality reporting accuracy for UE Category NB1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| NPDCCH Repetition | Pm-Dsg (%) | Conditions | | | | |
| Ês/Iot | Io NOTE 1 range | | | |
| E-UTRA/NR operating band groups NOTE 2 | Minimum Io | | Maximum Io |
|  | dB |  | dBm/15kHz | dBm/BWChannel | dBm/BWChannel |
| R NOTE 1 | ≤1 | ≥ -6 dB | NFDD\_G | -122.9 | N/A | -70 |
| R/4 NOTE 1 | >1 | ≥ -6 dB | NFDD\_G | -122.9 | N/A | -70 |
| R NOTE 1 | ≤1 | -15 ≤ Ês/Iot ≤ -6 dB | NFDD\_G | - 122.9 | N/A | -70 |
| R/8 NOTE 1 | >1 | -15 ≤ Ês/Iot ≤ -6 dB | NFDD\_G | - 122.9 | N/A | -70 |
| NOTE 1: R is the reported NPDCCH repetition level that UE has reported in CQI-NPDCCH-NB or CQI-NPDCCH-Short-NB.  NOTE 2: Io is assumed to have constant EPRE across the bandwidth.  NOTE 3: E-UTRA/NR operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.22.17 Channel quality reporting for UE Category NB2 with 16-QAM

Table 9.1.22.17-1: Downlink channel quality measurement report mapping when the reception of unicast NPDSCH modulated with 16-QAM is configured

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reported value | NPDCCH repetition level | NPDSCH transport block  error probability not exceeding 0.1 | | | |
| Modulation | Code rate x 1024 | Repetition | Efficiency |
| noMeasurement | No measurement reporting | Out of range | | | |
| candidateRep-A | 1 | QPSK | 221 | 1 | 0.4316 |
| candidateRep-B | 2 | QPSK | 140 | 1 | 0.2737 |
| candidateRep-C | 4 | QPSK | 81 | 1 | 0.1579 |
| candidateRep-D | 8 | QPSK | 81 | 2 | 0.0789 |
| candidateRep-E | 16 | QPSK | 81 | 4 | 0.0395 |
| candidateRep-F | 32 | QPSK | 81 | 8 | 0.0198 |
| candidateRep-G | 1 | QPSK | 336.8 | 1 | 0.6579 |
| candidateRep-H | 1 | QPSK | 453.6 | 1 | 0.8860 |
| candidateRep-I | 1 | QPSK | 579.4 | 1 | 1.1316 |
| candidateRep-J | 1 | QPSK | 759 | 1 | 1.4825 |
| candidateRep-K | 1 | 16QAM | 487.3 | 1 | 1.9035 |
| candidateRep-L | 1 | 16QAM | 541.2 | 1 | 2.1140 |
| candidateRep-M | 1 | 16QAM | 658 | 1 | 2.5702 |
| candidateRep-N | 1 | 16QAM | 783.7 | 1 | 3.0614 |
| candidateRep-O | 1 | 16QAM | 837.6 | 1 | 3.2719 |

### 9.1.23 Power Headroom for UE Category NB1

The requirements in this clause shall apply for power headroom for UE Category NB1 as defined in [31].

The power headroom provides the serving eNB with information about the differences between the UE configured maximum output power (PCMAX,) defined in TS 36.101 [5] and the estimated power for UL-NSCH transmission of the serving cell [3].

Table 9.1.23 -1: The applicability of power headroom report mapping requirements for different power class UE

|  |  |
| --- | --- |
| Power class | Power headroom report mapping |
| PC3 and PC5 | As defined in section 9.1.23.3 |
| PC6 | As defined in section 9.1.23.4 |

#### 9.1.23.1 Period

The reported power headroom shall be estimated over 1 slot of NPUSCH transmissions.

#### 9.1.23.2 Reporting Delay

The power headroom reporting delay is defined as the time between the beginning of the power headroom reference period and the time when the UE starts transmitting the power headroom over the radio interface. The reporting delay of the power headroom shall be 0 ms, which is applicable for all configured triggering mechanisms for power headroom reporting.

#### 9.1.23.3 Report Mapping for UE Category NB1

The power headroom reporting range is from -54 dB ...+11 dB for UE category NB1 when the enhanced coverage level 0 is selected during the random access procedure [17]. The report mapping is defined in Table 9.1.23.3-1 for UEs not supporting enhanced PHR, and in Table 9.1.23.3-1A for UEs supporting enhanced PHR[31].

Table 9.1.23.3-1: Power headroom report mapping for UE category NB1 UEs not supporting enhanced PHR [31] when the enhanced coverage level 0 is selected during random access procedure [17]

|  |  |
| --- | --- |
| Reported value | Measured quantity value (dB) |
| POWER\_HEADROOM\_0 | -54 ≤ PH < 5 |
| POWER\_HEADROOM\_1 | 5 ≤ PH < 8 |
| POWER\_HEADROOM\_2 | 8 ≤ PH < 11 |
| POWER\_HEADROOM\_3 | PH ≥ 11 |

Table 9.1.23.3-1A: Power headroom report mapping for UE category NB1 UEs supporting enhanced PHR [31] when the enhanced coverage level 0 is selected during random access procedure [17]

|  |  |
| --- | --- |
| Reported value | Measured quantity value (dB) |
| POWER\_HEADROOM\_0 | -5 ≤ PH < -37 |
| POWER\_HEADROOM\_1 | -37 ≤ PH < -33 |
| POWER\_HEADROOM\_2 | -33 ≤ PH < -29 |
| POWER\_HEADROOM\_3 | -29 ≤ PH < -25 |
| POWER\_HEADROOM\_4 | -25 ≤ PH < -21] |
| POWER\_HEADROOM\_5 | -21 ≤ PH < -17 |
| POWER\_HEADROOM\_6 | -17 ≤ PH < -13 |
| POWER\_HEADROOM\_7 | -13 ≤ PH < -9 |
| POWER\_HEADROOM\_8 | -9 ≤ PH < -5 |
| POWER\_HEADROOM\_9 | -5 ≤ PH < -1 |
| POWER\_HEADROOM\_10 | -1 ≤ PH < 3 |
| POWER\_HEADROOM\_11 | 3]≤ PH < 7 |
| POWER\_HEADROOM\_12 | 7≤ PH < 1] |
| POWER\_HEADROOM\_13 | 11] ≤ PH < 15 |
| POWER\_HEADROOM\_14 | 15 ≤ PH < 19 |
| POWER\_HEADROOM\_15 | PH ≥ 19 |

The power headroom reporting range is from -54 dB ...+6 or 11 dB for UE category NB1 when enhanced coverage level other than 0 is selected during the random access procedure [17]. The report mapping is defined in Table 9.1.23.3-2 for the UEs not supporing enhanced PHR, and in Table 9.1.23.3-2A for UEs supporting enhanced PHR [31].

Table 9.1.23.3-2: Power headroom report mapping for UE category NB1 UEs not supporting enhanced PHR [31] when the enhanced coverage level other than 0 is selected during random access procedure [17]

|  |  |
| --- | --- |
| Reported value | Measured quantity value (dB) |
| POWER\_HEADROOM\_0 | -54 ≤ PH < -10 |
| POWER\_HEADROOM\_1 | -10 ≤ PH < -2 |
| POWER\_HEADROOM\_2 | -2 ≤ PH < 6 |
| POWER\_HEADROOM\_3 | PH ≥ 6 |

Table 9.1.23.3-2A: Power headroom report mapping for UE category NB1 supporting enhanced PHR [31] when the enhanced coverage level other than 0 is selected during random access procedure [17]

|  |  |
| --- | --- |
| Reported value | Measured quantity value (dB) |
| POWER\_HEADROOM\_0 | -54 ≤ PH < -45 |
| POWER\_HEADROOM\_1 | -45 ≤ PH < -41] |
| POWER\_HEADROOM\_2 | -41 ≤ PH < -37 |
| POWER\_HEADROOM\_3 | -37 ≤ PH < -33 |
| POWER\_HEADROOM\_4 | -33 ≤ PH < -29 |
| POWER\_HEADROOM\_5 | -29 ≤ PH < [25 |
| POWER\_HEADROOM\_6 | -25 ≤ PH < -21 |
| POWER\_HEADROOM\_7 | -21 ≤ PH < -17 |
| POWER\_HEADROOM\_8 | -17 ≤ PH < -13] |
| POWER\_HEADROOM\_9 | -13 ≤ PH < -9 |
| POWER\_HEADROOM\_10 | -9 ≤ PH < -5 |
| POWER\_HEADROOM\_11 | -5 ≤ PH < -1 |
| POWER\_HEADROOM\_12 | -1 ≤ PH < 3 |
| POWER\_HEADROOM\_13 | 3 ≤ PH < 7 |
| POWER\_HEADROOM\_14 | 7 ≤ PH < 1] |
| POWER\_HEADROOM\_15 | PH ≥ 11 |

##### 9.1.23.3.1 Void

##### 9.1.23.3.2 Void

#### 9.1.23.4 Report Mapping for UE Category NB1 for UE Power Class 6

The power headroom reporting range is -54 dB … +11 dB for UE category NB1 when the enhanced coverage level 0 is selected during the random access procedure [17] for UE power class 6 [5]. The report mapping is defined in Table 9.1.23.4-1 for the UEs not supporting enhanced PHR, and in Table 9.1.23.4-1A for UEs supporting enhanced PHR [31].

Table 9.1.23.4-1: Power headroom report mapping for UE category NB1 UEs not supporting enhanced PHR when the enhanced coverage level 0 is selected during random access procedure [17] for UE PC6

|  |  |
| --- | --- |
| Reported value | Measured quantity value (dB) |
| POWER\_HEADROOM\_0 | -54 ≤ PH < 5] |
| POWER\_HEADROOM\_1 | 5 ≤ PH < 8 |
| POWER\_HEADROOM\_2 | 8 ≤ PH < 11 |
| POWER\_HEADROOM\_3 | PH ≥ 11 |

Table 9.1.23.4-1A: Power headroom report mapping for UE category NB1 for UE PC6 and supporting enhanced PHR [31] when the enhanced coverage level 0 is selected during random access procedure [17] for UE PC6

|  |  |
| --- | --- |
| Reported value | Measured quantity value (dB) |
| POWER\_HEADROOM\_0 | -54 ≤ PH < [45 |
| POWER\_HEADROOM\_1 | -45 ≤ PH < [41 |
| POWER\_HEADROOM\_2 | -41 ≤ PH < [37 |
| POWER\_HEADROOM\_3 | -37 ≤ PH < [33 |
| POWER\_HEADROOM\_4 | -33 ≤ PH < [29 |
| POWER\_HEADROOM\_5 | -29 ≤ PH < [25 |
| POWER\_HEADROOM\_6 | -25 ≤ PH < [-1 |
| POWER\_HEADROOM\_7 | -21 ≤ PH < [17 |
| POWER\_HEADROOM\_8 | -17 ≤ PH < [1] |
| POWER\_HEADROOM\_9 | -13 ≤ PH < [] |
| POWER\_HEADROOM\_10 | -9 ≤ PH < [5 |
| POWER\_HEADROOM\_11 | -5 ≤ PH < [1 |
| POWER\_HEADROOM\_12 | -1 ≤ PH < 3 |
| POWER\_HEADROOM\_13 | 3 ≤ PH < 7 |
| POWER\_HEADROOM\_14 | 7 ≤ PH < 11 |
| POWER\_HEADROOM\_15 | PH ≥ 11 |

The power headroom reporting range is from -54 dB ...0 dB for UE category NB1 when the enhanced coverage level other than 0 is selected during the random access procedure [17] for UE power class of 6 [5]. The report mapping is defined in Table 9.1.23.4-2.

Table 9.1.23.4-2: Power headroom report mapping for UE category NB1 when the enhanced coverage level other than 0 is selected during random access procedure [17] for UE PC6

|  |  |
| --- | --- |
| Reported value | Measured quantity value (dB) |
| POWER\_HEADROOM\_0 | -5] ≤ PH < -20 |
| POWER\_HEADROOM\_1 | -20 ≤ PH < -10 |
| POWER\_HEADROOM\_2 | -10 ≤ PH < 0 |
| POWER\_HEADROOM\_3 | PH ≥ 0 |

### 9.1.24 Void

### 9.1.25 Measurement accuracy for UE category M2

#### 9.1.25.1 Inter-Frequency RSTD Accuracy Requirement for UE catergory M2 in CE mode A

The accuracy requirements in Table 9.1.25.1-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.32 for a corresponding Band

There are no measurement gaps overlapping with the PRS subframes of the measured serving cell.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

Table 9.1.25.1-1: RSTD measurement accuracy for CEModeA

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | | |
| PRS Ês/Iot | Minimum PRS  bandwidth, which is minimum of serving cell channel bandwidth and the PRS bandwidths of the reference cell and the measured neighbour cell *i* | Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i* | The number of consecutive downlink subframes NPRS among the reference cell and the measured neighbour cell *i* as defined in [24] | Io Note 5 range | | |
| E-UTRA operating band groups Note 6 | Minimum Io Note 1 | Maximum Io |
| Ts Note 2 | dB | RB |  |  |  | dBm/15kHz | dBm/BWChannel |
| ±21 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | ≥ 12 | ≥ 4 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±10 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 24 | ≥ 4 | ≥ 2 | Note 4 | Note 4 | Note 4 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 6 RB.  NOTE 5: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 6: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | | |

#### 9.1.25.2 Inter-Frequency RSTD Accuracy Requirement for UE catergory M2 in CE mode B

The accuracy requirements in Table 9.1.25.2-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.32 for a corresponding Band

There are no measurement gaps overlapping with the PRS subframes of the measured serving cell.

The parameter expectedRSTDUncertainty signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

Table 9.1.25.2-1: RSTD measurement accuracy for CEModeB

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | | |
| PRS Ês/Iot | Minimum PRS  bandwidth, which is minimum of serving cell channel bandwidth and the PRS bandwidths of the reference cell and the measured neighbour cell *i* | Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i* | The number of consecutive downlink subframes NPRS among the reference cell and the measured neighbour cell *i* as defined in [24] | Io Note 5 range | | |
| E-UTRA operating band groups Note 6 | Minimum Io Note 1 | Maximum Io |
| Ts Note 2 | dB | RB |  |  |  | dBm/15kHz | dBm/BWChannel |
| ±21 | (PRS Ês/Iot)ref ≥-15dB  and  (PRS Ês/Iot)*i* ≥-15dB | ≥ 6 | ≥ 30 | ≥ 4 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±10 | (PRS Ês/Iot)ref ≥-15dB  and  (PRS Ês/Iot)*i* ≥-15dB | ≥ 24 | ≥ 8 | ≥ 4 | Note 4 | Note 4 | Note 4 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 6 RB.  NOTE 5: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 6: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | | |

#### 9.1.25.3 UE RX-TX time difference Accuracy Requirement for Cat-M2

The UE RX-TX time difference is measured from the PCell.

The accuracy requirements in Table 9.1.25.3-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

No changes to the uplink transmission timing are applied during the measurement period.

