**3GPP TSG-RAN WG4 Meeting #102-e *R4-2207119***

**Electronic Meeting, Feb. 21– March 3, 2022**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.133** | **CR** | **DraftCR** | **rev** |  | **Current version:** | **17.4.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

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|  | | | | | | | | | | |
| ***Title:*** | Draft Big CR: RRM requirements Rel-17 NR MG enhancements | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Intel, MediaTek | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_MG\_ehn-core | | | | |  | ***Date:*** | | | 2022-03-5 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | No requirements on these measurements with the new aspects introduced in Rel17 NR\_MG\_enh-core WI in the current RAN4 specs.  This document includes the endoresed draft CRs:  **Endorsed in 101-bis-e**:   |  |  |  | | --- | --- | --- | | TDoc Endorsed CR | CR title | Source companies | | R4-2202613 | Draft CR on measurement delay requirements for concurrent MG patterns | CATT | | R4-2202605 | CR on CSSF for concurrent gaps | Apple | | R4-2202606 | Draft CR on inter-RAT measurement requirements with concurrent gaps | vivo | | R4-2202608 | DraftCR on inter-frequency measurement delay requirements with concurrent gaps | Xiaomi | | R4-2202609 | DraftCR on positioning measurement requirements due to concurrent gap in NR | Intel Corporation | | R4-2202610 | Draft CR to 38133 on CSI-RS based L3 measurement requirements with concurrent gap | OPPO | | R4-2202611 | draftCR on concurrent gaps (9.1.2B) | Ericsson | | R4-2202612 | CR on collision handling and MG related requirements for concurrent MGs | Huawei, Hisilicon | | R4-2202617 | Draft CR on measurement delay requirements with Pre-MG | CATT | | R4-2202618 | CR on Pre-MG activation/deactivation delay | Apple | | R4-2202619 | Draft CR on 38.133 for L1 measurement impact of preconfigured gap | MediaTek | | R4-2202620 | DraftCR on inter-RAT measurement delay requirements with pre-configured gaps | Xiaomi | | R4-2202621 | DraftCR on inter-frequency measurement requirements with pre-MG in NR | Intel | | R4-2202622 | Draft CR to 38133 on gap interruption for Pre-MG | Oppo | | R4-2201622 | CR on pre-MG applicability | Huawei | | R4-2202624 | Measurement requirements for Pre-MG in TS 38.133 | Ericsson | | R4-2202628 | CR on NCSG applicability | Apple | | R4-2202629 | Draft CR for interruption for de-activated SCell measurement due to NCSG | vivo | | R4-2202630 | Draft CR on 38.133 for L1 measurement impact of NCSG | MediaTek inc. | | R4-2202631 | DraftCR on interruption of NCSG in NR | Intel Corporation | | R4-2202633 | Draft CR for UE behavior after the interruptions of NCSG | ZTE Corporation | | R4-2202634 | CR on use cases and CSSF for NCSG | Huawei, Hisilicon | | R4-2202635 | CR: NCSG scheduling restriction | Qualcomm communications-France | | R4-2202636 | Measurement requirements for NCSG in TS 38.133 | Ericsson | | R4-2202628 | CR on NCSG applicability | Apple | | R4-2202629 | Draft CR for interruption for de-activated SCell measurement due to NCSG | vivo |   **Endorsed in 102-e**:   |  |  |  | | --- | --- | --- | | TDoc Endorsed CR | CR title | Source companies | | R4-2207084 | CR on CSSF for concurrent gaps | Apple | | R4-2206875 | Draft CR on measurement delay requirements for concurrent MG patterns | CATT | | R4-2206876 | Draft CR on 38.133 for L1 measurement impact of concurrent gaps | MTK | | R4-2206877 | DraftCR on inter-frequency measurement delay requirements with concurrent gaps | Xiaomi | | R4-2206878 | Draft CR to 38133 on CSI-RS based L3 measurement requirements with concurrent gap | OPPO | | R4-2206879 | DraftCR to TS 38.133: Positioning measurement requirements due to concurrent gap in NR | Intel Corporation | | R4-2206880 | CR on collision handling for concurrent MGs | Huawei | | R4-2206881 | draftCR on concurrent gaps(9.1.2B) | Ericsson | | R4-2206882 | Draft CR: Corrections to RRM requirements Rel-17 NR MG enhancements | Nokia | | R4-2206884 | CR on Pre-MG activation/deactivation delay | Apple | | R4-2206885 | Draft CR on measurement delay requirements with Pre-MG | CATT | | R4-2206887 | CR on pre-MG applicability | Huawei | | R4-2206888 | Draft CR for Measurement requirements for Pre-MG in TS 38.133 | Ericsson | | R4-2206891 | Draft CR on mgta for NCSG | Intel Corporation | | R4-2206892 | CR: NCSG scheduling restriction | Qualcomm, Inc. | | R4-2206893 | CR on NCSG | Apple | | R4-2206894 | Draft CR on measurement delay requirements with NCSG | CATT | | R4-2206895 | Draft CR on 38.133 for L1 measurement impact of NCSG | MediaTek inc. | | R4-2206896 | Draft CR to UE behaviour to group the frequency layers with NCSG | OPPO | | R4-2206897 | CR on use cases and CSSF for NCSG | Huawei | | R4-2206898 | Updates to NCSG patterns in TS 38.133 （No changes in comparison with bigCR | Ericsson | | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | |  |  |  |  | | --- | --- | --- | --- | | Index of change | Clause impacted | Endorsed CRs in R4#101bis-e | Endorsed CRs in R4#102-e | | #1 | 3.3 | R4-2202624,#1  R4-2202628,#1  R4-2202636,#1 |  | | #2 | 8.1 | R4-2202607, #1~3(Not endorsed since the conflicted text with R4-2202630)  R4-2202619, #1~3  R4-2202630, #1~3 | R4-2206895, #1~3  R4-2206876, #1~3 | | #3 | 8.2.2 | R4-2202629, #1 |  | | #4 | 8.5 | R4-2202607, #4~9(Not endorsed since the conflicted text with R4-2202630)  R4-2202619, #4~9  R4-2202630, #4~9 | R4-2206895, #4~9  R4-2206876, #4~9 | | #5 | 8.14 (New) | R4-2202618, #1 | R4-2206884, #1 | | #6 | 9.1.X1(new) | R4-2202624, #2  R4-2201622,#1 | R4-2206888,  R4-2206887,#1 | | #7 | 9.1.X2(new) | R4-2202611, #1  R4-2202612, #1 |  | | #8 | 9.1.X3(new) | R4-2202628, #2  R4-2202636, #2  R4-2202631, #1  R4-2202633, #1  (note: the index of clause confliction among these changes was resolved in the big CR) | R4-2206880, #1  R4-2206881,#1 | | #9 | 9.1.5  9.1.5.1  9.1.5.2 | R4-2202605, #1 (the clauses which were not changed was removed.) | R4-2207084, #1 | | #10 | 9.1.5.X1(new) | R4-2202634, #1 | R4-2206897, #1 | | #11 | 9.2.5  9.2.6 | R4-2202617, #1~2  R4-2202613, #1~2 (the clauses which were not changed was removed.) | R4-2206875,#1,2  R4-2206885,#1,2  R4-2206894, # | | #12 | 9.2.X1(new) | R4-2202627 #1,  R4-2202635 #1 | R4-2206894, #1  R4-2206892, #1 | | #13 | 9.3.4  9.3.5  9.3.9 | R4-2202621, #1~2  R4-2202608, #1(the clauses which were not changed was removed.) | R4-2206877, #1  R4-2206894, #4 | | #14 | 9.3.X1(new) | R4-2202627 #2,  R4-2202635 #2 | R4-2206892, #2 | | #15 | 9.4 | R4-2202606,#1, #2  R4-2202620,#1 | R4-2206892, #3  R4-2206882, #1  R4-2206894, #5 | | #16 | 9.5.4  9.5A.4 | R4-2202607, #10~11(Not endorsed since the conflicted text with R4-2202630)  R4-2202619, #10~11  R4-2202630, #10~11 | R4-2206895, #10~11  R4-2206876, #10~11 | | #17 | 9.9 | R4-2202609, #1 | R4-2206879, #1~4 | | #18 | 9.10.2.5  9.10.3 | R4-2202610, #1  R4-2202610, #2 | R4-2206878, #1 | | #19 | 7.X1 |  | R4-2206893, #1 | | #20 | 9.2.1 |  | R4-2206896, #1 | | #21 | 9.3.1 |  | R4-2206896,#2 | | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | No core requirements on NR measurement gap enhancement will be specified | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.3  7.8.1  7.X1  8.1  8.2.2  8.5  8.X1 (new)  9.1.X1(new)  9.1X2(new)  9.1.X3(new)  9.1.5  9.1.5.1  9.1.5.2  9.1.5.X1(new)  9.2.1  9.2.5  9.2.6  9.2.X1(new)  9.3.1  9.3.4  9.3.5  9.3.9  9.3.X1(new)  9.4  9.5.4  9.5A.4  9.9  9.10.2.5  9.10.3 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  |  | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS 38.533 | | |
| ***(show related CRs)*** | |  |  | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | This draft CR is based on draft CR endorsed in R4-2017373 at RAN4#97-e. | | | | | | | | |

**--- start of change #1: 3.3 ---**

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [11] 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 [11].