RSRP|dBm according to Annex B.2.14 for a corresponding Band

Table 9.1.25.3-1: UE Rx – Tx time difference measurement accuracy for CEModeA

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | |
| Ês/Iot | Downlink transmission  bandwidth of PCell | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| Ts Note 2 | dB | RB |  | dBm/15kHz | dBm/BWChannel |
| ±20 | ≥-3 dB | ≥ 6 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±10 | ≥-3 dB | ≥ 24 | Note 3 | Note 3 | Note 3 |
| NOTE 1: When in dBm/15kHz, the minimum Io condition is expressed as the average Io per RE over all REs in that symbol. Io may be different in different symbols within a subframe.  NOTE 2: Ts is the basic timing unit defined in TS 36.211.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with downlink bandwidth ≥1.4 MHz.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.25.4 Intra-Frequency RSTD Accuracy Requirement for UE catergory M2 in CE mode A

The accuracy requirements in Table 9.1.25.4-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.34 for a corresponding Band

For a UE that does not need a measurement gap for intra-frequency RSTD measurement, there are no measurement gaps overlapping with the PRS subframes of the measured serving cell and PRS are available within the UE measurement bandwidth in all PRS subframes

For a UE that needs a measurement gap for intra-frequency RSTD measurement, the measurement gaps are configured to contain PRS subframes

The parameter *expectedRSTDUncertainty* signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

Table 9.1.25.4-1: RSTD measurement accuracy for CEModeA

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | | |
| PRS Ês/Iot | Minimum PRS  bandwidth, which is minimum of serving cell channel bandwidth and the PRS bandwidths of the reference cell and the measured neighbour cell *i* Note 5 | Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i* | The number of consecutive downlink subframes NPRS among the reference cell and the measured neighbour cell *i* as defined in [24] | Io Note 6 range | | |
| E-UTRA operating band groups Note 7 | Minimum Io Note 1 | Maximum Io |
| Ts Note 2 | dB | RB |  |  |  | dBm/15kHz | dBm/BWChannel |
| ±15Note8 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | ≥ 12 | ≥ 6 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±15Note9 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 6 | ≥ 12 | ≥4 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | (PRS Ês/Iot)ref ≥-6dB  and  (PRS Ês/Iot)*i* ≥-13dB | ≥ 24 | ≥ 4 | ≥ 2 | Note 4 | Note 4 | Note 4 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 6 RB.  NOTE 5: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 6: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 7: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 8: The requirement applies when PRS are available within the UE measurement bandwidth in all PRS subframes and measurement gaps are not required.  NOTE 9: The requirement applies when measurement gaps are required. | | | | | | | |

#### 9.1.25.5 Intra-Frequency RSTD Accuracy Requirement for UE catergory M2 in CE mode B

The accuracy requirements in Table 9.1.25.5-1 are valid under the following conditions:

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

PRP 1,2|dBm according to Annex B.3.34 for a corresponding Band

For a UE that does not need a measurement gap for intra-frequency RSTD measurement, there are no measurement gaps overlapping with the PRS subframes of the measured serving cell and PRS are available within the UE measurement bandwidth in all PRS subframes

For a UE that needs a measurement gap for intra-frequency RSTD measurement, the measurement gaps are configured to contain PRS subframes

The parameter *expectedRSTDUncertainty* signalled over LPP by E-SMLC as defined in TS 36.355 [24] is less than 5 µs.

Table 9.1.25.5-1: RSTD measurement accuracy for CEModeB

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Accuracy | Conditions | | | | | | |
| PRS Ês/Iot | Minimum PRS  bandwidth, which is minimum of serving cell channel bandwidth and the PRS bandwidths of the reference cell and the measured neighbour cell *i* Note 5 | Minimum number of available measurement subframes among the reference cell and the measured neighbour cell *i* | The number of consecutive downlink subframes NPRS among the reference cell and the measured neighbour cell *i* as defined in [24] | Io Note 6 range | | |
| E-UTRA operating band groups Note 7 | Minimum Io Note 1 | Maximum Io |
| Ts Note 2 | dB | RB |  |  |  | dBm/15kHz | dBm/BWChannel |
| ±15Note8 | (PRS Ês/Iot)ref ≥-15dB  and  (PRS Ês/Iot)*i* ≥-15dB | ≥ 6 | ≥ 30 | ≥ 6 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±15Note9 | (PRS Ês/Iot)ref ≥-15dB  and  (PRS Ês/Iot)*i* ≥-15dB | ≥ 6 | ≥ 30 | ≥ 4 | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_B | -120.5 | -50 |
| FDD-M1\_C, TDD-M1\_C | -120 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_H | -117.5 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | (PRS Ês/Iot)ref ≥-15dB  and  (PRS Ês/Iot)*i* ≥-15dB | ≥ 24 | ≥ 8 | ≥ 4 | Note 4 | Note 4 | Note 4 |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA assistance data defined in [24].  NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 6 RB.  NOTE 5: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 6: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 7: E-UTRA operating band groups are as defined in Section 3.5.  NOTE 8: The requirement applies when PRS are available within the UE measurement bandwidth in all PRS subframes and measurement gaps are not required.  NOTE 9: The requirement applies when measurement gaps are required. | | | | | | | |

### 9.1.26 Measurement Accuracy for non-BL CE UE

The requirements defined in Section 9.1.26 do not apply when the UE is of category 1bis.

#### 9.1.26.1 Intra-frequency Absolute Accuracy of RSRP for non-BL CE UE in CE mode A

The requirements for absolute accuracy of RSRP in this clause apply to a cell on the same frequency as that of the serving cell for non-BL CE UE.

The accuracy requirements in Table 9.1.26.1-1 and Table 9.1.26.1-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

For a UE capable RSRP measurement based on RSS [4], provided that RSS configuration *rss-ConfigCarrierInfo* [2] has been indicated by higher layers and measurement conditions as defined in clause 8.13.2.1 are met, the accuracy requirement as specified in Table. 9.1.21.1-3 and Table. 9.1.21.1-4 shall apply. Otherwise, the accuracy requirement as specified in Table 9.1.26.1-1 and Table 9.1.26.1-2 shall apply.

Table 9.1.26.1-1: RSRP Intra frequency absolute accuracy for non-BL CE UE with CE mode A for FDD and TDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±5.5 | ±8.5 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.26.1-2: RSRP Intra frequency absolute accuracy for non-BL DE UE with CE mode A for HD-FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±5.5 | ±8.5 | ≥-6 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | FDD-M1\_A, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.26.1-3: RSS based RSRP Intra frequency absolute accuracy for non-BL CE UE with CE mode A for FDD and TDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±3.5 | ±6.5 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±6 | ±9 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.26.1-4: RSS based RSRP Intra frequency absolute accuracy for non-BL DE UE with CE mode A for HD-FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±3.5 | ±6.5 | ≥-6 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±6 | ±9 | ≥-6 dB | FDD-M1\_A, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.26.2 Intra-frequency Relative Accuracy of RSRP for non-BL CE UE in CE mode A

The same requirement as for UE category M1 in Clause 9.1.21.2 applies.

#### 9.1.26.3 Intra-frequency Absolute Accuracy of RSRP for non-BL CE UE in CE mode B

The requirements for absolute accuracy of RSRP in this clause apply to a cell on the same frequency as that of the serving cell for non-BL CE UE.

The accuracy requirements in Table 9.1.26.3-1 and Table 9.1.26.3-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

For a UE capable RSRP measurement based on RSS [4], provided that RSS configuration *rss-ConfigCarrierInfo* [2] has been indicated by higher layers and measurement conditions as defined in clause 8.13.3.1 are met, the accuracy requirement as specified in Table. 9.1.26.3-3 and Table. 9.1.26.3-4 shall apply. Otherwise, the accuracy requirement as specified in Table 9.1.26.3-1 and Table 9.1.26.3-2 shall apply.

Table 9.1.26.3-1: RSRP Intra frequency absolute accuracy for non-BL CE UE with CE mode B for FDD and TDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| ±6 | ±9 | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±10 | ±13 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| ±8 | ±11 | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.26.3-2: RSRP Intra frequency absolute accuracy for non-BL CE UE with CE mode B for HD-FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| ±6 | ±9 | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±10 | ±13 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| ±8 | ±11 | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.26.3-3: RSS based RSRP Intra frequency absolute accuracy for non-BL CE UE with CE mode B for FDD and TDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±6 | ±9 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| ±4.5 | ±7.5 | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| ±6.5 | ±9.5 | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.26.3-3: RSS based RSRP Intra frequency absolute accuracy for non-BL CE UE with CE mode B for HD-FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±6 | ±9 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| ±4.5 | ±7.5 | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| ±6.5 | ±9.5 | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.26.4 Intra-frequency Relative Accuracy of RSRP for non-BL CE UE in CE mode B

The relative accuracy of RSRP is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on the same frequency for the non-BL CE UE.

The accuracy requirements in Table 9.1.26.4-1 and Table 9.1.26.4-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.8 for a corresponding Band.

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

Table 9.1.26.4-1: RSRP Intra frequency relative accuracy for non-BL CE UE with CE mode B for FDD and TDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±3 | ±3 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5 | ±5 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

Table 9.1.26.4-2: RSRP Intra frequency relative accuracy for non-BL CE UE with CE mode B for HD-FDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±3 | ±3 | ≥-12 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±5 | ±5 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.26.5 RSRP Measurement Report Mapping

The same RSRP reporting range as for UE category M1 in Clause 9.1.21.5 applies.

#### 9.1.26.6 Intra-frequency Absolute Accuracy of RSRQ for non-BL CE UE in CE mode A

The same requirement as for UE category M1 in Clause 9.1.21.6 applies.

#### 9.1.26.7 Intra-frequency Absolute Accuracy of RSRQ for non-BL CE UE in CE mode B

The requirements for absolute accuracy of RSRQ in this clause apply to a cell on the same frequency as that of the serving cell for the non-BL CE UE.

The accuracy requirements in Tables 9.1.26.7-1 and 9.1.26.7-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

Table 9.1.26.7-1: RSRQ Intra frequency absolute accuracy for non-BL CE UE with CE mode B for FDD and TDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±4 | ±5.5 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

Table 9.1.26.7-2: RSRQ Intra frequency absolute accuracy for non-BL CE UE with CE mode B for HD-FDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±4 | ±5.5 | ≥-12 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.26.8 RSRQ Measurement Report Mapping

The same RSRQ reporting range as for UE category M1 in Clause 9.1.21.8 applies.

#### 9.1.26.9 Inter-frequency Absolute Accuracy of RSRP for non-BL CE UE in CE mode A

The requirements for absolute accuracy of RSRP in this clause apply to a cell on another frequency than that of the serving cell for non-BL CE UE.

The accuracy requirements in Table 9.1.26.9-1 and Table 9.1.26.9-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

Table 9.1.26.9-1: RSRP Inter frequency absolute accuracy for non-BL CE UE with CE mode A for FDD and TDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±5.5 | ±8.5 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | FDD-M1\_A, TDD-M1\_A, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.26.9-2: RSRP Inter frequency absolute accuracy for non-BL CE UE with CE mode A for HD-FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±5.5 | ±8.5 | ≥-6 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | FDD-M1\_A, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.26.10 Inter-frequency Relative Accuracy of RSRP for non-BL CE UE in CE mode A

The relative accuracy of RSRP is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on another frequency for the non-BL CE UE.

The accuracy requirements in Table 9.1.26.10-1 and Table 9.1.26.10-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.8 for a corresponding Band.

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

Table 9.1.26.10-1: RSRP Inter frequency relative accuracy for non-BL CE UE with CE mode A for FDD and TDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±5.5 | ±6.5 | ≥-3 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6.5 | ±6.5 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

Table 9.1.26.10-2: RSRP Inter frequency relative accuracy for non-BL CE UE with CE mode A for HD-FDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±5.5 | ±6.5 | ≥-3 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6.5 | ±6.5 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.26.11 Inter-frequency Absolute Accuracy of RSRP for non-BL CE UE in CE mode B

The requirements for absolute accuracy of RSRP in this clause apply to a cell on another frequency than that of the serving cell for the non-BL UE.

The accuracy requirements in Table 9.1.26.11-1 and Table 9.1.26.11-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.1 for a corresponding Band

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

Table 9.1.26.11-1: RSRP Inter frequency absolute accuracy for non-BL CE UE with CE mode B for FDD and TDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E, TDD-M1\_E | -119 | N/A | -70 |
| ±6 | ±9 | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±10 | ±13 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, TDD-M1\_A, FDD-M1\_D, FDD-M1\_E, TDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| ±8 | ±11 | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

Table 9.1.26.11-2: RSRP Inter frequency absolute accuracy for non-BL CE UE with CE mode B for HD-FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A | -121 | N/A | -70 |
| FDD-M1\_D | -119.5 | N/A | -70 |
| FDD-M1\_E | -119 | N/A | -70 |
| ±6 | ±9 | ≥-12 dB | FDD-M1\_F | -118.5 | N/A | -70 |
| FDD-M1\_G | -118 | N/A | -70 |
| FDD-M1\_N | -114.5 | N/A | -70 |
| ±10 | ±13 | -15≤Ês/Iot≤-12 dB | FDD-M1\_A, FDD-M1\_D, FDD-M1\_E, FDD-M1\_F, FDD-M1\_G, FDD-M1\_N | N/A | -70 | -50 |
| ±8 | ±11 | ≥-12 dB |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.1.26.12 Inter-frequency Relative Accuracy of RSRP for non-BL CE UE in CE mode B

The relative accuracy of RSRP is defined as the RSRP measured from one cell compared to the RSRP measured from another cell on another frequency.

The accuracy requirements in Table 9.1.26.12-1 and Table 9.1.26.12-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.8 for a corresponding Band.

At least 1 DL subframe per radio frame of measured cell is available at the UE for RSRP measurement assuming measured cell is identified cell.

Table 9.1.26.12-1: RSRP Inter frequency relative accuracy for non-BL CE UE with CE mode B for FDD and TDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±6 | ±9 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

Table 9.1.26.12-2: RSRP Inter frequency relative accuracy for non-BL CE UE with CE mode B for HD-FDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±6 | ±9 | ≥-12 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±8 | ±11 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.26.13 Inter-frequency Absolute Accuracy of RSRQ for non-BL CE UE in CE mode A

The same requirement as for UE category M1 in Clause 9.1.21.13 applies.

#### 9.1.26.14 Inter-frequency Relative Accuracy of RSRQ for non-BL CE UE in CE mode A

The same requirement as for UE category M1 in Clause 9.1.21.14 applies.

#### 9.1.26.15 Inter-frequency Absolute Accuracy of RSRQ for non-BL CE UE in CE mode B

The requirements for absolute accuracy of RSRQ in this clause apply to a cell that has different carrier frequency from the serving cell for the non-BL CE UE.

The accuracy requirements in Tables 9.1.26.15-1 and 9.1.26.15-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP|dBm according to Annex B.3.3 for a corresponding Band

Table 9.1.26.15-1: RSRQ Inter frequency absolute accuracy for non-BL CE UE with CE mode B for FDD and TDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±4 | ±5.5 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

Table 9.1.26.15-2: RSRQ Inter frequency absolute accuracy for non-BL CE UE with CE mode B for HD-FDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±4 | ±5.5 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.1.26.16 Inter-frequency Relative Accuracy of RSRQ for non-BL CE UE in CE mode B

The relative accuracy of RSRQ in inter frequency case is defined as the RSRQ measured from one cell compared to the RSRQ measured from another cell on a different frequency.

The accuracy requirements in Tables 9.1.26.16-1 and 9.1.26.16-2 are valid under the following conditions:

Cell specific reference signals are transmitted either from one, two or four antenna ports.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

RSRP1,2|dBm according to Annex B.3.4 for a corresponding Band



| Channel 1\_Io ‑Channel 2\_Io | ≤ 20 dB

Table 9.1.26.16-1: RSRQ Inter frequency relative accuracy for non-BL CE UE with CE mode B for FDD and TDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±4.5 | ±5.5 | ≥-12 dB | FDD-M1\_A, TDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E, TDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6.5 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

Table 9.1.26.16-2: RSRQ Inter frequency relative accuracy for non-BL CE UE with CE mode B for HD-FDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2 | Io Note 1 range | | |
| E-UTRA operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±4.5 | ±5.5 | ≥-12 dB | FDD-M1\_A | -121 | -50 |
| FDD-M1\_D | -119.5 | -50 |
| FDD-M1\_E | -119 | -50 |
| FDD-M1\_F | -118.5 | -50 |
| FDD-M1\_G | -118 | -50 |
| FDD-M1\_N | -114.5 | -50 |
| ±6.5 | ±6.5 | -15≤Ês/Iot≤-12 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

### 9.1.27 SFN and frame Timing Difference (SFTD)

#### 9.1.27.1 SFTD Accuracy Requirement

The SFN and frame timing difference (SFTD) is measured between PCell and NR PSCell under EN-DC, or between PCell and NR cell for inter-RAT SFTD. The inter-RAT SFTD measurement can only be configured for E-UTRA - NR band combinations that are supported by the UE.

The accuracy requirements in Table 9.1.27.1-4 are appilicable under the following conditions:

For PCell SFN and frame timing measurement:

- Cell specific reference signals are transmitted either from one, two or four antenna ports.

- Conditions defined in TS 36.101 [5] clause 7.3 for reference sensitivity are fulfilled.

- No changes to the uplink transmission timing are applied during the measurement period.

- RSRP|dBm according to Annex B.3.5 for a corresponding Band.

- Io range defined in Table 9.1.27.1-1.