AoA Angle of Arrival

AoD Angle of Departure

BFD Beam Failure Detection

BFD-RS BFD Reference Signal

BLER Block Error Rate

BM-RS Beam Management Reference Signal

BWP Bandwidth Part

CA Carrier Aggregation

CBD Candidate Beam Detection

CBW Channel Bandwidth

CC Component Carrier

CCA Clear Channel Assessment

CLI Cross Link Interference

CMR Channel Measurement Resource

CORESET Control Resource Set

CP Cyclic Prefix

CSI Channel-State Information

CSI-RS CSI Reference Signal

CSI-RSRP CSI Reference Signal based Reference Signal Received Power

CSI-RSRQ CSI Reference Signal based Reference Signal Received Quality

CSI-SINR CSI Reference Signal based Signal to Noise and Interference Ratio

CSI\_RP Received (linear) average power of the resource elements that carry NR CSI-RS signals and channels, measured at the UE antenna connector

DBT Discovery Burst Transmission

DC Dual Connectivity

DCI Downlink Control Information

DL Downlink

DL-AoD Downlink Angle-of-Departure

DL-TDOA Downlink Time Difference Of Arrival

DMRS Demodulation Reference Signal

DRX Discontinuous Reception

E-CID Enhanced Cell ID

E-UTRA Evolved UTRA

E-UTRAN Evolved UTRAN

EN-DC E-UTRA-NR Dual Connectivity

FDD Frequency Division Duplex

FR Frequency Range

HARQ Hybrid Automatic Repeat Request

HO Handover

IMR Interference Measurement Resource

L1-RSRP Layer 1 RSRP

L1 SL-RSRP Layer 1 Sidelink RSRP which corresponds to PSCCH-RSRP and/or PSSCH-RSRP

LMF Location Management Function

LPP LTE Positioning Protocol

MAC Medium Access Control

MCG Master Cell Group

MDT Minimization of Drive Tests

MG Measurement Gap

MGL Measurement Gap Length

MGRP Measurement Gap Repetition Period

MIB Master Information Block

MN Master Node

ML Measurement Length

MR-DC Multi-Radio Dual Connectivity

NE-DC NR-E-UTRA Dual Connectivity

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

NR New Radio

NR-DC NR-NR Dual Connectivity

NCSG Network Controlled Small Gap

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

PCell Primary Cell

PDCCH Physical Downlink Control Channel

PDSCH Physical Downlink Shared Channel

PLMN Public Land Mobile Network

PRACH Physical RACH

Pre-MG Pre-configured Measurenent Gap

PRP PRS Received Power

PRS Positioning Reference Signal

PRS-RSRP Positioning Reference Signal based Reference Signal Received Power

PSBCH Physical Sidelink Broadcast Channel

PSBCH-RSRP Physical Sidelink Broadcast Channel DMRS based Reference Signal Received Power

PSCCH Physical Sidelink Control Channel

PSCCH-RSRP Physical Sidelink Control Channel DMRS based Reference Signal Received Power

PSCell Primary SCell

PSS Primary Synchronization Signal

PSSCH Physical Sidelink Shared Channel

PSSCH-RSRP Physical Sidelink Shared Channel DMRS based Reference Signal Received Power

pTAG Primary Timing Advance Group

PUCCH Physical Uplink Control Channel

PUSCH Physical Uplink Shared Channel

QCL Quasi Co-Location

RACH Random Access Channel

RAT Radio Access Technology

RLM Radio Link Monitoring

RLM-RS Reference Signal for RLM

RMSI Remaining Minimum System Information

RRC Radio Resource Control

RRM Radio Resource Management

RSSI Received Signal Strength Indicator

RSRP Reference Signal Received Power

RSRQ Reference Signal Received Quality

RSTD Reference Signal Time Difference

RTT Round Trip Time

S-SSB Sidelink Synchronization Signal Block

S-SSB\_RP Received (linear) average power of the resource elements that carry NR S-SSB signals and channels, measured at the UE antenna connector

SA Standalone operation mode

SCC Secondary Component Carrier

SCell Secondary Cell

SCG Secondary Cell Group

SCS Subcarrier Spacing

SCSSSB SSB subcarrier spacing

SDL Supplementary Downlink

SFN System Frame Number

SFTD SFN and Frame Timing DifferenceSI System Information

SIB System Information Block

SL-RSSI Sidelink Received Signal Strength Indicator

SLSS Sidelink Synchronization Signal

SMTC SSB-based Measurement Timing configuration

SpCell Special Cell

SRS Sounding Reference Signal

SRS-RSRP Sounding Reference Signal based Reference Signal Received Power

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

SSB\_RP Received (linear) average power of the resource elements that carry NR SSB signals and channels, measured at the UE antenna connector.

SSS Secondary Synchronization Signal

sTAG Secondary Timing Advance Group

SUL Supplementary Uplink

TA Timing Advance

TAG Timing Advance Group

TCI Transmission Configuration Indicator

TDD Time Division Duplex

TDOA Time Difference Of Arrival

TRP Transmission-Reception Point

TTI Transmission Time Interval

UE User Equipment

UL Uplink

VIL Visible Interruption Length

VIRP Visible Interruption Repetition Period

**--- end of change #1 ---**

**----start of change #19 (R4-2206893)----**

## 7.8 Void

## 7.X1 *deriveSSB-IndexFromCell* tolerance

### 7.X1.1 Minimum requirements

When *deriveSSB-IndexFromCell-inter* is enabled, the UE assumes frame boundary alignment (including half frame, subframe and slot boundary alignment) across cells on the target carrier and reference carrier is within a tolerance not worse than min(2 SSB symbols of target carrier, 1 PDSCH symbol of the reference cell) and the SFNs of all cells on the target carrier and reference carrier are the same. The reference cell is the serving cell which is used for SSB indexes derivation.

**---end of change #19----**

**--start of change #2: 8.1-1 (R4-2202619, R4-2202630, R4-2206895, R4-2206876)---**

#### 8.1.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_out\_SSB [ms] period becomes worse than the threshold Qout\_SSB within TEvaluate\_out\_SSB [ms] evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_in\_SSB [ms] period becomes better than the threshold Qin\_SSB within TEvaluate\_in\_SSB [ms] evaluation period.

TEvaluate\_out\_SSB and TEvaluate\_in\_SSB are defined in Table 8.1.2.2-1 for FR1.

TEvaluate\_out\_SSB and TEvaluate\_in\_SSB are defined in Table 8.1.2.2-2 for FR2 with scaling factor N=8.

For a UE that supports either concurrent measurement gaps, pre-MG gaps or NCSG, measurement gaps in this section includes any configured and active gap.

*Editor’s note: the term “[measurement gap]” in this clause could be either the legacy gap or the VIL or NCSG. RAN4 to further study whether a better terminology can be used to replace [measurement gap].*

For FR1, for a UE not supporting [concurrent gaps] or when the UE is not configured with concurrent gaps,

- , when in the monitored cell there are [measurement gaps] configured for intra-frequency, inter-frequency or inter-RAT measurements, and these [measurement gaps] are overlapping with some but not all occasions of the SSB; and

- P = 1 when in the monitored cell there are no [measurement gaps] overlapping with any occasion of the SSB.

For FR2, for a UE not supporting [concurrent gaps] or when the UE is not configured with concurrent gaps,

- , when RLM-RS resource is not overlapped with [measurement gap] and the RLM-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P is Psharing factor, when the RLM-RS resource is not overlapped with [measurement gap] and RLM-RS resource is fully overlapped with SMTC period (TSSB = TSMTCperiod).

- , when the RLM-RS resource is partially overlapped with [measurement gap] and the RLM-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with [measurement gap] and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xRP and TSSB < 0.5\*TSMTCperiod

- , when the RLM-RS is partially overlapped with [measurement gap] and the RLM-RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with [measurement gap] and TSMTCperiod = xRP and TSSB = 0.5 × TSMTCperiod

- , when the RLM-RS resource is partially overlapped with [measurement gap] and the RLM-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with [measurement gap]

- , when the RLM-RS resource is partially overlapped with [measurement gap] and the RLM-RS resource is fully overlapped with SMTC occasion (TSSB = TSMTCperiod) and SMTC occasion is partially overlapped with [measurement gap] (TSMTCperiod < xRP)

When concurrent gaps are configured,

- P value for an RLM-RS resource to be measured is defined as

* Ntotal / Noutside\_MG in FR1
* Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0
* Ntotal / Navailable in FR2 with Navailable > 0

- For a window W of duration max(TL1, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any RLM-RS resource occasion:

* Ntotal is the total number of RLM-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and
* Noutside\_MG is the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
* Navailable is the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W
* TL1 is periodicity of the target RLM-RS.

where,

Psharing factor = 1, if the RLM-RS resource outside gap is

* not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,
* not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

Psharing factor = 3, otherwise.