Table 9.1.27.1-1: PCell Io range conditions for SFTD measurement accuracy

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Io Note 1 range | | |
| E-UTRA operating band groups Note 4, 5 | Minimum Io | Maximum Io |
|  | dBm/15kHz Note 2, 3 | dBm/BWChannel |
| Conditions | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| NOTE 1: When in dBm/15kHz, the minimum Io condition is expressed as the average Io per RE over all REs in that symbol. Io may be different in different symbols within a subframe.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in clause B.4.2 and B.4.3.  NOTE 3: The condition level is increased by MSD as defined in clause 7.3B in TS 38.101-3 [54], if applicable depending on E-UTRA – NR band combination.  NOTE 4: NR operating band groups are as defined in clause 3.5 in TS 38.133 [50].  NOTE 5: Only E-UTRA bands within EN-DC band combinations as specified in clause 5.5B in TS 38.101-3 [54] are applicable. | | | |

For NR PSCell, or NR cell SFN and frame timing measurement in FR1:

- Conditions defined in TS 38.101-1 [18] clause 7.3 for reference sensitivity are fulfilled.

- Io range defined in Table 9.1.27.1-2.

Table 9.1.27.1-2: NR PSCell, or NR cell Io range conditions for SFTD measurement accuracy in FR1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Io Note 1 range | | | |
| NR operating band groups Note 4, 5 | Minimum Io Note 2, 3 | | Maximum Io |
|  | dBm/ SCSSSB | | dBm/BWChannel |
| SCSSSB = 15 kHz | SCSSSB = 30 kHz |
| Conditions | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A | -121 | -118 | -50 |
| NR\_FDD\_FR1\_B | -120.5 | -117.5 | -50 |
| NR\_TDD\_FR1\_C | -120 | -117 | -50 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -119.5 | -116.5 | -50 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -119 | -116 | -50 |
| NR\_FDD\_FR1\_G | -118 | -115 | -50 |
| NR\_FDD\_FR1\_H | -117.5 | -114.5 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ΔRIB,c as defined in clause 7.3B in TS 38.101-3 [54], depending on E-UTRA – NR band combination.  NOTE 3: The condition level is increased by MSD as defined in clause 7.3B in TS 38.101-3 [54], if applicable depending on E-UTRA – NR band combination.  NOTE 4: NR operating band groups are as defined in clause 3.5 in TS 38.133 [50].  NOTE 5: Only NR bands within EN-DC band combinations as specified in clause 5.5B in TS 38.101-3 [54] are applicable. | | | | |

For NR PSCell, or NR cell SFN and frame timing measurement in FR2:

- Conditions defined in TS 38.101-2 [19] clause 7.3 for reference sensitivity are fulfilled.

- Io range defined in Table 9.1.27.1-3.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in TS 38.101-2 [19] clause 7.3.4.

Table 9.1.27.1-3: NR PSCell, or NR cell Io range conditions for SFTD measurement accuracy in FR2

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Io Note 1 range | | |
| Minimum Io Note 2, 3 | | Maximum Io |
| dBm/ SCSSSB | | dBm/BWChannel |
| SCSSSB = 15 kHz | SCSSSB = 30 kHz |
| Conditions | Same value as SSB\_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival | Same value as SSB\_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival | 50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth and specified at the Reference point.  NOTE 2: Values based on Refsens and EIS spherical coverage as defined in TS 38.101-2 [19] clauses 7.3.2 and 7.3.4. Applicable side condition selected depending on angle of arrival.  NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. | | | |

Table 9.1.27.1-4: SFTD measurement accuracy

|  |  |  |
| --- | --- | --- |
| Accuracy | Conditions | |
| Ês/Iot | Frequency range |
| Ts Note 1 | dB |  |
| 40 | ≥ -3 dB | FR1 |
| 40 | FR2 |
| NOTE 1: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies. | | |

### 9.1.28 SFN and Frame Timing Difference (SFTD) under CCA

#### 9.1.28.1 SFTD Accuracy Requirement under CCA

The SFN and frame timing difference (SFTD) is measured between PCell and NR PSCell under CCA in EN-DC, or between PCell and NR cell under CCA for inter-RAT SFTD. The inter-RAT SFTD measurement can only be configured for E-UTRA - NR band combinations that are supported by the UE.

The accuracy requirements in Table 9.1.28.1-2 are appilicable under the following conditions:

For PCell SFN and frame timing measurement:

- Cell specific reference signals are transmitted either from one, two or four antenna ports.

- Conditions defined in TS 36.101 [5] clause 7.3 for reference sensitivity are fulfilled.

- No changes to the uplink transmission timing are applied during the measurement period.

- RSRP|dBm according to Annex B.3.5 for a corresponding Band.

- Io range defined in Table 9.1.27.1-1 above.

For NR PSCell, or NR cell SFN and frame timing measurement in FR1:

- Conditions defined in TS 38.101-1 [18] clause 7.3F for reference sensitivity are fulfilled.

- Io range defined in Table 9.1.28.1-1.

Table 9.1.28.1-1: NR PSCell, or NR cell Io range conditions for SFTD measurement accuracy with NR cell under CCA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Io Note 1 range | | | |
| NR operating band groups Note 4, 5 | Minimum Io Note 2, 3 | | Maximum Io |
|  | dBm/ SCSSSB | | dBm/BWChannel |
| SCSSSB = 15 kHz | SCSSSB = 30 kHz |
| Conditions | NR\_CCA\_FR1\_I | -117 | -114 | -50 |
|  | NR\_CCA\_FR1\_J | -116.5 | -113.5 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ΔRIB,c as defined in clause 7.3B in TS 38.101-3 [54], depending on E-UTRA – NR band combination.  NOTE 3: The condition level is increased by MSD as defined in clause 7.3B in TS 38.101-3 [54], if applicable depending on E-UTRA – NR band combination.  NOTE 4: NR operating band groups are as defined in clause 3.5 in TS 38.133 [50].  NOTE 5: Only NR bands within EN-DC band combinations as specified in clause 5.5B in TS 38.101-3 [54] are applicable. | | | | |

Table 9.1.28.1-2: SFTD measurement accuracy with NR cell under CCA

|  |  |  |
| --- | --- | --- |
| Accuracy | Conditions | |
| Ês/Iot | Frequency range |
| Ts Note 1 | dB |  |
| 40 | ≥ -3 dB | FR1 |
| NOTE 1: Ts is the basic timing unit defined in TS 36.211 [16].  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies. | | |

## 9.2 UTRAN FDD Measurements

The requirements in this clause are applicable for a UE:

- in state RRC\_CONNECTED

- performing measurements according to clause 8.1.2.4 with appropriate measurement gaps

- that is synchronised to the cell that is measured.

The reported measurement result after layer 1 filtering shall be an estimate of the average value of the measured quantity over the measurement period. The reference point for the measurement result after layer 1 filtering is referred to as point B in the measurement model described in TS 25.302 [6].

The accuracy requirements in this clause are valid for the reported measurement result after layer 1 filtering. The accuracy requirements are verified from the measurement report at point D in the measurement model having the layer 3 filtering disabled.

### 9.2.1 UTRAN FDD CPICH RSCP

NOTE: This measurement is for handover between E-UTRAN and UTRAN FDD and for SON.

The requirements in this clause are valid for terminals supporting this capability.

The measurement period for RRC\_CONNECTED state is specified in clauses 8.1.2.4.1 and 8.1.2.4.2.

In RRC\_CONNECTED state the accuracy requirements shall meet the absolute accuracy requirements in table 9.2.1-1, under the following conditions:

- CPICH Ec/Io condition for a detectable cell is as specified in clauses 8.1.2.4.1, 8.1.2.4.2, 8.1.2.4.7, 8.1.2.4.8;

- SCH\_Ec/Io condition for a detectable cell is as specified in clauses 8.1.2.4.1, 8.1.2.4.2, 8.1.2.4.7, 8.1.2.4.8.

Table 9.2.1-1: UTRAN FDD CPICH\_RSCP absolute accuracy

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | |
| Normal condition | Extreme condition | Io range | | |
| UTRA operating bands | Minimum Io | Maximum Io |
| dB | dB |  | dBm/3.84 MHz | dBm/3.84 MHz |
| ±6 | ±9 | Band I, IV, VI, X XI, XIX and XXI | -94 | -70 |
| Band IX | -93 | -70 |
| Band II, V and VII | -92 | -70 |
| Band III, VIII, XII, XIII, XIV , XX and XXII | -91 | -70 |
| Band XXV, XXVI Note 1 | -90.5 | -70 |
| ±8 | ±11 | Note 2 | -70 | -50 |
| NOTE 1: For Band XXVI, the condition has the minimum Io of -92 dBm/3.84 MHz when the carrier frequency of the assigned UTRA channel is within 869-894 MHz for the UE which supports both Band V and Band XXVI operating frequencies.  NOTE 2: The same bands apply for this requirement as for the corresponding highest accuracy requirement. | | | | |

If the UE, in RRC\_CONNECTED state, needs measurement gaps to perform UTRAN FDD measurements, the relevant UTRAN FDD measurement procedure and measurement gap pattern stated in clause 8.1.2.4 shall apply.

The reporting range and mapping specified for FDD CPICH RSCP in TS 25.133 [18] shall apply.

### 9.2.2 Void

### 9.2.3 UTRAN FDD CPICH Ec/No

NOTE: This measurement is for handover between E-UTRAN and UTRAN FDD and for SON.

The requirements in this clause are valid for terminals supporting this capability.

The measurement period for RRC\_CONNECTED state is specified in clauses 8.1.2.4.1 and 8.1.2.4.2.

In RRC\_CONNECTED state the accuracy requirements shall be the same as the inter-frequency measurement accuracy requirements for FDD CPICH Ec/No in TS 25.133 [18].

If the UE, in RRC\_CONNECTED state, needs measurement gaps to perform UTRAN FDD measurements, the UTRAN FDD measurement procedure and measurement gap pattern stated in clause 8.1.2.4.1 shall apply.

The reporting range and mapping specified for FDD CPICH Ec/No in TS 25.133 [18] shall apply.

## 9.3 UTRAN TDD Measurements

The requirements in this clause are applicable for a UE:

- in state RRC\_CONNECTED

- performing measurements according to clause 8.1.2.4 with appropriate measurement gaps

- that is synchronised to the cell that is measured.

The reported measurement result after layer 1 filtering shall be an estimate of the average value of the measured quantity over the measurement period. The reference point for the measurement result after layer 1 filtering is referred to as point B in the measurement model described in TS 25.302 [6].

The accuracy requirements in this clause are valid for the reported measurement result after layer 1 filtering. The accuracy requirements are verified from the measurement report at point D in the measurement model having the layer 3 filtering disabled.

### 9.3.1 UTRAN TDD P-CCPCH RSCP

NOTE: This measurement is for handover between E-UTRAN and UTRAN TDD and for SON.

The requirements in this clause are valid for terminals supporting this capability.

The measurement period for RRC\_CONNECTED state is specified in clauses 8.1.2.4.3 and 8.1.2.4.4.

In RRC\_CONNECTED state the accuracy requirements shall be the same as the inter-frequency measurement accuracy requirements for TDD P-CCPCH in TS 25.123 [19].

If the UE, in RRC\_CONNECTED state, needs measurement gaps to perform UTRAN TDD measurements, the relevant UTRAN TDD measurement procedure and measurement gap pattern stated in clause 8.1.2.4 shall apply.

The reporting range and mapping specified for TDD P-CCPCH RSCP in TS 25.123 [19] shall apply.

### 9.3.2 Void

### 9.3.3 Void

## 9.4 GSM Measurements

The requirements in this clause are applicable for a UE:

- in state RRC\_CONNECTED

- performing measurements according to clause 8.1.2.4.5 with appropriate measurement gaps

- that is synchronised to the cell that is measured.

The reported measurement result after layer 1 filtering shall be an estimate of the average value of the measured quantity over the measurement period. The reference point for the measurement result after layer 1 filtering is referred to as point B in the measurement model described in TS 25.302 [6].

The accuracy requirements in this clause are valid for the reported measurement result after layer 1 filtering. The accuracy requirements are verified from the measurement report at point D in the measurement model having the layer 3 filtering disabled.

### 9.4.1 GSM carrier RSSI

NOTE: This measurement is for handover between E-UTRAN and GSM.

The requirements in this clause are valid for terminals supporting this capability.

The measurement period for RRC\_CONNECTED state is specified in clause 8.1.2.4.5.

In RRC\_CONNECTED state the measurement accuracy requirements for RXLEV in TS 45.008 [8] shall apply.

If the UE, in RRC\_CONNECED state, needs measurement gaps to perform GSM measurements, the GSM measurement procedure and measurement gap pattern stated in clause 8.1.2.4.5 shall apply.

The reporting range and mapping specified for RXLEV in TS 45.008 [8] shall apply.

## 9.5 CDMA2000 1x RTT Measurements

The requirements in this clause are applicable for a UE:

- in RRC\_CONNECTED state.

- synchronised to the cell that is measured.

### 9.5.1 CDMA2000 1x RTT Pilot Strength

NOTE: This measurement is for handover between E-UTRAN and cdma2000 1 x RTT.

The requirements in this clause are valid for terminals supporting this capability.

CDMA2000 1xRTT Pilot Strength defined in sub-clause 5.1.10 of [4] shall meet the performance requirement defined in sub-clause 3.2.4 of [14] on the cdma2000 1xRTT neighbour cells indicated by the serving eNode B.

## 9.6 PCMAX,c

For a UE configured with a secondary cell, the UE is required to report the UE configured maximum output power (PCMAX,c) together with the power headroom. This clause defines the requirements for the PCMAX,c reporting.

### 9.6.1 Report Mapping

The PCMAX,c reporting range is defined from -29dBm to 33 dBm with 1 dB resolution. Table 9.6.1-1 defines the reporting mapping.

Table 9.6.1-1 Mapping of PCMAX,c

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| PCMAX\_C\_00 | PCMAX,c < -29 | dBm |
| PCMAX\_C\_01 | -29 ≤ PCMAX,c < -28 | dBm |
| PCMAX\_C\_02 | -28 ≤ PCMAX,c < -27 | dBm |
| … | … | … |
| PCMAX\_C\_61 | 31 ≤ PCMAX,c < 32 | dBm |
| PCMAX\_C\_62 | 32 ≤ PCMAX,c < 33 | dBm |
| PCMAX\_C\_63 | 33 ≤ PCMAX,c | dBm |

### 9.6.2 Estimation Period

When *extendedPHR* is configured and UE is required to include PCMAX,c in Extended PHR MAC control element as defined in subclause 5.4.6 in [17], the UE shall calculate the PCMAX,c per activated serving cell c for UL-SCH transmission according to subclause 6.2.5A of TS 36.101 [5] over 1 subframe.

### 9.6.3 Reporting Delay

The PCMAX,c reporting delay is defined as the time between the beginning of the PCMAX,c reference period and the time when the UE starts transmitting PCMAX,c over the radio interface. The reporting delay of the PCMAX,c shall be 0 ms, which is applicable for all configured triggering mechanisms for PCMAX,c reporting.

## 9.7 IEEE802.11 Measurements

The requirements in this clause are applicable for a UE:

- in RRC\_CONNECTED state.

- synchronised to the IEEE 802.11 access point that is measured.

### 9.7.1 WLAN RSSI

NOTE: This measurement is for access network selection and traffic steering between E-UTRAN and WLAN.

The requirements in this clause are valid for terminals supporting this capability.

WLAN RSSI defined in sub-clause 5.1.16 of [4] shall meet the performance requirement defined in [32].

### 9.7.2 WLAN RSSI Measurement Report Mapping

This sub-clause 9.7.2 doesn’t apply to LPP *WLAN-MeasurementInformation*. The WLAN RSSI measurement report mapping is defined in [32] for LPP *WLAN-MeasurementInformation*.

The reporting range of WLAN RSSI is defined from -100 dBm to 40 dBm with 1 dB resolution.

The mapping of measured quantity is defined in Table 9.7.2-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 9.7.2-1: WLAN RSSI measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| WLAN RSSI\_00 | WLAN RSSI < -100 | dBm |
| WLAN RSSI\_01 | -100 ≤ WLAN RSSI < -99 | dBm |
| WLAN RSSI\_02 | -99 ≤ WLAN RSSI < -98 | dBm |
| … | … | … |
| WLAN RSSI\_139 | 38 ≤ WLAN RSSI < 39 | dBm |
| WLAN RSSI\_140 | 39 ≤ WLAN RSSI < 40 | dBm |
| WLAN RSSI\_141 | 40 ≤ WLAN RSSI | dBm |

## 9.8 MBSFN Measurements

### 9.8.1 Introduction

MBSFN measurements include MBSFN RSRP, MBSFN RSRQ, and MCH BLER, which are defined in [4]. The measurements are used for MDT.

The requirements in Section 9.8 apply for 15 kHz subcarrier spacing configured in MBSFN subframes. The same requirements apply also for 370.73 Hz, 2.5 kHz, 1.25 kHz and 7.5 kHz subcarrier spacing, provided that MBSFN RSRP|dBm/(L) kHz = MBSFN RSRP|dBm/15kHz + 10∙log10(L/15), where L is 370.73 Hz, 2.5 kHz, 1.25 kHz or 7.5 kHz.

### 9.8.2 MBSFN RSRP

#### 9.8.2.1 Absolute MBSFN RSRP measurement accuracy requirements

The requirements for absolute accuracy of MBSFN RSRP in this clause apply to any carrier, which may be the same as or different from any serving unicast carrier, where PMCH is received while meeting performance requirements in Section 10 of [5].

The accuracy requirements in Table 9.8.2.1-1 are valid under the following conditions:

MBSFN RS are transmitted from antenna port 4 in the MBSFN subframes where PMCH is received.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

MBSFN RSRP|dBm/15kHz is the same as RSRP|dBm/15kHz specified in Annex B.3.1 for each corresponding Band.

Table 9.8.2.1-1: Absolute MBSFN RSRP measurement accuracy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | | |
| E-UTRA operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±4.5 | ±9 | ≥-6 dB | FDD\_A, TDD\_A | -121 | N/A | -70 |
| FDD\_B1, FDD\_B2 | -120.5 | N/A | -70 |
| FDD\_C, TDD\_C | -120 | N/A | -70 |
| FDD\_D | -119.5 | N/A | -70 |
| FDD\_E, TDD\_E | -119 | N/A | -70 |
| FDD\_F | -118.5 | N/A | -70 |
| FDD\_G | -118 | N/A | -70 |
| FDD\_H | -117.5 | N/A | -70 |
| FDD\_N | -114.5 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | FDD\_A, TDD\_A, FDD\_B1, FDD\_B2, FDD\_C, TDD\_C, FDD\_D, FDD\_E, TDD\_E, FDD\_F, FDD\_G, FDD\_H, FDD\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA operating band groups are as defined in Section 3.5. | | | | | | |

#### 9.8.2.2 MBSFN RSRP measurement report mapping

The reporting range of MBSFN RSRP is defined from -140 dBm to -44 dBm with 1 dB resolution, for 15kHz subcarrier spacing.

The mapping of measured quantity is defined in Table 9.8.2.2-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 9.8.2.2-1: MBSFN RSRP measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| MBSFN\_RSRP\_00 | MBSFN\_RSRP < -140 | dBm / 15 kHz |
| MBSFN\_RSRP\_01 | -140 ≤ MBSFN\_RSRP < -139 | dBm / 15 kHz |
| MBSFN\_RSRP\_02 | -139 ≤ MBSFN\_RSRP < -138 | dBm / 15 kHz |
| … | … | … |
| MBSFN\_RSRP\_95 | -46 ≤ MBSFN\_RSRP < -45 | dBm / 15 kHz |
| MBSFN\_RSRP\_96 | -45 ≤ MBSFN\_RSRP < -44 | dBm / 15 kHz |
| MBSFN\_RSRP\_97 | -44 ≤ MBSFN\_RSRP | dBm / 15 kHz |

#### 9.8.2.3 MBSFN RSRP measurement report mapping for 7.5 kHz subcarrier spacing

The reporting range of MBSFN RSRP is defined from -143 dBm to -47 dBm with 1 dB resolution, for 7.5 kHz subcarrier spacing.

The mapping of measured quantity is defined in Table 9.8.2.3-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 9.8.2.3-1: MBSFN RSRP measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| MBSFN\_RSRP\_00 | MBSFN\_RSRP < -143 | dBm / 7.5 kHz |
| MBSFN\_RSRP\_01 | -143 ≤ MBSFN\_RSRP < -142 | dBm / 7.5 kHz |
| MBSFN\_RSRP\_02 | -142 ≤ MBSFN\_RSRP < -141 | dBm / 7.5 kHz |
| … | … | dBm / 7.5 kHz |
| MBSFN\_RSRP\_95 | -49 ≤ MBSFN\_RSRP < -48 | dBm / 7.5 kHz |
| MBSFN\_RSRP\_96 | -48 ≤ MBSFN\_RSRP < -47 | dBm / 7.5 kHz |
| MBSFN\_RSRP\_97 | -47 ≤ MBSFN\_RSRP | dBm / 7.5 kHz |

#### 9.8.2.4 MBSFN RSRP measurement report mapping for 1.25 kHz subcarrier spacing

The reporting range of MBSFN RSRP is defined from -151 dBm to -55 dBm with 1 dB resolution, for 1.25 kHz subcarrier spacing.

The mapping of measured quantity is defined in Table 9.8.2.4-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 9.8.2.4-1: MBSFN RSRP measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| MBSFN\_RSRP\_00 | MBSFN\_RSRP < -151 | dBm / 1.25 kHz |
| MBSFN\_RSRP\_01 | -151 ≤ MBSFN\_RSRP < -150 | dBm / 1.25 kHz |
| MBSFN\_RSRP\_02 | -150 ≤ MBSFN\_RSRP < -149 | dBm / 1.25 kHz |
| … | … | dBm / 1.25 kHz |
| MBSFN\_RSRP\_95 | -57 ≤ MBSFN\_RSRP < -56 | dBm / 1.25 kHz |
| MBSFN\_RSRP\_96 | -56 ≤ MBSFN\_RSRP < -55 | dBm / 1.25 kHz |
| MBSFN\_RSRP\_97 | -55 ≤ MBSFN\_RSRP | dBm / 1.25 kHz |

#### 9.8.2.5 MBSFN RSRP measurement report mapping for 2.5 kHz subcarrier spacing

The reporting range of MBSFN RSRP is defined from -148 dBm to -52 dBm with 1 dB resolution, for 2.5 kHz subcarrier spacing.

The mapping of measured quantity is defined in Table 9.8.2.5-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 9.8.2.5-1: MBSFN RSRP measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| MBSFN\_RSRP\_00 | MBSFN\_RSRP < -148 | dBm / 2.5 kHz |
| MBSFN\_RSRP\_01 | -148 ≤ MBSFN\_RSRP < -147 | dBm / 2.5 kHz |
| MBSFN\_RSRP\_02 | -147 ≤ MBSFN\_RSRP < -146 | dBm / 2.5 kHz |
| … | … | … |
| MBSFN\_RSRP\_95 | -54 ≤ MBSFN\_RSRP < -53 | dBm / 2.5 kHz |
| MBSFN\_RSRP\_96 | -53 ≤ MBSFN\_RSRP < -52 | dBm / 2.5 kHz |
| MBSFN\_RSRP\_97 | -52 ≤ MBSFN\_RSRP | dBm / 2.5 kHz |

#### 9.8.2.6 MBSFN RSRP measurement report mapping for 370.37Hz subcarrier spacing

The reporting range of MBSFN RSRP is defined from -156 dBm to -60 dBm with 1 dB resolution, for 370.37 kHz subcarrier spacing.

The mapping of measured quantity is defined in Table 9.8.2.6-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 9.8.2.6-1: MBSFN RSRP measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| MBSFN\_RSRP\_00 | MBSFN\_RSRP < -156 | dBm / 370.37Hz |
| MBSFN\_RSRP\_01 | -156 ≤ MBSFN\_RSRP < -155 | dBm / 370.37Hz |
| MBSFN\_RSRP\_02 | -155 ≤ MBSFN\_RSRP < -154 | dBm / 370.37Hz |
| … | … | … |
| MBSFN\_RSRP\_95 | -62 ≤ MBSFN\_RSRP < -61 | dBm / 370.37Hz |
| MBSFN\_RSRP\_96 | -61 ≤ MBSFN\_RSRP < -60 | dBm / 370.37Hz |
| MBSFN\_RSRP\_97 | -60 ≤ MBSFN\_RSRP | dBm / 370.37Hz |

### 9.8.3 MBSFN RSRQ

#### 9.8.3.1 Absolute MBSFN RSRQ measurement accuracy requirements

The requirements for absolute accuracy of MBSFN RSRQ in this clause apply to any carrier, which may be the same as or different from a serving unicast carrier, where PMCH is received while meeting performance requirements in Section 10 of [5].

The accuracy requirements in Table 9.8.3.1-1 are valid under the following conditions:

MBSFN RS are transmitted from antenna port 4 in the MBSFN subframes where PMCH is received.

Conditions defined in 36.101 Clause 7.3 for reference sensitivity are fulfilled.

MBSFN RSRP|dBm/15kHz is the same as RSRP|dBm/15kHz specified in Annex B.3.1 for each corresponding Band.

Table 9.8.3.1-1: Absolute MBSFN RSRQ measurement accuracy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot | Io Note 1 range | | |
| E-UTRA operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±2.5 | ±4 | ≥-3 dB | FDD\_A, TDD\_A | -121 | -50 |
| FDD\_B1, FDD\_B2 | -120.5 | -50 |
| FDD\_C, TDD\_C | -120 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_H | -117.5 | -50 |
| FDD\_N | -114.5 | -50 |
| ±3.5 | ±4 | ≥-6 dB | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA operating band groups are as defined in Section 3.5. | | | | | |

#### 9.8.3.2 MBSFN RSRQ measurement report mapping

The reporting range of MBSFN RSRQ is defined from -23 dB to -8 dB with 0.5 dB resolution, for 15 kHz subcarrier spacing.

The mapping of measured quantity is defined in Table 9.8.3.2-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 9.8.3.2-1: MBSFN RSRQ measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| MBSFN\_RSRQ\_00 | MBSFN\_RSRQ < -23 | dB / 15 kHz |
| MBSFN\_RSRQ\_01 | -23 ≤ MBSFN\_RSRQ < -22.5 | dB / 15 kHz |
| MBSFN\_RSRQ\_02 | -22.5 ≤ MBSFN\_RSRQ < -22 | dB / 15 kHz |
| … | … | … |
| MBSFN\_RSRQ\_30 | -8.5 ≤ MBSFN\_RSRQ < -8 | dB / 15 kHz |
| MBSFN\_RSRQ\_31 | -8 ≤ MBSFN\_RSRQ | dB / 15 kHz |

#### 9.8.3.3 MBSFN RSRQ measurement report mapping for 7.5 kHz subcarrier spacing

The reporting range of MBSFN RSRQ is defined from -26 dB to -8 dB with 0.4 dB resolution, for 7.5 kHz subcarrier spacing.

The mapping of measured quantity is defined in Table 9.8.3.3-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 9.8.3.3-1: MBSFN RSRQ measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| MBSFN\_RSRQ\_00 | MBSFN\_RSRQ < -26.0 | dB |
| MBSFN\_RSRQ\_01 | -26.0 ≤ MBSFN\_RSRQ < -25.4 | dB |
| MBSFN\_RSRQ\_02 | -25.4 ≤ MBSFN\_RSRQ < -24.8 | dB |
| … | … | … |
| MBSFN\_RSRQ\_30 | -8.6 ≤ MBSFN\_RSRQ < -8 | dB |
| MBSFN\_RSRQ\_31 | -8 ≤ MBSFN\_RSRQ | dB |

#### 9.8.3.4 MBSFN RSRQ measurement report mapping for 1.25 kHz subcarrier spacing

The reporting range of MBSFN RSRQ is defined from -32 dB to -14 dB with 0.4 dB resolution, for 1.25 kHz subcarrier spacing.

The mapping of measured quantity is defined in Table 9.8.3.4-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 9.8.3.4-1: MBSFN RSRQ measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| MBSFN\_RSRQ\_00 | MBSFN\_RSRQ < -32 | dB |
| MBSFN\_RSRQ\_01 | -32 ≤ MBSFN\_RSRQ < -31.4 | dB |
| MBSFN\_RSRQ\_02 | -31.4 ≤ MBSFN\_RSRQ < -30.8 | dB |
| … | … | … |
| MBSFN\_RSRQ\_30 | -14.6 ≤ MBSFN\_RSRQ < -14 | dB |
| MBSFN\_RSRQ\_31 | -14 ≤ MBSFN\_RSRQ | dB |

#### 9.8.3.5 MBSFN RSRQ measurement report mapping for 2.5 kHz subcarrier spacing

The reporting range of MBSFN RSRQ is defined from -31 dB to -13 dB with 0.6 dB resolution, for 2.5 kHz subcarrier spacing.

The mapping of measured quantity is defined in Table 9.8.3.5-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 9.8.3.5-1: MBSFN RSRQ measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| MBSFN\_RSRQ\_00 | MBSFN\_RSRQ < -31 | dB |
| MBSFN\_RSRQ\_01 | -31 ≤ MBSFN\_RSRQ < -30.4 | dB |
| MBSFN\_RSRQ\_02 | -30.4 ≤ MBSFN\_RSRQ < -29.8 | dB |
| … | … | … |
| MBSFN\_RSRQ\_30 | -13.6 ≤ MBSFN\_RSRQ < -13 | dB |
| MBSFN\_RSRQ\_31 | -13 ≤ MBSFN\_RSRQ | dB |

#### 9.8.3.6 MBSFN RSRQ measurement report mapping for 370.37 kHz subcarrier spacing

The reporting range of MBSFN RSRQ is defined from -38 dB to -16 dB with 0.7 dB resolution, for 370.37Hz subcarrier spacing.

The mapping of measured quantity is defined in Table 9.8.3.6-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 9.8.3.6-1: MBSFN RSRQ measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| MBSFN\_RSRQ\_00 | MBSFN\_RSRQ < -38 | dB |
| MBSFN\_RSRQ\_01 | -39.0 ≤ MBSFN\_RSRQ < -38.3 | dB |
| MBSFN\_RSRQ\_02 | -38.3 ≤ MBSFN\_RSRQ < -37.6 | dB |
| … | … | … |
| MBSFN\_RSRQ\_30 | -17.7 ≤ MBSFN\_RSRQ < -17 | dB |
| MBSFN\_RSRQ\_31 | -16 ≤ MBSFN\_RSRQ | dB |

### 9.8.4 MCH BLER

MCH BLER shall be measured as defined in [4].

#### 9.8.4.1 Measurement report mapping for MCH BLER

The UE shall report MCH BLER together with the corresponding total number of MCH blocks, which were received by the UE during the MCH BLER measurement period and used for calculating the reported MCH BLER.

The reporting range of MCH BLER is defined from 0.1% to 50% with uniform quantization in log domain.

The mapping of measured quantity is defined in Table 9.8.4.1-1. The range in the signalling may be larger than the range specified in the table below.