If the high layer in TS 38.331 [2] signaling of *smtc2*is present, TSMTCperiod follows *smtc2*; Otherwise TSMTCperiod follows *smtc1.* TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

When a measurement gap is configured,

* an RLM-RS resource or an SMTC occasion is considered to be overlapped with the [measurement gap] if it overlaps a measurement gap occasion, and
* xRP = MGRP

When NCSG is configured,

* an RLM-RS resource or an SMTC occasion is considered to be overlapped with the [measurement gap] if
  + - it overlaps the VIL1 or VIL2 of NCSG, or
    - it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

and

* xRP = VIRP

If the UE is configured with Pre-MG, an RLM-RS resource or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

When concurrent gaps are configured, an RLM-RS or an SMTC occasion is not considered as overlapped by a gap occasion if the gap occasion is dropped according to [9.1.2B].

If the high layer in TS 38.331 [2] signaling of smtc2 is present, TSMTCperiod follows smtc2; Otherwise TSMTCperiod follows smtc1.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and [measurement gap] configurations does not meet previous conditions

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

Table 8.1.2.2-1: Evaluation period TEvaluate\_out\_SSB and TEvaluate\_in\_SSB for FR1

|  |  |  |
| --- | --- | --- |
| Configuration | TEvaluate\_out\_SSB (ms) | TEvaluate\_in\_SSB (ms) |
| no DRX | Max(200, Ceil(10 × P) × TSSB) | Max(100, Ceil(5 × P) × TSSB) |
| DRX cycle≤320ms | Max(200, Ceil(15 × P) × Max(TDRX,TSSB)) | Max(100, Ceil(7.5 × P) × Max(TDRX,TSSB)) |
| DRX cycle>320ms | Ceil(10 × P) × TDRX | Ceil(5 × P) × TDRX |
| NOTE: TSSB is the periodicity of the SSB configured for RLM. TDRX is the DRX cycle length. | | |

Table 8.1.2.2-2: Evaluation period TEvaluate\_out\_SSB and TEvaluate\_in\_SSB for FR2

|  |  |  |
| --- | --- | --- |
| Configuration | TEvaluate\_out\_SSB (ms) | TEvaluate\_in\_SSB (ms) |
| no DRX | Max(200, Ceil(10 × P × N) × TSSB) | Max(100, Ceil(5 × P × N) × TSSB) |
| DRX cycle≤320ms | Max(200, Ceil(15 × P × N) × Max(TDRX,TSSB)) | Max(100, Ceil(7.5 × P × N) × Max(TDRX,TSSB)) |
| DRX cycle>320ms | Ceil(10 × P × N) × TDRX | Ceil(5 × P × N) × TDRX |
| NOTE: TSSB is the periodicity of the SSB configured for RLM. TDRX is the DRX cycle length. | | |

**<<Omitted the unchanged clauses>>**

#### 8.1.3.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_out\_CSI-RS ms period becomes worse than the threshold Qout\_CSI-RS within TEvaluate\_out\_CSI-RS ms evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_in\_CSI-RS ms period becomes better than the threshold Qin\_CSI-RS within TEvaluate\_in\_CSI-RS ms evaluation period.

- TEvaluate\_out\_CSI-RS and TEvaluate\_in\_CSI-RS are defined in Table 8.1.3.2-1 for FR1.

- TEvaluate\_out\_CSI-RS and TEvaluate\_in\_CSI-RS are defined in Table 8.1.3.2-2 for FR2 with scaling factor N=1.

The requirements of TEvaluate\_out\_CSI-RS and TEvaluate\_in\_CSI-RS apply provided that the CSI-RS for RLM is not in a resource set configured with repetition ON. The requirements do not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for RLM and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

For a UE that supports either concurrent measurement gaps, pre-MG gaps or NCSG, measurement gaps in this section includes any configured and active gap.

*Editor’s note: the term “[measurement gap]” in this clause could be either the legacy gap or the VIL or NCSG. RAN4 to further study whether a better terminology can be used to replace [measurement gap].*

For FR1, for a UE not supporting [concurrent gaps] or when the UE is not configured with concurrent gaps,

- , when in the monitored cell there are [measurement gaps] configured for intra-frequency, inter-frequency or inter-RAT measurements, and these [measurement gaps] are overlapping with some but not all occasions of the CSI-RS; and

- P=1 when in the monitored cell there are no [measurement gaps] overlapping with any occasion of the CSI-RS.

For FR2, for a UE not supporting [concurrent gaps] or when the UE is not configured with concurrent gaps,

- P=1, when the RLM-RS resource is not overlapped with [measurement gap] and also not overlapped with SMTC occasion.

- , when the RLM-RS resource is partially overlapped with [measurement gap] and the RLM-RS resource is not overlapped with SMTC occasion (TCSI-RS < xRP)

- , when the RLM-RS resource is not overlapped with [measurement gap] and the RLM-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod).

- P = Psharing factor, when the RLM-RS resource is not overlapped with [measurement gap] and RLM-RS resource is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod).

- , when the RLM-RS resource is partially overlapped with [measurement gap] and the RLM-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with [measurement gap] and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xRP and TCSI-RS < 0.5 × TSMTCperiod

- , when the RLM-RS resource is partially overlapped with [measurement gap] and the RLM-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with [measurement gap] and TSMTCperiod = xRP and TCSI-RS = 0.5 × TSMTCperiod

- , when the RLM-RS resource is partially overlapped with [measurement gap] and the RLM-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is partially or fully overlapped with [measurement gap]

- , when the RLM-RS resource is partially overlapped with [measurement gap] and the RLM-RS resource is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod) and SMTC occasion is partially overlapped with [measurement gap] (TSMTCperiod < xRP)

When concurrent gaps are configured,

- P value for an RLM-RS resource to be measured is defined as

* Ntotal / Noutside\_MG in FR1
* Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0
* Ntotal / Navailable in FR2 with Navailable > 0

- For a window W of duration max(TL1, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any RLM-RS resource occasion:

* Ntotal is the total number of RLM-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and
* Noutside\_MG is the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
* Navailable is the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W
* TL1 is periodicity of the target RLM-RS.

where,

Psharing factor = 1, if the RLM-RS resource outside gap is

* not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,
* not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

Psharing factor = 3, otherwise.

If the high layer in TS 38.331 [2] signaling of *smtc2*is present, TSMTCperiod follows *smtc2*; Otherwise TSMTCperiod follows *smtc1.* TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

When a measurement gap is configured,

* an RLM-RS resource or an SMTC occasion is considered to be as overlapped with the [measurement gap] if it overlaps a measurement gap occasion, and
* xRP = MGRP

When NCSG is configured,

* an RLM-RS resource or an SMTC occasion is considered to be as overlapped with the [measurement gap] if
  + - it overlaps the VIL1 or VIL2 of NCSG, or
    - it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

and

* xRP = VIRP

If the UE is configured with Pre-MG, an RLM-RS resource or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

When concurrent gaps are configured, an RLM-RS or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to [9.1.2B].

If the high layer in TS 38.331 [2] signaling of *smtc2*is present, TSMTCperiod follows *smtc2*; Otherwise TSMTCperiod follows *smtc1.*

Note: The overlap between CSI-RS for RLM and SMTC means that CSI-RS based RLM is within the SMTC window duration.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and [measurement gap] configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

The values of Mout and Min used in Table 8.1.3.2-1 and Table 8.1.3.2-2 are defined as:

- Mout = 20 and Min = 10, if the CSI-RS resource configured for RLM is transmitted with higher layer CSI-RS parameter *density* [6, clause 7.4.1] set to 3 and over the bandwidth ≥ 24 PRBs.

Table 8.1.3.2-1: Evaluation period TEvaluate\_out\_CSI-RS and TEvaluate\_in\_CSI-RS for FR1

|  |  |  |
| --- | --- | --- |
| Configuration | TEvaluate\_out\_CSI-RS (ms) | TEvaluate\_in\_CSI-RS (ms) |
| no DRX | Max(200, Ceil(Mout×P)×TCSI-RS) | Max(100, Ceil(Min×P) × TCSI-RS) |
| DRX ≤ 320ms | Max(200, Ceil(1.5×Mout×P)× Max(TDRX, TCSI-RS)) | Max(100, Ceil(1.5×Min×P)× Max(TDRX, TCSI-RS)) |
| DRX > 320ms | Ceil(Mout×P) × TDRX | Ceil(Min×P) × TDRX |
| NOTE: TCSI-RS is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for TCSI-RS equal to 5 ms, 10ms, 20 ms or 40 ms. TDRX is the DRX cycle length. | | |

Table 8.1.3.2-2: Evaluation period TEvaluate\_out\_CSI-RS and TEvaluate\_in\_CSI-RS for FR2

|  |  |  |
| --- | --- | --- |
| Configuration | TEvaluate\_out\_CSI-RS (ms) | TEvaluate\_in\_CSI-RS (ms) |
| no DRX | Max(200, Ceil(Mout×P×N)×TCSI-RS) | Max(100, Ceil(Min×P×N) × TCSI-RS) |
| DRX ≤ 320ms | Max(200, Ceil(1.5×Mout×P×N)× Max(TDRX, TCSI-RS)) | Max(100, Ceil(1.5×Min×P×N)× Max(TDRX, TCSI-RS)) |
| DRX > 320ms | Ceil(Mout×P×N) × TDRX | Ceil(Min×P×N) × TDRX |
| NOTE: TCSI-RS is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for TCSI-RS equal to 5 ms, 10 ms, 20 ms or 40 ms. TDRX is the DRX cycle length. | | |

**<<Omitted the unchanged clauses>>**

#### 8.1A.2.2 Minimum Requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_out\_SSB,CCA [ms] period becomes worse than the threshold Qout\_SSB,CCA within TEvaluate\_out\_SSB,CCA [ms] evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last TEvaluate\_in\_SSB,CCA [ms] period becomes better than the threshold Qin\_SSB,CCA within TEvaluate\_in\_SSB,CCA [ms] evaluation period. During the in-sync evaluation procedure, layer 1 of the UE shall not send any in-sync indication for the cell to the higher layers when Lin exceeds Lin,max, where Lin and Lin,max are defined in Table 8.1A.2.2-1.