Table 9.8.4.1-1: MCH BLER measurement report mapping

|  |  |  |
| --- | --- | --- |
| Reported value | Measured quantity value | Unit |
| MCH BLER\_00 | MCH BLER < 0.1 | % |
| MCH BLER\_01 | 0.1≤ MCH BLER < 0.123 | % |
| MCH BLER\_02 | 0.123≤ MCH BLER < 0.151 | % |
| MCH BLER\_03 | 0.151≤ MCH BLER <0.186 | % |
| MCH BLER\_04 | 0.186≤ MCH BLER <0.229 | % |
| MCH BLER\_05 | 0.229≤ MCH BLER <0.282 | % |
| MCH BLER\_06 | 0. 282≤ MCH BLER <0.347 | % |
| MCH BLER\_07 | 0. 347≤ MCH BLER <0.426 | % |
| MCH BLER\_08 | 0. 426≤ MCH BLER <0.525 | % |
| MCH BLER\_09 | 0. 525≤ MCH BLER <0.645 | % |
| MCH BLER\_10 | 0. 645≤ MCH BLER <0.794 | % |
| MCH BLER\_11 | 0. 794≤ MCH BLER <0.976 | % |
| MCH BLER\_12 | 0. 976≤ MCH BLER <1.201 | % |
| MCH BLER\_13 | 1. 201≤ MCH BLER <1.478 | % |
| MCH BLER\_14 | 1. 478≤ MCH BLER <1.818 | % |
| MCH BLER\_15 | 1. 818≤ MCH BLER <2.236 | % |
| MCH BLER\_16 | 2. 236≤ MCH BLER <2.751 | % |
| MCH BLER\_17 | 2. 751≤ MCH BLER <3.384 | % |
| MCH BLER\_18 | 3. 384≤ MCH BLER <4.163 | % |
| MCH BLER\_19 | 4.163≤ MCH BLER <5.121 | % |
| MCH BLER\_20 | 5.121≤ MCH BLER <6.300 | % |
| MCH BLER\_21 | 6.300≤ MCH BLER <7.750 | % |
| MCH BLER\_22 | 7.750≤ MCH BLER <9.533 | % |
| MCH BLER\_23 | 9.533≤ MCH BLER <11.728 | % |
| MCH BLER\_24 | 11.728≤ MCH BLER <14.427 | % |
| MCH BLER\_25 | 14.427≤ MCH BLER <17.478 | % |
| MCH BLER\_26 | 17.478≤ MCH BLER <21.833 | % |
| MCH BLER\_27 | 21.833≤ MCH BLER <26.858 | % |
| MCH BLER\_28 | 26.858≤ MCH BLER <33.040 | % |
| MCH BLER\_29 | 33.040≤ MCH BLER <40.645 | % |
| MCH BLER\_30 | 40.645≤ MCH BLER < 50 | % |
| MCH BLER\_31 | 50 ≤ MCH BLER | % |

#### 9.8.4.2 Measurement report mapping for MCH Block Number

The reporting range of the total number of received MCH blocks during the measurement period is defined from 0 to 65152. The total number of received MCH blocks is quantized to two values n and m with the mappings defined in Table 9.8.4.2-1 and Table 9.8.4.2-2, respectively.

The range in the signalling may be larger than the range specified in the table below.

NR in Table 9.8.4.2-1 and Table 9.8.4.2-2 represents the total number of received MCH blocks. f(NR) is a function of NR with the definition that, from where the quantized total number of MCH blocks is found as .

Table 9.8.4.2-1: Number of received MCH blocks mapping to n

|  |  |
| --- | --- |
| Reported value, n | Number of received MCH blocks |
| MCH\_NR\_N\_00 | 0 ≤ NR < 256 |
| MCH\_NR\_N\_01 | 256≤ NR < 768 |
| MCH\_NR\_N\_02 | 768≤ NR < 1792 |
| MCH\_NR\_N\_03 | 1792≤ NR < 3840 |
| MCH\_NR\_N\_04 | 3840≤ NR < 7936 |
| MCH\_NR\_N\_05 | 7936≤ NR <16128 |
| MCH\_NR\_N\_06 | 16128≤ NR < 32512 |
| MCH\_NR\_N\_07 | 32512≤ NR |

Table 9.8.4.2-2: Number of received MCH blocks mapping to m

|  |  |
| --- | --- |
| Reported value, m | f(NR) |
| MCH\_NR\_M\_00 | 0 ≤ f(NR) < 1 |
| MCH\_NR\_M\_01 | 1≤ f(NR) < 2 |
| MCH\_NR\_M\_02 | 2≤ f(NR) < 3 |
| … | … |
| MCH\_NR\_M\_253 | 253 ≤ f(NR) < 254 |
| MCH\_NR\_M\_254 | 254≤ f(NR) < 255 |
| MCH\_NR\_M\_255 | 255≤ f(NR) |

## 9.9 ProSe Measurements

### 9.9.1 Introduction

The requirements in this section are applicable for a UE capable of ProSe Direct Communication and/or ProSe Direct Discovery.

The reported measurement result after layer 1 filtering shall be an estimate of the average value of the measured quantity over the measurement period. The reference point for the measurement result after layer 1 filtering is referred to as point B in the measurement model described in [25].

The accuracy requirements in this clause are:

- applicable for AWGN radio propagation conditions,

- assume independent interference (noise) at each receiver antenna port.

- valid for the reported measurement result after layer 1 filtering,

- are verified from the measurement report at point D in the measurement model having the higher layer filtering disabled.

### 9.9.2 Intra-Frequency S-RSRP Measurement Accuracy Requirements

#### 9.9.2.1 Absolute S-RSRP Accuracy

The requirements for absolute accuracy of S-RSRP in this clause apply to a ProSe synchronization source on the same frequency as that of the own ProSe UE performing the measurement.

The accuracy requirements in Table 9.9.2.1-1 are valid under the following conditions:

- Demodulation reference signals are transmitted from one port.

- Conditions defined in 36.101 Clause 7.3D for reference sensitivity are fulfilled.

- S-RSRP|dBm according to Annex B.5.1 for a corresponding Band are fulfilled.

Table 9.9.2.1-1: Intra-frequency S-RSRP absolute accuracy for UE capable of ProSe Direct Communication and/or ProSe Direct Discovery

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot Note 4 | Io Note 1 range | | | |
| E-UTRA ProSe operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±4.5 | ±9 | ≥-6 dB | FDD\_A | -121 | N/A | -70 |
| FDD\_D | -119.5 | N/A | -70 |
| FDD\_E, TDD\_E | -119 | N/A | -70 |
| FDD\_F | -118.5 | N/A | -70 |
| FDD\_G | -118 | N/A | -70 |
| FDD\_N | -114.5 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | FDD\_A, FDD\_D, FDD\_E, TDD\_E, FDD\_F, FDD\_G, FDD\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA ProSe operating band groups are as defined in Section 3.5 for the corresponding E-UTRA operating bands.  NOTE 4: Ês/Iot for a SyncRef UE is the minimum of the Ês/Iot of PSSS/PSBCH and the Ês/Iot of SSSS | | | | | | |

#### 9.9.2.2 Relative Accuracy of S-RSRP

The relative accuracy of S-RSRP is defined as the S-RSRP measured from one ProSe synchronization source compared to the S-RSRP measured from another ProSe synchronization source on the same frequency.

The accuracy requirements in Table 9.9.2.2-1 are valid under the following conditions:

- Demodulation reference signals are transmitted from one port.

- Conditions defined in 36.101 Clause 7.3D for reference sensitivity are fulfilled.

- S-RSRP1,2|dBm according to Annex B.5.2 for a corresponding Band.

Table 9.9.2.2-1: S-RSRP Intra frequency relative accuracy for UE capable of ProSe direct communication and/or ProSe Direct Discovery

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2, 6 | Io Note 1 range | | |
| E-UTRA ProSe operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±2 | ±3 | ≥-3 dB | FDD\_A | -121 | -50 |
| FDD\_D | -119.5 | -50 |
| FDD\_E, TDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_N | -114.5 | -50 |
| ±3 | ±3 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of SyncRef UEs to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA ProSe operating band groups are as defined in Section 3.5 for the corresponding E-UTRA operating bands.  NOTE 6: Ês/Iot for a SyncRef UE is the minimum of the Ês/Iot of PSSS/PSBCH and the Ês/Iot of SSSS | | | | | |

### 9.9.3 Intra-Frequency SD-RSRP Measurement Accuracy Requirements

The requirements in this clause are applicable for a remote ProSe UE:

- in state RRC\_IDLE or RRC\_CONNECTED if the frequency used for ProSe is the serving frequency, or

- is out of coverage on the frequency used for ProSe, and

- that is synchronised to the ProSe relay UE that is measured.

#### 9.9.3.1 Absolute SD-RSRP Accuracy

The requirements for absolute accuracy of SD-RSRP in this clause apply to a ProSe UE performing SD-RSRP measurements on the same frequency as used by the ProSe relay UE transmitting the relay Discovery message.

The accuracy requirements in Table 9.9.3.1-1 are valid under the following conditions:

- Demodulation reference signals are transmitted from one port.

- Conditions defined in 36.101 Clause 7.3D for reference sensitivity are fulfilled.

- SD-RSRP|dBm according to Annex B.5.4 for a corresponding Band are fulfilled.

- *numReTx* is configured as 3 for the relay Discovery transmissions. For *numReTx* < 3, the minimum Ês/Noc at which the accuracy requirements are fulfilled is expected to be higher than as specified for *numReTx*=3.

Table 9.9.3.1-1: Intra-frequency SD-RSRP absolute accuracy for remote UE [2] capable of ProSe Direct Communication and ProSe Direct Discovery and configured by upper layers for relay operation.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Noc Note 4 | Io Note 1 range | | | |
| E-UTRA ProSe operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±4.5 | ±9 | ≥-1.5 dB | FDD\_D | -119.5 | N/A | -70 |
| FDD\_E | -119 | N/A | -70 |
| FDD\_F | -118.5 | N/A | -70 |
| FDD\_G | -118 | N/A | -70 |
| FDD\_N | -114.5 | N/A | -70 |
| ±8 | ±11 | ≥-1.5 dB | FDD\_D, FDD\_E, FDD\_F, FDD\_G, FDD\_N | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA ProSe operating band groups are as defined in Section 3.5 for the corresponding E-UTRA operating bands.  NOTE 4: When *numReTx* is configured as 3 for the relay Discovery transmissions. For *numReTx* < 3, the minimum Ês/Noc at which the accuracy requirements are fulfilled is expected to be higher than as specified for *numReTx*=3.  NOTE 5: Layer 1 filtering for SD-RSRP is performed using PSDCH (re)transmissions within a discovery period. | | | | | | |

#### 9.9.3.2 Relative Accuracy of SD-RSRP

The relative accuracy of SD-RSRP in this clause apply to a ProSe UE performing SD-RSRP measurements on the same frequency as used by the ProSe relay UE transmitting the relay Discovery message.

The accuracy requirements in Table 9.9.3.2-1 are valid under the following conditions:

- Demodulation reference signals are transmitted from one port.

- Conditions defined in 36.101 Clause 7.3D for reference sensitivity are fulfilled.

- SD-RSRP|dBm according to Annex B.5.5 for a corresponding Band are fulfilled.

- *numReTx* is configured as 3 for the relay Discovery transmissions. For *numReTx* < 3, the minimum Ês/Noc at which the accuracy requirements are fulfilled is expected to be higher than as specified for *numReTx*=3.

Table 9.9.3.2-1: Intra-frequency SD-RSRP relative accuracy for remote UE [2] capable of ProSe Direct Communication and ProSe Direct Discovery and configured by upper layers for relay operation.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Noc Note 6 | Io Note 1 range | | |
| E-UTRA ProSe operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±2 | ±3 | ≥-1.5 dB | FDD\_D | -119.5 | -50 |
| FDD\_E | -119 | -50 |
| FDD\_F | -118.5 | -50 |
| FDD\_G | -118 | -50 |
| FDD\_N | -114.5 | -50 |
| ±3 | ±3 | ≥-1.5 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Noc is the minimum Ês/Noc of the pair of ProSe Relay UEs to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA ProSe operating band groups are as defined in Section 3.5 for the corresponding E-UTRA operating bands.  NOTE 6: When *numReTx* is configured as 3 for the relay Discovery transmissions. For *numReTx* < 3, the minimum Ês/Noc at which the accuracy requirements are fulfilled is expected to be higher than as specified for *numReTx*=3.  NOTE 7: Layer 1 filtering for SD-RSRP is performed using PSDCH (re)transmissions within a discovery period. | | | | | |

## 9.10 V2X Measurements

### 9.10.1 Introduction

The requirements in this section are applicable for a UE capable of V2X sidelink communication.

The reported measurement result after layer 1 filtering shall be an estimate of the average value of the measured quantity over the measurement period. The reference point for the measurement result after layer 1 filtering is referred to as point B in the measurement model described in [25].

The accuracy requirements in this clause are:

- applicable for AWGN radio propagation conditions,

- assume independent interference (noise) at each receiver antenna port.

- valid for the reported measurement result after layer 1 filtering,

- are verified from the measurement report at point D in the measurement model having the higher layer filtering disabled.

### 9.10.2 Intra-Frequency S-RSRP Measurement Accuracy Requirements

#### 9.10.2.1 Absolute S-RSRP Accuracy

The requirements for absolute accuracy of S-RSRP in this clause apply to a V2X synchronization source on the same frequency as that of the own V2X UE performing the measurement.

The accuracy requirements in Table 9.10.2.1-1 are valid under the following conditions:

- Demodulation reference signals are transmitted from one port.

- Conditions defined in 36.101 Clause 7.3.1G for reference sensitivity are fulfilled.

- S-RSRP|dBm according to Annex B.6.2 for a corresponding Band are fulfilled.

Table 9.10.2.1-1: Intra-frequency S-RSRP absolute accuracy for UE capable of V2X sidelink communication

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot Note 4 | Io Note 1 range | | | |
| E-UTRA V2X operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±4.5 | ±9 | ≥-6 dB | TDD\_G | -118 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | TDD\_G | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA V2X operating band groups are as defined in Section 3.5 for the corresponding E-UTRA operating bands.  NOTE 4: Ês/Iot for a SyncRef UE is the minimum of the Ês/Iot of PSSS/PSBCH and the Ês/Iot of SSSS | | | | | | |

#### 9.10.2.2 Relative Accuracy of S-RSRP

The relative accuracy of S-RSRP is defined as the S-RSRP measured from one V2X synchronization source compared to the S-RSRP measured from another V2X synchronization source on the same frequency.

The accuracy requirements in Table 9.10.2.2-1 are valid under the following conditions:

- Demodulation reference signals are transmitted from one port.

- Conditions defined in 36.101 Clause 7.3.1G for reference sensitivity are fulfilled.

- S-RSRP1,2|dBm according to Annex B.6.3 for a corresponding Band.

Table 9.10.2.2-1: S-RSRP Intra frequency relative accuracy for UE capable of V2X sidelink communication

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | |
| Normal condition | Extreme condition | Ês/Iot Note 2, 6 | Io Note 1 range | | |
| E-UTRA V2X operating band groups Note 5 | Minimum Io | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 4 | dBm/BWChannel |
| ±2 | ±3 | ≥-3 dB | TDD\_G | -118 | -50 |
| ±3 | ±3 | ≥-6 dB | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of SyncRef UEs to which the requirement applies.  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 5: E-UTRA V2X operating band groups are as defined in Section 3.5 for the corresponding E-UTRA operating bands.  NOTE 6: Ês/Iot for a SyncRef UE is the minimum of the Ês/Iot of PSSS/PSBCH and the Ês/Iot of SSSS | | | | | |

### 9.10.3 PSSCH-RSRP Measurement Accuracy Requirements

#### 9.10.3.1 Intra-frequency Absolute PSSCH-RSRP Accuracy

The requirements for absolute accuracy of PSSCH-RSRP in this clause apply to a UE performing PSSCH-RSRP measurements on the same frequency as used by operating V2X sidelink communication.

The accuracy requirements in this clause are:

- applicable for AWGN radio propagation conditions,

- assume independent interference (noise) at each receiver antenna port.

The accuracy requirements in Table 9.10.3.1-1 are valid under the following conditions:

- Demodulation reference signals are transmitted from one port.

- Conditions defined in 36.101 Clause 7.3.1G for reference sensitivity are fulfilled.

- PSSCH-RSRP|dBm according to Annex B.6.5 for a corresponding Band are fulfilled.

Table 9.10.3.1-1: Intra-frequency PSSCH-RSRP absolute accuracy for UE capable of V2X sidelink communication

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | | | |
| Normal condition | Extreme condition | Ês/Iot Note 4 | Io Note 1 range | | | |
| E-UTRA V2X operating band groups Note 3 | Minimum Io | | Maximum Io |
| dB | dB | dB |  | dBm/15kHz Note 2 | dBm/BWChannel | dBm/BWChannel |
| ±5 | ±9.5 | ≥0 | TDD\_G | -118 | N/A | -70 |
|  |  |  |  |
| ±8.5 | ±11.5 | ≥0 | TDD\_G | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 3: E-UTRA V2X operating band groups are as defined in Section 3.5 for the corresponding E-UTRA operating bands.  NOTE 4: The parameter Ês/Iot is the Ês/Iot of PSSCH-DMRS. | | | | | | |

### 9.10.4 S-RSSI Measurement Accuracy Requirements

#### 9.10.4.1 Intra-frequency absolute S-RSSI measurement accuracy requirements

The intra-frequency S-RSSI requirements are specified in Table 9.10.4.1-1. The requirements apply for measurement period of 1subframe (1ms) and for any configured measurement bandwidth larger than 5RBs (0.9MHz), provided that:

- All symbols duing each RSSI measurement duration are available for RSSI sampling within the same measurement interval.