For a UE that supports either concurrent measurement gaps, pre-MG gaps or NCSG, measurement gaps in this section includes any configured and active gap.

*Editor’s note: the term “[measurement gap]” in this clause could be either the legacy gap or the VIL or NCSG. RAN4 to further study whether a better terminology can be used to replace [measurement gap].*

TEvaluate\_out\_SSB,CCA and TEvaluate\_in\_SSB,CCA are defined in Table 8.1A.2.2-1, where

- For a UE not supporting [concurrent gaps] or when concurrent gaps are not configured,

- , when in the monitored cell there are [measurement gaps] configured for intra-frequency, inter-frequency or inter-RAT measurements, and these [measurement gaps] are overlapping with some but not all occasions of the SSB RLM-RS resources; and

- P=1 when in the monitored cell there are no [measurement gaps] overlapping with any occasion of the SSB RLM-RS resources.

- When concurrent gaps are configured,

- P value for an RLM-RS resource to be measured is defined as Ntotal / Noutside\_MG

- For a window W of duration max(TL1, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gap and per-FR measurement gap within the same FR as serving cell, and starting at the beginning of any RLM-RS resource occasion:

* Ntotal is the total number of RLM-RS resource occasions within the window, including those overlapped with measurement gap occasions within the window, and
* Noutside\_MG is the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

- When a measurement gap is configured,

* an RLM-RS resource is considered to be as overlapped with the [measurement gap] if it overlaps a measurement gap occasion, and
* xRP = MGRP

- When NCSG is configured,

* an RLM-RS resource is considered to be as overlapped with the [measurement gap] if it overlaps the VIL1 or VIL2 of NCSG, and
* xRP = VIRP
* If the UE is configured with Pre-MG, an RLM-RS resource is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.
* When concurrent gaps are configured, an RLM-RS is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to [9.1.2B].

If the high layer in TS 38.331 [2] signaling of *smtc2*is present, TSMTCperiod follows *smtc2*; Otherwise TSMTCperiod follows *smtc1.*

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and [measurement gap] configurations does not meet previous conditions.

Table 8.1A.2.2-1: Evaluation period TEvaluate\_out\_SSB,CCA and TEvaluate\_in\_SSB,CCA

|  |  |  |  |
| --- | --- | --- | --- |
| Configuration | TEvaluate\_out\_SSB,CCA (ms) | | TEvaluate\_in\_SSB,CCA (ms) |
|  | RLM-RS SSB Es/IotNote4 ≥-7 dB | RLM-RS SSB Es/Iot Note4 <-7 dB |  |
| no DRX | Max(200, Ceil(17\*P)\*TSSB) | Max(200, Ceil(24\*P)\*TSSB) | Max(100, Ceil((5+Lin)\*P)\*TSSB) |
| DRX cycle≤320 | Max(200, Ceil(1.5\*15\*P)\*Max(TDRX,TSSB)) | Max(200, Ceil(1.5\*20\*P)\*Max(TDRX,TSSB)) | Max(100, Ceil(1.5\*(5+Lin)\*P)\*Max(TDRX,TSSB)) |
| DRX cycle>320 | Ceil(13\*P)\*TDRX | Ceil(16\*P)\*TDRX | Ceil((5+Lin)\*P)\*TDRX |
| NOTE 1: TSSB is the periodicity of the SSB configured for RLM. TDRX is the DRX cycle length.  NOTE 2: When DRX is not configured, Lin is the number of RLM-RS SSB occasions which are not available at the UE during TEvaluate\_in\_SSB,CCA, where Lin ≤ Lin,max. When DRX is configured, Lin is the number of DRX cycles in which at least one RLM-RS SSB occasion is not available at the UE during TEvaluate\_in\_SSB,CCA, where Lin ≤ Lin,max. The UE is not required to determine the availability of SSB occasions more frequent than once per DRX cycle length, when configured with DRX.  NOTE 3: Lin,max=7 for Max(TDRX,TSSB) ≤ 40 assuming TDRX=0 for non-DRX case,  Lin,max=5 for 40<Max(TDRX,TSSB)≤320,  Lin,max=3 for TDRX>320.  NOTE 4: RLM-RS SSB Es/Iot is the averaged Es/Iot over the most recent previous out-of-sync evaluation period. | | | |

**<<Omitted the unchanged clauses>>**

**---end of change #2: 8.1 ---**

**---start of change #3: 8.2.2 (R4-2202629)---**

##### 8.2.2.2.3 Interruptions during measurements on deactivated SCC

Interruptions on PCell or activated SCell(s) 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.

* If the PCell or activated SCell(s) is not in the same band as the deactivated SCell, the UE is only allowed to cause interruptions on PCell or activated SCell(s) immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in Table 8.2.2.2.2-1.

If the PCell or activated SCell(s) is in the same band as the deactivated SCell, the UE is only allowed to cause an interruption on PCell or activated SCell(s) no earlier than X slots before TSMTC\_duration and no later than X slots after TSMTC\_duration, provided the cell specific reference signals from the active serving cells and the deactivated SCell are available in the same slot, where X and TSMTC\_duration are given by Table 8.2.2.2.3-1. The interruption shall not exceed requirements in Table 8.2.2.2.3-1.

The interruption requirements in Table 8.2.2.2.3-1 are not applicable when a UE is configured with NCSG unless the SMTC on the deactivated SCC is fully non-overlapped with NCSG.

Table 8.2.2.2.3-1: Interruption duration for measurement on deactivated SCell for intra-band CA

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length (ms) | X (slots) | Interruption length (slots) |
| 0 | 1 | 1 | 2 + TSMTC\_duration \* |
| 1 | 0.5 | 1 | 2 + TSMTC\_duration \* |
| 2 | 0.25 | 2 | 4 + TSMTC\_duration \* |
| 3 | 0.125 | 4 | 8 + TSMTC\_duration \* |
| NOTE 1: TSMTC\_duration measured in subframes is the longest SMTC duration among all above active serving cells and the deactivated SCell to be measured;  NOTE 2: is as defined in TS 38.211 [6]. | | | |

**---end of change #3: 8.2.2 (R4-2202629)---**

**---start of change #4: 8.5 (R4-2202619,R4-2202630, R4-2206895, R4-2206876)---**

**<<Omitted the unchanged clauses>>**

#### 8.5.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured SSB resource in set  estimated over the last TEvaluate\_BFD\_SSB ms period becomes worse than the threshold Qout\_LR\_SSB within TEvaluate\_BFD\_SSB ms period.

The value of TEvaluate\_BFD\_SSB is defined in Table 8.5.2.2-1 for FR1.

The value of TEvaluate\_BFD\_SSB is defined in Table 8.5.2.2-2 for FR2 with scaling factor N=8

For a UE that supports either concurrent measurement gaps, pre-MG gaps or NCSG, measurement gaps in this section includes any configured and active gap.

*Editor’s note: the term “[measurement gap]” in this clause could be either the legacy gap or the VIL or NCSG. RAN4 to further study whether a better terminology can be used to replace [measurement gap].*

For FR1, for a UE not supporting [concurrent gaps] or when the UE is not configured with concurrent gaps,

- , when in the monitored cell there are [measurement gaps] configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB.

- P=1 when in the monitored cell there are no [measurement gaps] overlapping with any occasion of the SSB.

For FR2, for a UE not supporting [concurrent gaps] or when the UE is not configured with concurrent gaps,

- , when BFD-RS resource is not overlapped with [measurement gap] and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P = Psharing factor, when the BFD-RS resource is not overlapped with [measurement gap] and the BFD-RS resource is fully overlapped with SMTC period (TSSB = TSMTCperiod).

- , when the BFD-RS resource is partially overlapped with [measurement gap] and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with [measurement gap] and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xRP and TSSB < 0.5\*TSMTCperiod

- , when the BFD-RS resource is partially overlapped with [measurement gap] and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with [measurement gap] and TSMTCperiod = xRP and TSSB = 0.5\*TSMTCperiod

- , when the BFD-RS resource is partially overlapped with [measurement gap] (TSSB <xRP) and the BFD-RS resource is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with [measurement gap].

- , when the BFD-RS resource is partially overlapped with [measurement gap] and the BFD-RS resource is fully overlapped with SMTC occasion (TSSB = TSMTCperiod) and SMTC occasion is partially overlapped with [measurement gap] (TSMTCperiod < xRP)

When concurrent gaps are configured,

- P value for a BFD-RS resource to be measured is defined as

* Ntotal / Noutside\_MG in FR1
* Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0
* Ntotal / Navailable in FR2 with Navailable > 0

- For a window W of duration max(TL1, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any BFD-RS resource occasion:

* Ntotal is the total number of BFD-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and
* Noutside\_MG is the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
* Navailable is the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W
* TL1 is periodicity of the target BFD-RS.

where,

Psharing factor = 1, if the BFD-RS resource outside gap is

* not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,
* not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

Psharing factor = 3, otherwise.

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, TSMTCperiod corresponds to the value of higher layer parameter *smtc2*; Otherwise TSMTCperiod corresponds to the value of higher layer parameter *smtc1*. TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, given the SMTC offset of all CCs in FR2 provided the same offset.

When a measurement gap is configured,

* + a BFD-RS resource or an SMTC occasion is considered to be as overlapped with the [measurement gap] if it overlaps a measurement gap occasion, and
  + xRP = MGRP

When NCSG is configured,

* a BFD-RS resource or an SMTC occasion is considered to be as overlapped with the [measurement gap] if
  + - it overlaps the VIL1 or VIL2 of NCSG, or
    - it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

and

* + xRP = VIRP

If the UE is configured with Pre-MG, a BFD-RS resource or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

When concurrent gaps are configured, a BFD-RS or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to [9.1.2B].

Longer evaluation period would be expected if the combination of BFD-RS resource, SMTC occasion and [measurement gap] configurations does not meet pervious conditionsFor either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

Table 8.5.2.2-1: Evaluation period TEvaluate\_BFD\_SSB for FR1

|  |  |
| --- | --- |
| Configuration | TEvaluate\_BFD\_SSB (ms) |
| no DRX | Max(50, Ceil(5 × P) × TSSB) |
| DRX cycle ≤ 320ms | Max(50, Ceil(7.5 × P) × Max(TDRX,TSSB)) |
| DRX cycle > 320ms | Ceil(5 × P) × TDRX |
| Note: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length. | |

Table 8.5.2.2-2: Evaluation period TEvaluate\_BFD\_SSB for FR2

|  |  |
| --- | --- |
| Configuration | TEvaluate\_BFD\_SSB (ms) |
| no DRX | Max(50, Ceil(5 × P × N) × TSSB) |
| DRX cycle ≤ 320ms | Max(50, Ceil(7.5 × P × N) × Max(TDRX,TSSB)) |
| DRX cycle > 320ms | Ceil(5 × P × N) × TDRX |
| Note: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length. | |

**<<Omitted the unchanged clauses>>**

#### 8.5.3.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the CSI-RS resource in set  estimated over the last TEvaluate\_BFD\_CSI-RS ms period becomes worse than the threshold Qout\_LR\_CSI-RS within TEvaluate\_BFD\_CSI-RS ms period.

The value of TEvaluate\_BFD\_CSI-RS is defined in Table 8.5.3.2-1 for FR1.

The value of TEvaluate\_BFD\_CSI-RS is defined in Table 8.5.3.2-2 for FR2 with N=1. The requirements of TEvaluate\_BFD\_CSI-RS apply provided that the CSI-RS for BFD is not in a resource set configured with repetition ON. The requirements shall not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for BFD and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

For a UE that supports either concurrent measurement gaps, pre-MG gaps or NCSG, measurement gaps in this section includes any configured and active gap.

*Editor’s note: the term “[measurement gap]” in this clause could be either the legacy gap or the VIL or NCSG. RAN4 to further study whether a better terminology can be used to replace [measurement gap].*

For FR1, for a UE not supporting [concurrent gaps] or when the UE is not configured with concurrent gaps,

- , when in the monitored cell there are [measurement gaps] configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS.

- P = 1 when in the monitored cell there are no [measurement gaps] overlapping with any occasion of the CSI-RS.

For FR2, for a UE not supporting [concurrent gaps] or when the UE is not configured with concurrent gaps,

- P = 1, when the BFD-RS resource is not overlapped with [measurement gap] and also not overlapped with SMTC occasion.

- , when the BFD-RS resource is partially overlapped with [measurement gap] and the BFD-RS resource is not overlapped with SMTC occasion (TCSI-RS < xRP)

- , when the BFD-RS resource is not overlapped with [measurement gap] and the BFD-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod).

- P = Psharing factor, when the BFD-RS resource is not overlapped with [measurement gap] and the BFD-RS resource is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod).

- , when the BFD-RS resource is partially overlapped with [measurement gap] and the BFD-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with [measurement gap] and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xGRP and TCSI-RS < 0.5 × TSMTCperiod

- , when the BFD-RS resource is partially overlapped with [measurement gap] and the BFD-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with [measurement gap] and TSMTCperiod = xRP and TCSI-RS = 0.5 × TSMTCperiod

- , when the BFD-RS resource is partially overlapped with [measurement gap] (TCSI-RS < xRP) and the BFD-RS resource is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is partially or fully overlapped with [measurement gap].

- , when the BFD-RS resource is partially overlapped with [measurement gap] and the BFD-RS resource is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod) and SMTC occasion is partially overlapped with [measurement gap] (TSMTCperiod < xRP)

When concurrent gaps are configured,

- P value for a BFD-RS resource to be measured is defined as

* Ntotal / Noutside\_MG in FR1
* Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0
* Ntotal / Navailable in FR2 with Navailable > 0

- For a window W of duration max(TL1, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any BFD-RS resource occasion:

* Ntotal is the total number of BFD-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and
* Noutside\_MG is the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
* Navailable is the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W
* TL1 is periodicity of the target BFD-RS.

where,

Psharing factor = 1, if the BFD-RS resource outside gap is

* not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,
* not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

Psharing factor = 3, otherwise.

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, TSMTCperiod corresponds to the value of higher layer parameter *smtc2*; Otherwise TSMTCperiod corresponds to the value of higher layer parameter *smtc1*. TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

When a measurement gap is configured,

* + a BFD-RS resource or an SMTC occasion is considered to be as overlapped with the [measurement gap] if it overlaps a measurement gap occasion, and
  + xRP = MGRP

When NCSG is configured,

* a BFD-RS resource or an SMTC occasion is considered to be as overlapped with the [measurement gap] if
  + - it overlaps the VIL1 or VIL2 of NCSG, or
    - it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

and

* + xRP = VIRP

If the UE is configured with Pre-MG, a BFD-RS resource or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

When concurrent gaps are configured, a BFD-RS or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to [9.1.2B].

Note: The overlap between CSI-RS for BFD and SMTC means that CSI-RS for BFD is within the SMTC window duration.

Longer evaluation period would be expected if the combination of the BFD-RS resource, SMTC occasion and [measurement gap] configurations does not meet pervious conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

The values of MBFD used in Table 8.5.3.2-1 and Table 8.5.3.2-2 are defined as

- MBFD = 10, if the CSI-RS resource(s) in set  used for BFD is transmitted with Density = 3 and over the bandwidth ≥ 24 PRBs.

The values of PBFD used in Table 8.5.3.2-1 and Table 8.5.3.2-2 are defined as

For each CSI-RS resource in the set  configured for PCell or PSCell in EN-DC or NE-DC or SA; or PCell in NR-DC

- PBFD = 1.

For each CSI-RS resource in the set  configured for PSCell in NR-DC

PBFD = 2 if UE is configured for beam failure detection on SCell, 1 otherwise.

For each CSI-RS resource in the set  configured for a SCell

- PBFD = Z in EN-DC or NE-DC or SA.

- PBFD = 2\* Z in NR-DC.

Where Z is the number of band(s) on which UE is performing beam failure detection only for SCell.

**Table 8.5.3.2-1: Evaluation period TEvaluate\_BFD\_CSI-RS for FR1**

|  |  |
| --- | --- |
| Configuration | TEvaluate\_BFD\_CSI-RS (ms) |
| no DRX | Max(50, Ceil(MBFD × P × PBFD) × TCSI-RS) |
| DRX cycle ≤ 320ms | Max(50, Ceil(1.5 × MBFD × P × PBFD) × Max(TDRX, TCSI-RS)) |
| DRX cycle > 320ms | Ceil(MBFD × P × PBFD) × TDRX |
| Note: TCSI-RS is the periodicity of CSI-RS resource in the set . TDRX is the DRX cycle length. | |

**Table 8.5.3.2-2: Evaluation period TEvaluate\_BFD\_CSI-RS for FR2**

|  |  |
| --- | --- |
| Configuration | TEvaluate\_BFD\_CSI-RS (ms) |
| no DRX | Max(50, Ceil(MBFD × P × N × PBFD) × TCSI-RS) |
| DRX cycle ≤ 320ms | Max(50, Ceil(1.5 × MBFD × P × N × PBFD) × Max(TDRX, TCSI-RS)) |
| DRX cycle > 320ms | Ceil(MBFD × P × N × PBFD) × TDRX |
| Note: TCSI-RS is the periodicity of CSI-RS resource in the set . TDRX is the DRX cycle length. | |

**<<Omitted the unchanged clauses>>**

#### 8.5.5.2 Minimum requirement

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured SSB resource in set  estimated over the last TEvaluate\_CBD\_SSB ms period becomes better than the threshold Qin\_LR provided SSB\_RP and SSB Ês/Iot are according to Annex Table B.2.4.1 for a corresponding band.