Table 9.10.4.1-1: Intra-frequency S-RSSI absolute accuracy

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | |
| Normal condition | Extreme condition |  | | |
| E-UTRA V2X operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±2.5 | ±5.5 | TDD\_G | -118 | -50 |
| ±4.5 | ±7.5 | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA V2X operating band groups are as defined in Section 3.5. | | | | |

#### 9.10.4.2 Intra-frequency relative S-RSSI measurement accuracy requirements

The relative accuracy of S-RSSI is defined as the RSRP measured on one configured measurement bandwidth compared to the S-RSSI measured on another configured measurement bandwidth.The intra-frequency S-RSSI relative requirements are specified in Table 9.10.4.2-1. The requirements apply for measurement period of 1000subframe (1s), for any configured measurement bandwidth larger than 5RBs (0.9MHz), and for sampling interval of 20ms,50ms and 100ms, provided that:

- All symbols duing each RSSI measurement duration are available for RSSI sampling within the same measurement interval.

Table 9.10.4.2-1: Intra-frequency S-RSSI relative accuracy

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Accuracy | | Conditions | | |
| Normal condition | Extreme condition |  | | |
| E-UTRA V2X operating band groups Note 4 | Minimum Io | Maximum Io |
| dB | dB |  | dBm/15kHz Note 3 | dBm/BWChannel |
| ±2.5 | ±5.5 | TDD\_G | -118 | -50 |
| ±4.5 | ±7.5 | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.  NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.  NOTE 3: The condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 4: E-UTRA V2X operating band groups are as defined in Section 3.5. | | | | |

## 9.11 NR Measurements

Unless otherwise specifically stated, the requirements in this clause are applicable for a UE:

- in RRC\_CONNECTED state

- performing inter-RAT E-UTRAN FDD – NR or E-UTRAN TDD – NR measurements with appropriate measurement gaps according to Section 8

- that is synchronised to the cell that is measured.

The reported measurement result after layer 1 filtering shall be an estimate of the average value of the measured quantity over the measurement period. The reference point for the measurement result after layer 1 filtering is referred to as point B in the measurement model described in TS 25.302 [6].

The accuracy requirements in this clause are valid for the reported measurement result after layer 1 filtering. The accuracy requirements are verified from the measurement report at point D in the measurement model having the layer 3 filtering disabled.

### 9.11.1 NR SS-RSRP Measurements

The accuracy requirements of NR SS-RSRP measurements in FR1 and the corresponding side conditions shall be the same as the inter-frequency SS-RSRP Absolute Accuracy Requirements in TS 38.133 [50] subclause 10.1.4.1. The accuracy requirements of NR SS-RSRP measurements in FR2 and the corresponding side conditions shall be the same as the inter-frequency SS-RSRP Absolute Accuracy Requirements in TS 38.133 [50] subclause 10.1.5.1.

The measurement period of NR SS-RSRP measurements in RRC\_CONNECTED state is specified in Sections 8.1.2.4.21 for UE with FDD PCell not configured with E-UTRA-NR Dual Connectivity operation. The measurement period of NR SS-RSRP measurements in RRC\_CONNECTED state is specified in Sections 8.1.2.4.22 for UE with TDD PCell not configured with E-UTRA-NR Dual Connectivity operation. For for UE with FDD PCell configured with E-UTRA-NR Dual Connectivity operation, the measurement period of NR SS-RSRP measurements in RRC\_CONNECTED state is specified in Sections 8.17.4.1. For for UE with TDD PCell configured with E-UTRA-NR Dual Connectivity operation, the measurement period of NR SS-RSRP measurements in RRC\_CONNECTED state is specified in Sections 8.17.4.2.

The reporting range and mapping specified for SS-RSRP measurements in TS 38.133 [50] subclause 10.1.6 shall apply.

### 9.11.1A NR SS-RSRP Measurements for DC Idle Mode Measurements

The requirements in this clause are applicable for a UE:

- in state RRC\_IDLE

- that is synchronised to the cell that is measured.

The requirements for absolute accuracy of NR SS-RSRP in this clause apply to a cell on an NR frequency, and the target cell has been measured by UE for DC Idle Mode Measurements as specified in clause 4.9.

The accuracy requirements of NR SS-RSRP measurements in FR1 and the corresponding side conditions shall be the same as the Inter-frequency RSRP accuracy requirements for FR1 CA/DC Idle Mode Measurements in TS 38.133 [50] subclause 10.1.4B. The accuracy requirements of NR SS-RSRP measurements in FR2 and the corresponding side conditions shall be the same as the Inter-frequency RSRP accuracy requirements for FR2 CA/DC Idle Mode Measurements in TS 38.133 [50] subclause 10.1.5B.

The reporting range and mapping specified for SS-RSRP measurements in TS 38.133 [50] subclause 10.1.6 shall apply.

### 9.11.2 NR SS-RSRQ Measurements

The accuracy requirements of NR SS-RSRQ measurements in FR1 and the corresponding side conditions shall be the same as the inter-frequency SS-RSRQ Absolute Accuracy Requirements in TS 38.133 [50] subclause 10.1.9.1. The accuracy requirements of NR SS-RSRQ measurements in FR2 and the corresponding side conditions shall be the same as the inter-frequency SS-RSRQ Absolute Accuracy Requirements in TS 38.133 [50] subclause 10.1.10.1.

The measurement period of NR SS-RSRQ measurements in RRC\_CONNECTED state is specified in Sections 8.1.2.4.21 for UE with FDD PCell not configured with E-UTRA-NR Dual Connectivity operation. The measurement period of NR SS-RSRQ measurements in RRC\_CONNECTED state is specified in Sections 8.1.2.4.22 for UE with TDD PCell not configured with E-UTRA-NR Dual Connectivity operation. For for UE with FDD PCell configured with E-UTRA-NR Dual Connectivity operation, the measurement period of NR SS-RSRQ measurements in RRC\_CONNECTED state is specified in Sections 8.17.4.1. For for UE with TDD PCell configured with E-UTRA-NR Dual Connectivity operation, the measurement period of NR SS-RSRQ measurements in RRC\_CONNECTED state is specified in Sections 8.17.4.2.

The reporting range and mapping specified for SS-RSRQ measurements in TS 38.133 [50] subclause 10.1.11 shall apply.

### 9.11.2A NR SS-RSRQ Measurements for DC Idle Mode Measurements

The requirements in this clause are applicable for a UE:

- in state RRC\_IDLE

- that is synchronised to the cell that is measured.

The requirements for absolute accuracy of NR SS-RSRQ in this clause apply to a cell on an NR frequency, and the target cell has been measured by UE for DC Idle Mode Measurements as specified in clause 4.9.

The accuracy requirements of NR SS-RSRQ measurements in FR1 and the corresponding side conditions shall be the same as the Inter-frequency RSRQ accuracy requirements for FR1 CA/DC Idle Mode Measurements in TS 38.133 [50] subclause 10.1.9B. The accuracy requirements of NR SS-RSRQ measurements in FR2 and the corresponding side conditions shall be the same as the Inter-frequency RSRQ accuracy requirements for FR2 CA/DC Idle Mode Measurements in TS 38.133 [50] subclause 10.1.10B.

The reporting range and mapping specified for SS-RSRQ measurements in TS 38.133 [50] subclause 10.1.11 shall apply.

### 9.11.3 NR SS-SINR Measurements

The accuracy requirements of NR SS-SINR measurements in FR1 and the corresponding side conditions shall be the same as the inter-frequency SS-SINR Absolute Accuracy Requirements in TS 38.133 [50] subclause 10.1.14.1. The accuracy requirements of NR SS-SINR measurements in FR2 and the corresponding side conditions shall be the same as the inter-frequency SS-SINR Absolute Accuracy Requirements in TS 38.133 [50] subclause 10.1.15.1.

The measurement period of NR SS-SINR measurements in RRC\_CONNECTED state is specified in Sections 8.1.2.4.21 for UE with FDD PCell not configured with E-UTRA-NR Dual Connectivity operation. The measurement period of NR SS-SINR measurements in RRC\_CONNECTED state is specified in Sections 8.1.2.4.22 for UE with TDD PCell not configured with E-UTRA-NR Dual Connectivity operation. For for UE with FDD PCell configured with E-UTRA-NR Dual Connectivity operation, the measurement period of NR SS-SINR measurements in RRC\_CONNECTED state is specified in Sections 8.17.4.1. For for UE with TDD PCell configured with E-UTRA-NR Dual Connectivity operation, the measurement period of NR SS-SINR measurements in RRC\_CONNECTED state is specified in Sections 8.17.4.2.

The reporting range and mapping specified for SS-SINR measurements in TS 38.133 [50] subclause 10.1.16 shall apply.

### 9.11.4 NR SS-RSRP Measurements under CCA

The accuracy requirements of NR SS-RSRP measurements under CCA in FR1 and the corresponding side conditions shall be the same as the inter-frequency SS-RSRP Absolute Accuracy Requirements under CCA in TS 38.133 [50] subclause 10.1.27.1.

The measurement period of NR SS-RSRP measurements under CCA in RRC\_CONNECTED state is specified in Sections 8.1.2.4.21A for UE with FDD PCell not configured with E-UTRA-NR Dual Connectivity operation. The measurement period of NR SS-RSRP measurements under CCA in RRC\_CONNECTED state is specified in Sections 8.1.2.4.22A for UE with TDD PCell not configured with E-UTRA-NR Dual Connectivity operation. For UE with FDD PCell configured with E-UTRA-NR Dual Connectivity operation, the measurement period of NR SS-RSRP measurements under CCA in RRC\_CONNECTED state is specified in Sections 8.17.4A.1. For for UE with TDD PCell configured with E-UTRA-NR Dual Connectivity operation, the measurement period under CCA of NR SS-RSRP measurements in RRC\_CONNECTED state is specified in Sections 8.17.4A.2.

The reporting range and mapping specified for SS-RSRP measurements in TS 38.133 [50] subclause 10.1.6 shall apply.

### 9.11.5 NR SS-RSRQ Measurements under CCA

The accuracy requirements of NR SS-RSRQ measurements under CCA in FR1 and the corresponding side conditions shall be the same as the inter-frequency SS-RSRQ Absolute Accuracy Requirements in TS 38.133 [50] subclause 10.1.30.1.

The measurement period of NR SS-RSRQ measurements under CCA in RRC\_CONNECTED state is specified in Sections 8.1.2.4.21A for UE with FDD PCell not configured with E-UTRA-NR Dual Connectivity operation. The measurement period of NR SS-RSRQ measurements under CCA in RRC\_CONNECTED state is specified in Sections 8.1.2.4.22A for UE with TDD PCell not configured with E-UTRA-NR Dual Connectivity operation. For for UE with FDD PCell configured with E-UTRA-NR Dual Connectivity operation, the measurement period of NR SS-RSRQ measurements under CCA in RRC\_CONNECTED state is specified in Sections 8.17.4A.1. For for UE with TDD PCell configured with E-UTRA-NR Dual Connectivity operation, the measurement period of NR SS-RSRQ measurements under CCA in RRC\_CONNECTED state is specified in Sections 8.17.4A.2.

The reporting range and mapping specified for SS-RSRQ measurements in TS 38.133 [50] subclause 10.1.11 shall apply.

### 9.11.6 NR SS-SINR Measurements under CCA

The accuracy requirements of NR SS-SINR measurements under CCA in FR1 and the corresponding side conditions shall be the same as the inter-frequency SS-SINR Absolute Accuracy Requirements in TS 38.133 [50] subclause 10.1.32.1.

The measurement period of NR SS-SINR measurements under CCA in RRC\_CONNECTED state is specified in Sections 8.1.2.4.21A for UE with FDD PCell not configured with E-UTRA-NR Dual Connectivity operation. The measurement period of NR SS-SINR measurements under CCA in RRC\_CONNECTED state is specified in Sections 8.1.2.4.22A for UE with TDD PCell not configured with E-UTRA-NR Dual Connectivity operation. For for UE with FDD PCell configured with E-UTRA-NR Dual Connectivity operation, the measurement period of NR SS-SINR measurements under CCA in RRC\_CONNECTED state is specified in Sections 8.17.4A.1. For for UE with TDD PCell configured with E-UTRA-NR Dual Connectivity operation, the measurement period of NR SS-SINR measurements under CCA in RRC\_CONNECTED state is specified in Sections 8.17.4A.2.

The reporting range and mapping specified for SS-SINR measurements in TS 38.133 [50] subclause 10.1.16 shall apply.

### 9.11.7 NR RSSI Measurements under CCA

The accuracy requirements of NR RSSI measurements in FR1 on a non-serving carrier frequency with CCA and the corresponding side conditions shall be the same as the inter-frequency RSSI absolute accuracy requirements in TS 38.133 [50] subclause 10.1.34.2. The accuracy requirements of NR RSSI measurements in FR1 on a serving carrier frequency with CCA and the corresponding side conditions shall be the same as the intra-frequency RSSI absolute accuracy requirements in TS 38.133 [50] subclause 10.1.34.1.

The measurement period of NR RSSI measurements in RRC\_CONNECTED state is specified in clause 8.1.2.4.21A for UE with FDD PCell not configured with E-UTRA-NR Dual Connectivity operation; clause 8.1.2.4.22A for UE with TDD PCell not configured with E-UTRA-NR Dual Connectivity operation; clause 8.17.4A.1 for UE with FDD PCell configured with E-UTRA-NR Dual Connectivity operation with PSCC on a carrier frequency with CCA; clause 8.17.4A.2 for UE with TDD PCell configured with E-UTRA-NR Dual Connectivity operation with PSCC on a carrier frequency with CCA.

The reporting range and mapping specified for RSSI measurements in TS 38.133 [50] subclause 10.1.34.3 shall apply.

### 9.11.8 NR Channel Occupancy Measurements under CCA

The accuracy requirements of NR channel occupancy measurements in FR1 on a non-serving carrier frequency with CCA and the corresponding side conditions shall be the same as the inter-frequency channel occupancy accuracy requirements in TS 38.133 [50] subclause 10.1.35.2. The accuracy requirements of NR channel occupancy measurements in FR1 on a serving carrier frequency with CCA and the corresponding side conditions shall be the same as the intra-frequency channel occupancy accuracy requirements in TS 38.133 [50] subclause 10.1.35.1.

The measurement period of NR channel occupancy measurements in RRC\_CONNECTED state is specified in clause 8.1.2.4.21A for UE with FDD PCell not configured with E-UTRA-NR Dual Connectivity operation; clause 8.1.2.4.22A for UE with TDD PCell not configured with E-UTRA-NR Dual Connectivity operation; clause 8.17.4A.1 for UE with FDD PCell configured with E-UTRA-NR Dual Connectivity operation with PSCC on a carrier frequency with CCA; clause 8.17.4A.2 for UE with TDD PCell configured with E-UTRA-NR Dual Connectivity operation with PSCC on a carrier frequency with CCA.

The reporting range specified for channel occupancy measurements in TS 38.331 [2] shall apply.

# 10 Measurements Performance Requirements for E-UTRAN

## 10.1 Received Interference Power

The measurement period shall be 100 ms.

### 10.1.1 Absolute accuracy requirement

Table 10.1.1-1: Received Interference Power absolute accuracy

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Accuracy [dB] | Conditions |
| Iob [dBm/180 kHz] |
| Iob | dBm/180 kHz | ± 4 | -117 ... -96 |

### 10.1.2 Relative accuracy requirement

The relative accuracy is defined as the Received Interference Power measured at one frequency compared to the Received Interference Power measured from the same frequency at a different time.

Table 10.1.2-1: Received Interference Power relative accuracy

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Accuracy [dB] | Conditions |
| Iob [dBm/180 kHz] |
| Iob | dBm/180 kHz | ± 0.5 | -117 ... -96  AND for changes ≤ ±9.0 dB |

### 10.1.3 Received Interference Power measurement report mapping

The reporting range for *Received Interference Power (RIP)* is from -126 ... -75 dBm.

In table 10.2.3-1 the mapping of measured quantity is defined. The range in the signalling may be larger than the guaranteed accuracy range.

Table 10.1.3-1: Received Interference Power measurement reporting range

| Reported value | Measured quantity value | Unit |
| --- | --- | --- |
| RTWP\_LEV \_000 | RIP < ‑126.0 | dBm |
| RTWP\_LEV \_001 | -126.0 ≤ RIP < ‑125.9 | dBm |
| RTWP\_LEV \_002 | -125.9 ≤ RIP < ‑125.8 | dBm |
| … | … | … |
| RTWP\_LEV \_509 | -75.2 ≤ RIP < -75.1 | dBm |
| RTWP\_LEV \_510 | -75.1 ≤ RIP < -75.0 | dBm |
| RTWP\_LEV \_511 | -75.0 ≤ RIP | dBm |

## 10.2 Angle of Arrival (AOA)

### 10.2.1 Range/mapping

The reporting range for AOA measurement is from 0 to 360 degree, with resolution of 0.5 degree.

The mapping of the measured quantity is defined in table 10.2.1-1.

Table 10.2.1-1: AOA measurement report mapping

|  |  |  |
| --- | --- | --- |
| ****Reported value**** | ****Measured quantity value**** | ****Unit**** |
| AOA\_ANGLE \_000 | 0 ≤ AOA\_ANGLE < 0.5 | degree |
| AOA\_ANGLE \_001 | 0.5 ≤ AOA\_ANGLE < 1 | degree |
| AOA\_ANGLE \_002 | 1 ≤ AOA\_ANGLE < 1.5 | degree |
| … | … | … |
| AOA\_ANGLE \_717 | 358.5 ≤ AOA\_ANGLE < 359 | degree |
| AOA\_ANGLE \_718 | 359 ≤ AOA\_ANGLE < 359.5 | degree |
| AOA\_ANGLE \_719 | 359.5 ≤ AOA\_ANGLE < 360 | degree |

## 10.3 Timing Advance (TADV)

### 10.3.1 Report mapping

The reporting range of TADV is defined from 0 to 49232Ts with 2Ts resolution for timing advance less or equal to 4096Ts and 8Ts for timing advance greater than 4096Ts.

The mapping of measured quantity is defined in Table 10.3.1-1.

Table 10.3.1-1: TADV measurement report mapping

|  |  |  |
| --- | --- | --- |
| ****Reported value**** | ****Measured quantity value**** | ****Unit**** |
| TIME\_ADVANCE\_00 | TADV < 2 | Ts |
| TIME\_ADVANCE\_01 | 2 ≤ TADV < 4 | Ts |
| TIME\_ADVANCE\_02 | 4 ≤ TADV < 6 | Ts |
| … | … | … |
| TIME\_ADVANCE\_2046 | 4092 ≤ TADV < 4094 | Ts |
| TIME\_ADVANCE\_2047 | 4094 ≤ TADV < 4096 | Ts |
| TIME\_ADVANCE\_2048 | 4096 ≤ TADV < 4104 | Ts |
| TIME\_ADVANCE\_2049 | 4104 ≤ TADV < 4112 | Ts |
| … | … | … |
| TIME\_ADVANCE\_7688 | 49216 ≤ TADV < 49224 | Ts |
| TIME\_ADVANCE\_7689 | 49224 ≤ TADV < 49232 | Ts |
| TIME\_ADVANCE\_7690 | 49232 ≤ TADV | Ts |

NOTE: For report mapping of type2 TADV for TDD, the TADV equal to (eNB Rx – Tx time difference) + 624Ts.

# 11 ProSe Requirements in Any Cell Selection state

## 11.1 Introduction

This section contains the requirements for the UE capable of ProSe Direct Communication and/or ProSe Direct Discovery when the UE is out of coverage on the carrier used for ProSe operation, as defined in [1]. The ProSe requirements shall apply provided that the sidelink used by the UE for ProSe Direct Communication and/or ProSe Direct Discovery is on the carrier that is preconfigured in the ProSe UE for out-of-coverage operation. The requirement apply when the UE is:

- in any cell selection state, or,

- out of coverage on the ProSe carrier and is associated with a serving cell on a non-ProSe carrier.

Note: Any cell selection state refers to a UE that is out of network coverage and is not associated with a serving cell on any carrier [1].

## 11.2 UE Transmit Timing for ProSe in Any Cell Selection State

### 11.2.1 Introduction

This clause contains requirements on the UE capable of ProSe Direct Communication and/or ProSe Direct Discovery regarding transmit timing if the UE is out of coverage on the carrier used for ProSe operation.

### 11.2.2 ProSe UE transmission timing

The requirements in this subclause are applicable when the reference timing used for deriving ProSe transmission is from another ProSe UE transmitting sidelink synchronization signals.

The sidelink transmissions takes place  before the reception of the first detected path (in time) of the corresponding timing reference frame from the UE, with  and [16]. The transmission timing error for sidelink transmissions shall be less than or equal to ±Te where the timing error limit value Te is specified in Table 11.2.2-1.

Table 11.2.2-1: Te Timing Error Limit

|  |  |
| --- | --- |
| Sidelink Bandwidth (MHz) | Te |
| ≥1.4 | 24\*TS |
| Note: TS is the basic timing unit defined in TS 36.211 | |

## 11.3 Initiation/Cease of SLSS Transmissions

### 11.3.1 Introduction

The requirements in this subclause apply when the conditions for SLSS transmissions specified in [2] are met and if *syncTxThreshOoC* is included in the preconfigured ProSe parameters.

### 11.3.2 Requirements

The UE shall be capable of measuring the S-RSRP of the selected SyncRef UE used to derive transmission timing for Prose Direct Communication and/or ProSe Direct Discovery and evaluate it to initiate/cease SLSS transmissions within Tevaluate,SLSS = 0.8 seconds.

If higher layer filtering for S-RSRP measurements is pre-configured, an additional delay in evaluation to initiate/cease SLSS transmissions can be expected.

For the selected SyncRef UE [2] used to derive transmission timing for ProSe Direct Communication and/or ProSe Direct Discovery:

- S-RSRP related side conditions given in Section 11.5 for a corresponding Band are fulfilled,

- ProSe SCH\_RP and SCH Ês/Iot according to Annex B.5.1 for a corresponding Band are fulfilled.

## 11.4 Measurements for ProSe in Any Cell Selection State

### 11.4.1 Introduction

This clause contains requirements for E-UTRA cell identification for the UE capable of ProSe Direct Communication and/or ProSe Direct Discovery if the UE is out of coverage on the carrier used for ProSe operation.

The UE can be preconfigured with ProSe resources for out of coverage ProSe operation.

The requirements in this section are applicable for the ProSe if the UE is out of coverage on the carrier used for ProSe operation using the preconfigured ProSe resources. The ProSe UE shall:

- continuously search for any detectable E-UTRA cell on the donwlink carrier frequency associated with the preconfigured ProSe carrier frequency for out of coverage ProSe operation, and

- if in any cell selection state, then search cells also on other carriers and perform cell selection according to the procedure specified in section 4.1.

### 11.4.2 Requirements

#### 11.4.2.1 E-UTRA FDD

The requirements in this subclause are applicable when the preconfigured ProSe carrier is FDD (parameter *tdd-ConfigSL* is configured as *none*).

The UE capable of ProSe Direct Communication and/or ProSe Direct Discovery immediately upon being out of coverage on the ProSe carrier shall search for any detectable cell on the carrier preconfigured with ProSe resources.

The UE shall be able to identify a newly detectable E-UTRA FDD cell on the downlink carrier frequency associated with the preconfigured with ProSe carrier frequency:

- within Tbasic\_identify\_OoC\_ProSe Tx\_ON if the UE is performing ProSe transmissions on the sidelink, or

- within Tbasic\_identify\_OoC\_ProSe Tx\_OFF  if the UE is not performing ProSe transmissions on the sidelink.

where,

Tbasic\_identify\_OoC\_ProSe Tx\_ON = 6.4 seconds, and

Tbasic\_identify\_OoC\_ProSe Tx\_OFF = 32 seconds.

An E-UTRA cell is considered detectable provided it meets the intra-frequency cell identification conditions specified in section 8.1.2.2.

#### 11.4.2.2 E-UTRA TDD

The requirements in this subclause are applicable when the preconfigured ProSe carrier is configured as TDD.

The UE capable of ProSe Direct Discovery immediately upon being out of coverage on the ProSe carrier shall search for any detectable cell on the carrier preconfigured with ProSe resources.

The UE shall be able to identify a newly detectable E-UTRA TDD cell on TDD carrier frequency preconfigured for ProSe operation:

- within Tbasic\_identify\_OoC\_ProSe Tx\_ON if the UE is performing ProSe transmissions on the sidelink, or

- within Tbasic\_identify\_OoC\_ProSe Tx\_OFF  if the UE is not performing ProSe transmissions on the sidelink.

where,

Tbasic\_identify\_OoC\_ProSe Tx\_ON = 6.4 seconds, and

Tbasic\_identify\_OoC\_ProSe Tx\_OFF = 32 seconds.

An E-UTRA cell is considered detectable provided it meets the intra-frequency cell identification conditions specified in section 8.1.2.2.

The UE shall be allowed to interrupt ProSe Direct Discovery operation in order to meet the requirements in this subclause.

## 11.5 Selection / Reselection of ProSe Synchronization Reference

### 11.5.1 Introduction

This clause contains requirements for the measurements performed by the UE capable of ProSe Direct Communication and/or ProSe Direct Discovery if the UE is out of coverage on the carrier used for ProSe operation.

### 11.5.2 Selection/Reselection to intra-frequency SyncRef UE

#### 11.5.2.1 Introduction

This clause contains requirements for the measurement for the ProSe synchronization on the UE capable of ProSe Direct Communication and/or ProSe Direct Discovery if the UE is out of coverage on the carrier used for ProSe operation.

#### 11.5.2.2 Requirements

The UE shall be able to identify newly detectable SyncRef UE within Tdetect,SyncRef UE seconds if SyncRef UE meets the selection / reselection criterion defined in TS 36.331 [2].

ProSe synchronization source, SyncRef UE, is defined as a ProSe synchronization source which is capable to transmit ProSe synchronization signals.

A SyncRef UE is considered to be detectable when

- S-RSRP related side conditions given in Section 9.9.2 are fulfilled for a corresponding Band,

- ProSe SCH\_RP and SCH Ês/Iot are fulfilled according to Annex B.5.3 for a corresponding Band.

Tdetect,SyncRef UE is defined as 20 seconds at SCH Es/Iot ≥ -4 dB, provided that the ProSe UE is allowed to drop a maximum of 2% of its ProSe Direct Communication and ProSe Direct Discovery transmissions at the physical layer for the purpose of SyncRef UE selection / reselection.

The UE capable of ProSe Direct Communication and/or ProSe Direct Discovery shall be capable of performing S-RSRP measurements for 6 identified ProSe synchronization sources with the measurement period of 400 ms. It is assumed that the ProSe synchronization sources do not drop or delay more than one SLSS transmission within the measurement period. Otherwise, the measurement period may be extended.

## 11.6 Void

## 11.7 Selection / Reselection of ProSe relay UE

### 11.7.1 Introduction

This section contains the requirements related to selection and reselection of ProSe relay UE when the remote UE is out of coverage on the frequency used for ProSe Direct Communication.

The requirements apply for the selection and reselection of candidate relay UEs that are transmitting relay discovery signals within the discovery resource pool as configured for the remote UE, and follow a synchronization source that either the same or is synchronized to the one use by remote UE.

### 11.7.2 Selection / Reselection of intra-frequency ProSe relay UE

For a remote UE configured by upper layer for relay operation, the remote UE shall search for candidate relay UEs for selection and/or reselection every discovery period.

If the remote UE has a selected sidelink relay UE, then the remote UE shall measure the SD-RSRP of the selected relay once in every four discovery periods and evaluate if it meets the relay selection criterion as defined in [TS 36.331, 5.10.11.4].

The remote UE shall measure SD-RSRP of the candidate relay UEs every Tmeasure, ProSe\_Relay\_Intra for intra-frequency relay UEs that are detected and measured according to the measurement rules.

For an intra-frequency relay UEs that are detected, but that has not been selected or reselected to, the remote UE shall be capable of evaluating that the intra-frequency relay UE has met selection or reselection criterion defined in [2, 5.10.11.4] within Tevaluate,ProSe\_Relay\_Intra as specified in table 11.7.2-1.

The minimum requirements are required to meet when the selected and candidate relay UEs are transmitting relay discovery message every discovery period.

Table 11.7.2-1: Tmeasure, ProSe\_Relay\_Intra and Tevaluate, ProSe\_Relay\_intra

|  |  |  |
| --- | --- | --- |
| Discovery Period [s] | Tmeasure,ProSe\_Relay\_Intra [s] (number of discovery periods) | Tevaluate, ProSe\_Relay\_intra [s] (number of discovery periods) |
| 0.04≤Discovery period≤10.24 | Note 1 (4) | Note 1 (16) |
| NOTE 1: Time depends upon the configured Discovery period. | | |

# 12 V2V Sidelink Communication Requirements for V2V Operation on Dedicated V2V Carrier

## 12.1 Introduction

This section contains the requirements for the UE capable of V2V sidelink communication under the following conditions:

- no cell operates on the carrier used for the V2V sidelink communcation and

- no configuration related to V2V communication is received by the UE from the serving cell.

## 12.2 Transmit Timing

This clause contains requirements regarding transmit timing for the UE capable of V2V sidelink communication under the following additional condition:

- the UE is pre-configured with parameters for enabling the UE to acquire timing synchronization.

### 12.2.1 GNSS as timing reference

The requirements in this subclause are applicable when the reference timing used by the UE for V2V communication is derived from GNSS signals.

The sidelink transmissions takes place  before the subframe starting boundary derived from subclause 5.10.14 of TS 36.331 [2], where  = 0 and . The transmission timing error for sidelink transmissions shall be less than or equal to ±Te where the timing error limit value Te is specified as 12\*Ts and Ts is the basic timing unit defined in TS 36.211.

## 12.3 Interruption

This clause contains interruption requirements for the UE capable of V2V sidelink communication under the following additional conditions:

- the UE is pre-configured with parameters for enabling the UE to acquire timing synchronization

~~-~~ the UE has dedicated transmitter chain and dedicated receiver chain for the V2V operation

- the UE performs independent concurrent E-UTRAN operation in an E-UTRA band and stand-alone V2V sidelink operation.

The UE shall not cause any interruption on the serving cell when receiving or transmitting V2V sidelink communication signals.

## 12.4 Reliability of GNSS signal

This clause contains requirements regarding reliability of GNSS signal for the UE capable of V2V sidelink communication under the following additional condition:

- the UE is pre-configured with parameters for enabling the UE to acquire the GNSS synchronization.

If UE considers GNSS is a reliable synchronization reference, the UE shall meet timing accuracy requirement as specified in 12.2 and frequency accuracy requirement as specified in 6.5.1G of TS36.101.

# 13 V2X Requirements

## 13.1 Introduction

This section contains the requirements for the UE capable of V2X sidelink communication when the UE is out of coverage on the carrier used for V2X sidelink operation, as defined in [1]. The requirements apply when the UE is:

- in any cell selection state, or,

- out of coverage on the V2X sidelink carrier and is associated with a serving cell on a non-V2X sidelink carrier.

Note: Any cell selection state refers to a UE that is out of network coverage and is not associated with a serving cell on any carrier [1].

Note: When a UE in RRC\_CONNECTED state is performing transmissions and/or reception for V2X sidelink communication, the UE shall meet all the requirements specified in Section 8 assuming that UE has a dedicated RX/TX chain for V2X sidelink communication. Otherwise, the UE may interrup the V2X sidelink communication in order to meet the measurement requirements specified in Section 8.

## 13.2 UE Transmit Timing

### 13.2.1 Introduction

This clause contains requirements of transmission timing for V2X sidelink communication when:

- GNSS is used as the synchronization reference source;

- Serving cell/PCell is used as the synchronization reference source;

- SyncRef UE is used as the synchronization reference source.

### 13.2.2 GNSS as synchronization reference source

The requirements in this subclause are applicable when the reference timing used by the UE for V2X sidelink communication is derived from GNSS.

The sidelink transmissions takes place  before the subframe starting boundary as defined in Clause 5.10.14 of TS 36.331 [2], where  = 0 and.

The transmission timing error requirements for sidelink transmissions in Section 12.2 as specified for V2V Sidelink Communication shall apply.

### 13.2.3 Serving cell/PCell as synchronization reference source

The requirements in this subclause are applicable when the reference timing used for Sidelink transmissions is the serving cell (RRC\_IDLE) or PCell (RRC\_CONNECTED) on a non-V2X sidelink carrier.

The sidelink transmissions takes place  before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell, where  = 0 and.

The requirements in Section 7.1 as specified for PRACH transmissions shall apply.