The UE shall monitor the configured SSB resources using the evaluation period in table 8.5.5.2-1 and 8.5.5.2-2 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320ms.

The value of TEvaluate\_CBD\_SSB is defined in Table 8.5.5.2-1 for FR1.

The value of TEvaluate\_CBD\_SSB is defined in Table 8.5.5.2-2 for FR2 with scaling factor N=8.

For a UE that supports either concurrent measurement gaps, pre-MG gaps or NCSG, measurement gaps in this section includes any configured and active gap.

*Editor’s note: the term “[measurement gap]” in this clause could be either the legacy gap or the VIL or NCSG. RAN4 to further study whether a better terminology can be used to replace [measurement gap].*

For FR1, for a UE not supporting [concurrent gaps] or when the UE is not configured with concurrent gaps,

- , when in the monitored cell there are [measurement gaps] configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB,

- P = 1 when in the monitored cell there are no [measurement gaps] overlapping with any occasion of the SSB.

For FR2, for a UE not supporting [concurrent gaps] or when the UE is not configured with concurrent gaps,

- , when candidate beam detection RS is not overlapped with [measurement gap] and candidate beam detection RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P is Psharing factor, when candidate beam detection RS is not overlapped with [measurement gap] and candidate beam detection RS is fully overlapped with SMTC period (TSSB = TSMTCperiod).

- , when candidate beam detection RS is partially overlapped with [measurement gap] and candidate beam detection RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with [measurement gap] and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xRP and TSSB < 0.5 × TSMTCperiod

- , when candidate beam detection RS is partially overlapped with [measurement gap] and candidate beam detection RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with [measurement gap] and TSMTCperiod = xRP and TSSB = 0.5 × TSMTCperiod

- , when candidate beam detection RS is partially overlapped with [measurement gap] and candidate beam detection RS is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with [measurement gap]

- , when candidate beam detection RS is partially overlapped with [measurement gap] and candidate beam detection RS is fully overlapped with SMTC occasion (TSSB = TSMTCperiod) and SMTC occasion is partially overlapped with [measurement gap] (TSMTCperiod < xRP)

When concurrent gaps are configured,

- P value for a CBD-RS resource to be measured is defined as

* Ntotal / Noutside\_MG in FR1
* Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0
* Ntotal / Navailable in FR2 with Navailable > 0

- For a window W of duration max(TL1, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any CBD-RS resource occasion:

* Ntotal is the total number of CBD-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and
* Noutside\_MG is the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
* Navailable is the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W
* TL1 is periodicity of the target CBD-RS.

where,

Psharing factor = 1, if the CBD-RS resource outside gap is

* not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,
* not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

Psharing factor = 3, otherwise.

If the high layer in TS 38.331 [2] signaling of *smtc2*is present, TSMTCperiod follows *smtc2*; Otherwise TSMTCperiod follows *smtc1.* TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

If the UE is configured with Pre-MG, a CBD-RS resource or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

When a measurement gap is configured,

* + a CBD-RS resource or an SMTC occasion is considered to be as overlapped with the [measurement gap] if it overlaps a measurement gap occasion, and
  + xRP = MGRP

When NCSG is configured,

* a CBD-RS resource or an SMTC occasion is considered to be as overlapped with the [measurement gap] if
  + - it overlaps the VIL1 or VIL2 of NCSG, or
    - it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

and

* + xRP = VIRP

When concurrent gaps are configured, a CBD-RS or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to [9.1.2B].

Longer evaluation period would be expected if the combination of the CBD-RS resource, SMTC occasion and [measurement gap] configurations does not meet pervious conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer CBD evaluation period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

The values of PCBD used in Table 8.5.5.2-1 and Table 8.5.5.2-2 are defined as

For each SSB resource in the set  configured for PCell or PSCell in EN-DC or NE-DC or SA; or PCell in NR-DC

- PCBD = 1.

For each SSB resource in the set  configured for PSCell in NR-DC

- PCBD = 2 if UE is configured for candidate beam detection on SCell, 1 otherwise.

For each SSB resource in the set  configured for a SCell

- PCBD = Z in EN-DC or NE-DC or SA.

- PCBD = 2\* Z in NR-DC.

Where Z is the number of band(s) on which UE is performing beam failure detection only for SCell

- PCBD is the number of band(s) on which UE is performing candidate beam detection only for SCell.

**Table 8.5.5.2-1: Evaluation period TEvaluate\_CBD\_SSB for FR1**

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_CBD\_SSB (ms)** |
| non-DRX, DRX cycle ≤ 320ms | Max(25, Ceil(3 × P × PCBD) × TSSB) |
| DRX cycle > 320ms | Ceil(3 × P × PCBD) × TDRX |
| Note: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length. | |

**Table 8.5.5.2-2: Evaluation period TEvaluate\_CBD\_SSB for FR2**

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_CBD\_SSB (ms)** |
| non-DRX, DRX cycle ≤ 320ms | Max(25, Ceil(3 × P × N × PCBD) × TSSB) |
| DRX cycle > 320ms | Ceil(3 × P × N × PCBD) × TDRX |
| Note: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length. | |

**<<Omitted the unchanged clauses>>**

#### 8.5.6.2 Minimum requirement

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured CSI-RS resource in set  estimated over the last TEvaluate\_CBD\_CSI-RS [ms] period becomes better than the threshold Qin\_LR within TEvaluate\_CBD\_CSI-RS [ms] period provided CSI-RS Ês/Iot is according to Annex Table B.2.4.2 for a corresponding band.

The UE shall monitor the configured CSI-RS resources using the evaluation period in table 8.5.6.2-1 and 8.5.6.2-2 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320ms.

The value of TEvaluate\_CBD\_CSI-RS is defined in Table 8.5.6.2-1 for FR1.

The value of TEvaluate\_CBD\_CSI-RS is defined in Table 8.5.6.2-2 for FR2 with scaling factor N=8.

For a UE that supports either concurrent measurement gaps, pre-MG gaps or NCSG, measurement gaps in this section includes any configured and active gap.

*Editor’s note: the term “[measurement gap]” in this clause could be either the legacy gap or the VIL or NCSG. RAN4 to further study whether a better terminology can be used to replace [measurement gap].*

For FR1, for a UE not supporting [concurrent gaps] or when the UE is not configured with concurrent gaps,

- , when in the monitored cell there are [measurement gaps] configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

- P = 1 when in the monitored cell there are no [measurement gaps] overlapping with any occasion of the CSI-RS.

For FR2, for a UE not supporting [concurrent gaps] or when the UE is not configured with concurrent gaps,

- P = 1, when candidate beam detection RS is not overlapped with [measurement gap] and also not overlapped with SMTC occasion.

- when candidate beam detection RS is partially overlapped with [measurement gap] and candidate beam detection RS is not overlapped with SMTC occasion (TCSI-RS < xRP)

- , when candidate beam detection RS is not overlapped with [measurement gap] and candidate beam detection RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod).

- P =Psharing factor, when candidate beam detection RS is not overlapped with [measurement gap] and candidate beam detection RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod).

- ,, when candidate beam detection RS is partially overlapped with [measurement gap] and candidate beam detection RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with [measurement gap] and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xRP and TCSI-RS < 0.5 × TSMTCperiod

- , when candidate beam detection RS is partially overlapped with [measurement gap] and candidate beam detection RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with [measurement gap] and TSMTCperiod = xRP and TCSI-RS = 0.5 × TSMTCperiod

- , when candidate beam detection RS is partially overlapped with [measurement gap] and candidate beam detection RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is partially or fully overlapped with [measurement gap]

- ,, when candidate beam detection RS is partially overlapped with [measurement gap] and candidate beam detection RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod) and SMTC occasion is partially overlapped with [measurement gap] (TSMTCperiod < xRP)

When concurrent gaps are configured,

- P value for a CBD-RS resource to be measured is defined as

* Ntotal / Noutside\_MG in FR1
* Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0
* Ntotal / Navailable in FR2 with Navailable > 0

- For a window W of duration max(TL1, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any CBD-RS resource occasion:

* Ntotal is the total number of CBD-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and
* Noutside\_MG is the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
* Navailable is the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W
* TL1 is periodicity of the target CBD-RS.

where,

Psharing factor = 1, if the CBD-RS resource outside gap is

* not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,
* not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

Psharing factor = 3, otherwise.

If the high layer in TS 38.331 [2] signaling of *smtc2* is present, TSMTCperiod follows *smtc2*; Otherwise TSMTCperiod follows *smtc1*. TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

If the UE is configured with Pre-MG, a CBD-RS resource or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

When a measurement gap is configured,

* + a CBD-RS resource or an SMTC occasion is considered to be as overlapped with the [measurement gap] if it overlaps the measurement gap occasion, and
  + xRP = MGRP

When NCSG is configured,

* a CBD-RS resource or an SMTC occasion is considered to be as overlapped with the [measurement gap] if
  + - it overlaps the VIL1 or VIL2 of NCSG, or
    - it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

and

* + xRP = VIRP

When concurrent gaps are configured, a CBD-RS or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to [9.1.2B].

Note: The overlap between CSI-RS for CBD and SMTC means that CSI-RS for CBD is within the SMTC window duration.

Longer evaluation period would be expected if the combination of the CBD-RS resource, SMTC occasion and [measurement gap] configurations does not meet pervious conditions.

Longer evaluation period would be expected if the CSI-RS is on the same OFDM symbols with RLM, BFD, BM-RS, or other CBD-RS, according to the measurement restrictions defined in clause 8.5.6.3.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer CBD evaluation period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

The values of MCBD used in Table 8.5.6.2-1 and Table 8.5.6.2-2 are defined as

- MCBD = 3, if the CSI-RS resource configured in the set  is transmitted with Density = 3 and over the bandwidth ≥ 24 PRBs.

The values of PCBD used in Table 8.5.6.2-1 and Table 8.5.6.2-2 are defined as

For each CSI-RS resource in the set  configured for PCell or PSCell in EN-DC or NE-DC or SA; or PCell in NR-DC

- PCBD = 1.

For each CSI-RS resource in the set  configured for PSCell in NR-DC

- PCBD = 2 if UE configured for candidate beam detection on SCell, 1 otherwise.

For each CSI-RS resource in the set  configured for a SCell

- PCBD = Z in EN-DC or NE-DC or SA.

- PCBD = 2\* Z in NR-DC.

Where Z is the number of band(s) on which UE is performing beam failure detection only for SCell

- PCBD is the number of band(s) on which UE is performing candidate beam detection only for SCell.

**Table 8.5.6.2-1: Evaluation period TEvaluate\_CBD\_CSI-RS for FR1**

|  |  |
| --- | --- |
| **Configuration** | **TEvaluateC\_CBD\_CSI-RS (ms)** |
| non-DRX, DRX cycle ≤ 320ms | Max(25, Ceil(MCBD × P × PCBD) × TCSI-RS) |
| DRX cycle > 320ms | Ceil(MCBD × P × PCBD) × TDRX |
| Note: TCSI-RS is the periodicity of CSI-RS resource in the set . TDRX is the DRX cycle length. | |

**Table 8.5.6.2-2: Evaluation period TEvaluate\_CBD\_CSI-RS for FR2**

|  |  |
| --- | --- |
| **Configuration** | **TEvaluate\_CBD\_CSI-RS (ms)** |
| non-DRX, DRX cycle ≤ 320ms | Max(25, Ceil(MCBD × P × N × PCBD) × TCSI-RS) |
| DRX cycle > 320ms | Ceil(MCBD × P × N × PCBD) × TDRX |
| Note: TCSI-RS is the periodicity of CSI-RS resource in the set . TDRX is the DRX cycle length. | |

**<<Omitted the unchanged clauses>>**

#### 8.5A.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured BFD-RS SSB resource in set estimated over the last TEvaluate\_BFD\_SSB\_CCA ms period becomes worse than the threshold Qout\_LR\_SSB,CCA within TEvaluate\_BFD\_SSB\_CCA ms period.

For a UE that supports either concurrent measurement gaps, pre-MG gaps or NCSG, measurement gaps in this section includes any configured and active gap.

*Editor’s note: the term “[measurement gap]” in this clause could be either the legacy gap or the VIL or NCSG. RAN4 to further study whether a better terminology can be used to replace [measurement gap].*

The value of TEvaluate\_BFD\_SSB\_CCA is defined in Table 8.5A.2.2-1, where

- For a UE not supporting [concurrent gaps] or when concurrent gaps are not configured,

- , when in the monitored cell there are [measurement gaps] configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the BFD-RS SSB.

- P=1 when in the monitored cell there are no [measurement gaps] overlapping with any occasion of the BFD-RS SSB.

- For a UE supporting [concurrent gap] and when concurrent gaps are configured,

- P value for a BFD-RS resource to be measured is defined as Ntotal / Noutside\_MG

- For a window W of duration max(TL1, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gap and per-FR measurement gap within the same FR as serving cell, and starting at the beginning of any BFD-RS resource occasion:

* Ntotal is the total number of BFD-RS resource occasions within the window, including those overlapped with measurement gap occasions within the window, and
* Noutside\_MG is the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

- When a measurement gap is configured,

* a BFD-RS resource is considered to be as overlapped with the [measurement gap] if it overlaps a measurement gap occasion, and
* xRP = MGRP

- When NCSG is configured,

* a BFD-RS resource is considered to be as overlapped with the [measurement gap] if it overlaps the VIL1 or VIL2 of NCSG, and
* xRP = VIRP

- When concurrent gaps are configured, a BFD-RS is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to [9.1.2B].

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, TSMTCperiod corresponds to the value of higher layer parameter *smtc2*; Otherwise TSMTCperiod corresponds to the value of higher layer parameter *smtc1*.

If the UE is configured with Pre-MG, a BFD-RS resource is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

Longer evaluation period would be expected if the combination of BFD-RS SSB resource, SMTC occasion and [measurement gap] configurations does not meet pervious conditions.

Table 8.5A.2.2-1: Evaluation period TEvaluate\_BFD\_SSB\_CCA

|  |  |  |
| --- | --- | --- |
| Configuration | TEvaluate\_BFD\_SSB\_CCA (ms) | |
|  | BFD-RS SSB Es/Iot Note2 ≥ -7 dB | BFD-RS SSB Es/Iot Note2 < -7 dB |
| no DRX | Max(50, Ceil((10 × P) × TSSB)) | Max(50, Ceil((12 × P) × TSSB)) |
| DRX cycle ≤ 320ms | Max(50, Ceil(1.5 × 8 × P) × Max(TDRX,TSSB)) | Max(50, Ceil(1.5 × 10 × P) × Max(TDRX,TSSB)) |
| DRX cycle > 320ms | Ceil(7 × P) × TDRX | Ceil(8 × P) × TDRX |
| Note 1: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length.  Note 2: BFD-RS SSB Es/Iot is the averaged BFD-RS SSB Es/Iot over the most recent previous evaluation period. | | |

**<<Omitted the unchanged clauses>>**

#### 8.5A.5.2 Minimum requirement

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured CBD-RS SSB resource in set  estimated over the last TEvaluate\_CBD\_SSB\_CCA ms period becomes better than the threshold Qin\_LR,CCA provided SSB\_RP and SSB Ês/Iot are according to Annex Table B.2.4.1 for a corresponding band.

The UE shall monitor the configured SSB resources using the evaluation period in table 8.5A.5.2-1 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320ms.

For a UE that supports either concurrent measurement gaps, pre-MG gaps or NCSG, measurement gaps in this section includes any configured and active gap.

*Editor’s note: the term “[measurement gap]” in this clause could be either the legacy gap or the VIL or NCSG. RAN4 to further study whether a better terminology can be used to replace [measurement gap].*

The value of TEvaluate\_CBD\_SSB\_CCA is defined in Table 8.5A.5.2-1, where

- For a UE not supporting [concurrent gaps] or when concurrent gaps are not configured,

- , when in the monitored cell there are [measurement gaps] configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CBD-RS SSB,

- P = 1 when in the monitored cell there are no [measurement gaps] overlapping with any occasion of the CBD-RS SSB.

- For a UE supporting [concurrent gap] or when concurrent gaps are configured,

- P value for a CBD-RS resource to be measured is defined as Ntotal / Noutside\_MG

- For a window W of duration max(TL1, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any CBD-RS resource occasion:

* Ntotal is the total number of CBD-RS resource occasions within the window, including those overlapped with measurement gap occasions within the window, and
* Noutside\_MG is the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

- If the UE is configured with Pre-MG, a CBD-RS resource is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- When a measurement gap is configured,

* a CBD-RS resource is considered to be as overlapped with the [measurement gap] if it overlaps a measurement gap occasion, and
* xRP = MGRP

- When NCSG is configured,

* a CBD-RS resource is considered to be as overlapped with the [measurement gap] if it overlaps the VIL1 or VIL2 of NCSG, and
* xRP = VIRP
* When concurrent gaps are configured, a CBD-RS is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to [9.1.2B].

Table 8.5A.5.2-1: Evaluation period TEvaluate\_CBD\_SSB\_CCA

|  |  |
| --- | --- |
| Configuration | TEvaluate\_CBD\_SSB\_CCA (ms) |
| non-DRX, DRX cycle ≤ 320ms | Max(25, Ceil((3 + LCBD) × P) × TSSB) |
| DRX cycle > 320ms | Ceil((3 + LCBD) × P) × TDRX |
| Note 1: TSSB is the periodicity of SSB in the set . TDRX is the DRX cycle length.  Note 2: When DRX is not configured, LCBD is the number of CBD-RS SSB occasions not available at the UE during TEvaluate\_CBD\_SSB\_CCA where LCBD ≤ LCBD,max. When DRX is configured, LCBD is the number of DRX cycles in which at least one of the CBD-RS SSB occasions not available at the UE during TEvaluate\_CBD\_SSB\_CCA where LCBD ≤ LCBD,max. The UE is not required to determine the availability of SSB occasions more frequent than once per DRX cycle length, when configured with DRX.  Note 3: LCBD,max=7 for Max(TDRX, TSSB) ≤ 40 assuming TDRX=0 for non-DRX,  LCBD,max=5 for 40 < Max(TDRX, TSSB) ≤ 320,  LCBD,max=3 for TDRX > 320.  Note 4 If LCBD>LCBD,max, the UE shall assume no new candidate beams are found for this evaluation period. | |

**---end of change #4: 8.5 ---**

**--- start of change #5: 8.X1 (R4-2202618,R4-2206884)---**

## 8.X1 Pre-configured measurement gap activation/deactivation delay

### 8. X1.1 Introduction

The requirements in this clause apply for a UE configured with PCell [or any activated SCell] in standalone NR.