### 13.2.4 SyncRef UE as synchronization reference source

The requirements in this subclause are applicable when the reference timing used for deriving sidelink transmission is from SyncRef UE transmitting sidelink synchronization signals.

The sidelink transmissions takes place  before the reception of the first detected path (in time) of the corresponding timing reference frame from the SyncRef UE, where  = 0 and.

The requirements in Section 11.2 as specified for ProSe in Any Cell Selection State shall apply.

## 13.3 Initiation/Cease of SLSS Transmissions

### 13.3.1 Introduction

The requirements in this subclause are applicable to the UE capable of V2X sidelink communication when:

- GNSS is used as the synchronization reference source;

- Serving cell / PCell is used as the synchronization reference source;

- SyncRef UE is used as the synchronization reference source.

#### 13.3.1.1 Initiation/Cease of SLSS transmissions with Serving cell / PCell as synchronization reference source

The requirements apply when the Serving cell / PCell is used as synchronization reference source and when the UE is

- out of coverage on the V2X sidelink carrier and in-coverage with a serving cell on a non-V2X sidelink carrier,

and when the conditions for SLSS transmissions specified in [2] are met; *networkControlledSyncTx* is not configured; and *syncTxThreshIC* is included in *SystemInformationBlockType21*. The UE shall be capable of measuring the RSRP of the cell used as synchronization reference source to evaluate to initiate/cease SLSS transmissions within Tevaluate,SLSS

where,

- Tevaluate,SLSS = 0.4 seconds when UE is not configured with DRX.

- Tevaluate,SLSS = as specified in Table 13.3.1.1-1 when UE is configured with DRX.

Table 13.3.1.1-1: Tevaluate,SLSS with V2X sidelink communication

|  |  |
| --- | --- |
| DRX cycle length [s] | Tevaluate,SLSS  [s] (number of DRX cycles) |
| ≤0.04 | 0.4 (Note 1) |
| 0.04<DRX-cycle≤2.56 | Note 2 (6) |
| Note1: Number of DRX cycles depends upon the DRX cycle in use  Note2: Time depends upon the DRX cycles in use | |

If higher layer filtering is configured, an additional delay in evaluation to initiate/cease SLSS transmissions can be expected.

For the cell as synchronization reference source:

- RSRP related side conditions given in Sections 9.1.2.1 and 9.1.2.2 and RSRQ related side conditions given in Clause 9.1.5.1 for a corresponding Band are fulfilled,

- SCH\_RP and SCH Ês/Iot according to Annex B.2.1 for a corresponding Band are fulfilled.

#### 13.3.1.2 Initiation/Cease of SLSS transmissions with GNSS as synchronization reference source

The requirements apply when GNSS is used as synchronization reference source and when the UE is

* out of coverage on the V2X sidelink carrier and in-coverage with a serving cell on a non-V2X sidelink carrier,

and when the conditions for SLSS transmissions specified in [2] are met; *networkControlledSyncTx* is not configured; and *syncTxThreshIC* is included in *SystemInformationBlockType21*.

The requirements in Section 13.3.1.1 shall apply.

#### 13.3.1.3 Initiation/Cease of SLSS transmissions with SyncRef UE as synchronization reference source

The requirements apply when SyncRef UE is used as synchronization reference source and when the UE is

* in any cell selection state, or
* out of coverage on the V2X sidelink carrier and is associated with a serving cell on a non-V2X sidelink carrier,

and when the conditions for SLSS transmissions specified in [2] are met and when SyncRef UE is used as synchronization reference source and if *syncTxThreshOoC* is included in the preconfigured V2X parameters.

The UE shall be capable of measuring the S-RSRP of the selected SyncRef UE used as synchronization reference source and evaluate it to initiate/cease SLSS transmissions within Tevaluate,SLSS = 0.64 seconds.

If higher layer filtering for S-RSRP measurements is pre-configured, an additional delay in evaluation to initiate/cease SLSS transmissions can be expected.

For the selected SyncRef UE [2] used to derive transmission timing for V2X sidelink communication:

- S-RSRP related side conditions given in Section 13.4 for a corresponding Band are fulfilled,

- V2X SCH\_RP and SCH Ês/Iot according to Annex B.6.4 for a corresponding Band are fulfilled.

## 13.4 Selection / Reselection of V2X Synchronization Reference Source

The requirements defined in section 13.4 do not apply to the UEs that do not support transmission and reception of SLSS.

A V2X SyncRef UE is considered to be detectable when

- S-RSRP related side conditions given in Section 9.10.2 are fulfilled for a corresponding Band,

- V2X SCH\_RP and SCH Ês/Iot according to Annex B.6.4 for a corresponding Band are fulfilled.

When GNSS synchronization reference source is configured as the highest priority and

- UE is synchronized to GNSS directly,

- UE shall not drop any V2X SLSS and data transmission for the purpose of selection/reselection to the SyncRef UE.

- UE is synchronized to a SyncRef UE that is synchronized to GNSS directly or in-directly,

- UE shall not drop any V2X data transmission for the purpose of selection/reselection to the SyncRef UE. The UE shall be able to identify newly detectable intra-frequency V2X SyncRef UE within Tdetect,SyncRef UE\_V2X seconds if the V2X SyncRef UE meets the selection / reselection criterion defined in TS 36.331 [2]. Tdetect,SyncRef UE\_V2X is defined as 1.6 seconds at SCH Es/Iot ≥0 dB, provided that the UE is allowed to drop a maximum of 30% of its SLSS transmissions during Tdetect,SyncRef UE\_V2X for the purpose of selection / reselection to the SyncRef UE.

- in other case

- The UE shall be able to identify newly detectable intra-frequency V2X SyncRef UE within Tdetect,SyncRef UE\_V2X seconds if the SyncRef UE meets the selection / reselection criterion defined in TS 36.331 [2]. Tdetect,SyncRef UE\_V2X is defined as 8 seconds at SCH Es/Iot ≥0 dB, provided that the UE is allowed to drop a maximum of 6% of its V2X data and SLSS transmissions during Tdetect,SyncRef UE\_V2X for the purpose of selection / reselection to the SyncRef UE. UE is allowed to drop up to 2 subframes of its V2X data reception per PSBCH monitoring occasion and overall drop rate shall not exceed 0.3% of its V2X data reception during Tdetect,SyncRef UE\_V2X for the purpose of selection / reselection to the SyncRef UE.

When serving cell/PCell synchronization reference source is configured as the highest priority,

- UE shall be able to identify newly detectable intra-frequency V2X SyncRef UE within Tdetect,SyncRef UE\_V2X seconds if the SyncRef UE meets the selection / reselection criterion defined in TS 36.331 [2]. Tdetect,SyncRef UE\_V2X is defined as 8 seconds at SCH Es/Iot ≥ 0 dB, provided that the V2X UE is allowed to drop a maximum of 6% of its V2X data and SLSS transmissions for the purpose of selection / reselection to the SyncRef UE. UE is allowed to drop up to 2 subframes of its V2X data reception per PSBCH monitoring occasion and overall drop rate shall not exceed 0.3% of its V2X data reception during Tdetect,SyncRef UE\_V2X for the purpose of selection / reselection to the SyncRef UE.

UE shall be capable of performing S-RSRP measurements for 3 identified intra-frequency V2X SyncRef UE with the measurement period of 320 ms. It is assumed that the V2X SyncRef UE do not drop or delay any SLSS transmission within the measurement period. Otherwise, the measurement period may be extended.

When UE is synchronized to GNSS directly, before selection / reselection of the new synchronization reference source UE shall evaluate the GNSS synchronization source reliability for at least 20 seconds before changing the synchronization reference from GNSS to another synchronization reference source. UE shall be always synchronized to GNSS directly during the evaluation of GNSS synchronization source reliability.

## 13.5 Autonomous Resource Selection/Reselection measurements

### 13.5.1 Introduction

This section contains the requirements related to autonomous resource selection/reselection of the UE capable of V2X sidelink communication.

### 13.5.2 PSSCH-RSRP measurements

The UE physical layer shall be capable of performing the PSSCH-RSRP measurements [4] on the carrier operating V2X sidelink communication for determining the subset of resources to be excluded in PSSCH resource selection in sidelink transmission mode 4. The PSSCH-RSRP measurement period corresponds to one sub-frame and the measurement shall meet the PSSCH-RSRP measurement accuracy requirement in Section 9.10.

### 13.5.3 S-RSSI measurements

The UE physical layer shall be capable of performing the S-RSSI measurements [4] on the carrier operating V2X sidelink communication for determining the subset of resources to be excluded in PSSCH resource selection in sidelink transmission mode 4. The S-RSSI measurement period corresponds to 1 second and the filtered measurement shall meet the S-RSSI measurement accuracy requirement in Section 9.10.

## 13.6 Congestion Control measurements

The UE shall be capable of estimating the channel busy ratio for one or more transmission pools indicated by higher layers [2], based on S-RSSI measurements provided by the physical layer.

When no sidelink transmissions occur, the UE physical layer shall perform a single-shot S-RSSI measurement for each sub-channel included in all the subframes configured as transmission pools.

The S-RSSI measurement performed according to this section shall meet the S-RSSI measurement accuracy requirements defined in Section 9.10.4.

The UE shall perform channel busy ratio (CBR) measurement based on S-RSSI measurements as described in TS 36.214 [4].

## 13.7 Interruption

### 13.7.1 Interruptions to WAN due to V2X Sidelink Communication

This sub-clause contains the requirements related to the interruptions on the serving cell(s) due to V2X sidelink communication.

A UE capable of V2X sidelink communication may indicate its interest (initiation or termination) in V2X sidelink communication to the connected eNodeB using IE *SidelinkUEInformation* [2].

The UE is allowed an interruption of up to 1 subframe on the serving cell(s) during the RRC reconfiguration procedure that includes the V2X sidelink communication configuration message *sl-V2X-ConfigDedicated* [2] (setup and release). This interruption is for both uplink and downlink of the serving cell(s).

### 13.7.2 V2X Sidelink Communication Dropping due to synchronization reference source change

This sub-clause contains the requirements related to the interruptions on the V2X sidelink communication due to synchronization source change.

UE is allowed to drop V2X sidelink signal transmission or reception for up to 1 subframe when synchronization reference source is changed:

- from GNSS

- to Serving cell/PCell;

- to SyncRef UE that is not synchronized to GNSS directly or in-directly;

- from SyncRef UE that is synchronized to GNSS directly or in-directly

- to Serving cell/PCell;

- to SyncRef UE that is not synchronized to GNSS directly or in-directly;

- from Serving cell/PCell

- to GNSS

- to SyncRef UE that is synchronized to GNSS directly or in-directly;

- from SyncRef UE that is not synchronized to GNSS directly or in-directly

- to GNSS;

- to SyncRef UE that is synchronized to GNSS directly or in-directly;

UE is allowed to interruption any V2X sidelink signals including PSSCH, PSCCH, PSBCH and SLSS signals.

### 13.7.3 Interruptions to WAN due to V2X Carrier Aggregation

This sub-clause contains the requirements related to the interruptions on the serving cell/PCell due to V2X component carrier addition/release.

When any number of component carriers is added or released for V2X carrier aggregation using the same *RRCConnectionReconfiguratio*n message as defined in TS 36.331 [2], the UE capable of V2X sidelink communication is allowed an interruption of up to 2 subframes to WAN. This interruption is for both uplink and downlink of serving cell/PCell.

Upon receiving V2X carrier addition/release command by using the RRCConnectionReconfiguration message that includes sl-V2X-ConfigDedicated in WAN subframe n, the interruption to WAN shall not occur before in WAN subframe n+5 and no later than in WAN subframe n + 21+N, where N is the number of component carrier added/released.

### 13.7.4 Interruptions to WAN due to NR V2X sidelink communication

This sub-clause contains the requirements related to the interruptions on the PCell due to NR V2X sidelink communication.

A UE capable of NR V2X sidelink communication may indicate its interest (initiation or termination) in NR V2X sidelink communication to the connected eNodeB using IE *SidelinkUEInformation*.

The UE is allowed an interruption of up to [2] subframes on the PCell during the RRC reconfiguration procedure that includes the NR V2X sidelink communication configuration message *sl-V2X-ConfigDedicated* (setup and release). This interruption is for both uplink and downlink of the PCell.

## 13.8 Reliability of GNSS signal

This clause contains requirements regarding reliability of GNSS signal for the UE capable of V2X sidelink communication under the following additional condition:

- The UE is configured or pre-configured with parameters for enabling the UE to acquire the GNSS synchronization.

If UE considers GNSS is a reliable synchronization reference, the UE shall meet timing accuracy requirement as specified in 12.2 and frequency accuracy requirement as specified in 6.5.1G of TS36.101. Otherwise, the UE shall be capable to select another synchronization reference source.

## 13.9 Component Carrier Addition and Release Delay for V2X Sidelink Carrier Aggregation

The requirements in this subclause are applicable to UE configured in sidelink transmission mode 3.

Upon receiving V2X carrier addition/release command by using the RRCConnectionReconfiguration message that includes sl-V2X-ConfigDedicated in WAN subframe n, UE shall accomplish the V2X component carrier addition/release no later than the end of WAN subframe n + 21+N, where N is the number of component carrier added/released.

NOTE: For UE configured in sidelink transmission mode 4, the delay is up to UE implementation.

## 13.10 Selection / Reselection of V2X Synchronization Reference Source for V2X Carrier Aggregation

Requirements in this clause are applicable to UE supporting V2X sidelink carrier aggregation.

When the UE is synchronized to a SyncRef UE in a carrier and required only to search other SyncRef UEs in the synchronized carrier, the UE shall be able to identify a newly detectable V2X SyncRef UE within Tdetect,SyncRef UE\_V2X if the SyncRef UE meets the selection/reselection criterion defined in TS 36.331 [2]. UE shall be capable of performing S-RSRP measurements for 3 identified V2X SyncRef UE with the measurement period of 320 ms.

When the synchronization reference source for V2X sidelink carrier aggregation is lost and has to search SyncRef UE on the aggregated carriers which are configured as synchronization carrier, the UE shall be able to identify a newly detectable V2X SyncRef UE within N×Tdetect,SyncRef UE\_V2X if the SyncRef UE meets the selection/reselection criterion defined in TS 36.331 [2]. UE shall be capable of performing S-RSRP measurements for 3 identified V2X SyncRef UE per carrier with the measurement period of N×320 ms.

It is assumed that the identified V2X SyncRef UE does not drop or delay any SLSS transmission within the measurement period. Otherwise, the measurement period may be extended.

When GNSS synchronization reference source is configured as the highest priority and

- UE is synchronized to a SyncRef UE that is synchronized to GNSS directly or in-directly,

- The value of Tdetect,SyncRef UE\_V2X is as 1.6 seconds at SCH Es/Iot ≥0 dB, provided that the UE is allowed to drop a maximum of 30% of its SLSS transmissions on each carrier operating V2X sidelink communication during Tdetect,SyncRef UE\_V2X for the purpose of selection / reselection to the SyncRef UE.

- in other case

- The value of Tdetect,SyncRef UE\_V2X is as 8 seconds at SCH Es/Iot ≥0 dB, provided that the UE is allowed to drop a maximum of 6% of its SLSS transmissions on each carrier operating V2X sidelink communication during Tdetect,SyncRef UE\_V2X for the purpose of selection / reselection to the SyncRef UE.

- UE is allowed to drop up to 2 subframes of its V2X data reception on each carrier operating V2X sidelink communication per PSBCH monitoring occasion and overall drop rate shall not exceed 0.3% of its V2X data reception during Tdetect,SyncRef UE\_V2X for the purpose of selection / reselection to the SyncRef UE.

When serving cell/PCell synchronization reference source is configured as the highest priority,

- The value of Tdetect,SyncRef UE\_V2X is as 8 seconds at SCH Es/Iot ≥0 dB, provided that the UE is allowed to drop a maximum of 6% of its SLSS transmissions on each carrier operating V2X sidelink communication during Tdetect,SyncRef UE\_V2X for the purpose of selection / reselection to the SyncRef UE.

- UE is allowed to drop up to 2 subframes of its V2X data reception on each carrier operating V2X sidelink communication per PSBCH monitoring occasion and overall drop rate shall not exceed [0.3%] of its V2X data reception during Tdetect,SyncRef UE\_V2X for the purpose of selection / reselection to the SyncRef UE.

N is the number of aggregated carriers configured as synchronization carrier.