UE shall complete the activation/deactivation of pre-configured measurement gap within the delay defined in this clause.

### 8. X1.2 Pre-configured measurement gap activation/deactivation upon DCI/timer-based BWP switch

#### 8. X1.2.1 Activation/deactivation upon DCI/timer-based BWP switch delay on a single CC

The requirements in this clause only apply to the case that the DCI/timer-based BWP switch is performed on a single CC with more than one BWP configurations configured on the CC.

When BWP switch occurs, which results in status change of pre-configured measurement gap according to clause [9.1.2A], UE shall be able to finish pre-configured activation or deactivation within [5] ms after the completion of the active BWP switch. The active BWP switch delay for single CC is defined in clause 8.6.2. Activation/deactivation of Pre-MG takes effect from the first complete MG occasion after the activation and deactivation delay. If the end of activation/deactivation of Pre-MG is within a gap occasion, the Pre-MG status shall not be changed immediately. Instead, the Pre-MG status shall be changed in the next gap occasion.

### 8. X1.3 Pre-configured measurement gap activation/deactivation upon SCell activation/deactivation

The requirements in this clause apply when one SCell or multiple SCells are activated/deactivated.

When one SCell or multiple SCells are activated/deactivated, which results in status change of pre-configured measurement gap according to clause [9.1.2A], UE shall be able to finish pre-configured activation or deactivation within [5] ms after the completion of SCell(s) activation/deactivation. The SCell(s) activation/deactivation delay for is defined in clause 8.3. Activation/deactivation of Pre-MG takes effect from the first complete MG occasion after the SCell(s) activation/deactivation delay. If the end of activation/deactivation of Pre-MG is within a gap occasion, the Pre-MG status shall not be changed immediately. Instead, the Pre-MG status shall be changed in the next gap occasion.

### 8. X1.3 Pre-configured measurement gap activation/deactivation upon RRC reconfiguration

The requirements in this clause apply when UE capable of autonomous activation/deactivation mechanism receives RRC reconfiguration to:

* Add/remove of any measurement object(s), or
* Add/release/change a SCell under CA, or
* Switch active BWP or update parameters of its active BWP.

If the aforementioned RRC reconfiguration results in status change of pre-configured measurement gap according to clause [9.1.2A], UE shall be able to finish pre-configured activation or deactivation within [5] ms after RRC processing delay specified in [2]. If the end of activation/deactivation of Pre-MG is within a gap occasion, the Pre-MG status shall not be changed immediately. Instead, the Pre-MG status shall be changed in the next gap occasion.

**--- end of change #5: 8.X1---**

**--- Start of change #6: 9.1.X1 (R4-2202624, R4-2201622, R4-2206887, R4-2206888)------**

9.1.X1 Pre-configured measurement gap

#### 9.1.X1.1 Introduction

A UE capable of Pre-configured measurement gap (Pre-MG) pattern can be configured with a Pre-MG pattern via RRC signalling [2].

The gap interruption requirements in Section 9.1.2 apply to Pre-MG when Pre-MG is activated, and no gap interruption is expected when Pre-MG is deactivated.

- The requirements apply for NR standalone operation with single carrier and NR CA.

Editor Note: RAN4 agreed to deprioritize Pre-MG for MR-DC in Rel17.

#### 9.1.X1.2 Requirements applicability

The requirements related to pre-configured measurement gap apply provided:

- UE indicates support of [*capability name for rule based pre-MG activation deactivation*] and/or [*capability name for RRC based pre-MG activation deactivation*], and

- either a single per-UE measurement gap is pre-configured by the network, or one or two per-FR measurement gaps are pre-configured by the network, and

- one of measurement gap patterns among measurement gap patterns #0 ~ #25 is configured for pre-configured measurement gap, and

- UE is in NR SA with single carrier or with NR CA.

A measurement gap is configured as pre-configured measurement gap if [*RAN2 signaling design for pre-MG configuration*] is indicated by network.

If UE indicates support of only [*capability name for RRC based pre-MG activation deactivation*], UE can expect the network to configure [*RAN2 signaling design for per BWP status indication*].

If a measurement gap is configured as pre-configured measurement gap, the applicability of measurement gap patterns is defined in Table 9.1.2-3.

A pre-configured measurement gap may not be sufficient to perform PRS measurements because it is not always activated as determined from the signalling provided by the network or from the autonomous rules to determine the status of the pre-configured measurement gap. In this scenario, the UE will inform the network that it is going to start/stop PRS measurements with the configured pre-configured measurement gap by initiating the existing *LocationMeasurementIndication* procedure.

9.1.X1.3 Requirements

Any of the measurement Gap pattern #0 to #25 defined in Table 9.1.2-1 can be configured as Pre-MG pattern.

The UE can determine the Pre-MG status based on autonomous activation/deactivation mechanism or based on network-controlled activation/deactivation mechanism.

A UE capable of both autonomous and network-controlled mechanisms for activation/deactivation of Pre-MG pattern will not use autonomous rules to determine the activation/deactivation status of the pre-configured MG if the network provides the activation/deactivation status via RRC indication [Signaling by RAN2].

##### 9.1.X1.3.1 Requirements for autonomous activation/deactivation mechanism

Requirements in this section apply when autonomous mechanism [1] is used for activation/deactivation of Pre-MG pattern.

The UE can autonomously change the Pre-MG status from activation to deactivation or vice versa based on any of the following triggering conditions:

* DCI, timer or RRC based active BWP switching,
* Activation/deactivation of SCell(s),
* Addition/removal of any measurement object(s)
* Addition/release/change of a SCell in carrier aggregation,
* Initiation of *LocationMeasurementIndication* procedure specified in clause 5.5.6 [2].

The UE shall autonomously determine the status of the per-UE Pre-MG pattern as deactivated immediately after the configuration of the per-UE Pre-MG pattern provided that all the configured measurements can be performed without measurement gaps. The UE shall autonomously determine the status of the per-FR Pre-MG pattern as deactivated immediately after the configuration of the per-FR Pre-MG pattern provided that all the configured measurements in the same FR can be performed without measurement gaps.

A measurement can be performed by the UE without measurement gaps if any of the following conditions is met:

* The UE is configured with SSB based intra-frequency measurements, and the conditions defined for SSB based intra-frequency measurement without gaps in Clause 9.2.1 are met, or
* The UE is configured with SSB based inter-frequency measurements, and the conditions defined for SSB based inter-frequency measurement without gaps in Clause 9.3.1 are met, or
* The UE is configured with CSI-RS based intra-frequency measurements.

The UE shall autonomously determine the status of the per-UE Pre-MG pattern as activated immediately after the configuration of the per-UE Pre-MG pattern provided that at least one of the configured measurements cannot be performed without measurement gaps. The UE shall autonomously determine the status of the per-FR Pre-MG pattern as activated immediately after the configuration of the per-FR Pre-MG pattern provided that at least one of the configured measurements in the same FR cannot be performed without measurement gaps.

A measurement cannot be performed by the UE without measurement gaps if any of the following conditions is met:

* The UE is configured with SSB based intra-frequency measurements, and the conditions defined for SSB based intra-frequency measurement without gaps in Clause 9.2.1 are not met, or
* The UE is configured with SSB based inter-frequency measurements, and the conditions defined for SSB based inter-frequency measurement without gaps in Clause 9.3.1 are not met, or
* The UE is configured with any of the following measurements:
  + CSI-RS based inter-frequency measurements, or
  + NR PRS-based positioning measurements, or
  + E-UTRA Inter-RAT measurements, or
  + E-UTRA Inter-RAT RSTD and E-CID measurements, or
  + UTRA Inter-RAT measurements.

##### 9.1.X1.3.2 Requirements for network-controlled activation/deactivation mechanism

The requirements in this section apply when network-controlled mechanism [1] is used for activation/deactivation of Pre-MG pattern.

For per-UE Pre-configured MG,

* the UE determines that the Pre-configured MG is activated if the Pre-configured MG status indication for the active DL BWP [Signaling by RAN2] for any of the activated CCs is ON, or if the additional status indication for any of the deactivated SCCs [Signaling by RAN2] is ON,
* otherwise, the UE determines that the Pre-configured MG is deactivated

For per-FR Pre-configured MG,

* the UE determines that the Pre-configured MG is activated if the Pre-configured MG status indication for the active DL BWP [Signaling by RAN2] for any of the activated CCs in the corresponding FR is ON, or if the additional status indication for any of the deactivated SCCs [Signaling by RAN2] in the corresponding FR is ON,
* otherwise, the UE determines that the Pre-configured MG is deactivated

##### 9.1.X1.3.3 Requirements for reception/transmission during activation/deactivation

The requirements in this section apply when autonomous mechanism or network-controlled mechanism is used for activation/deactivation [1] of Pre-MG pattern.

If per-UE Pre-MG pattern is activated then the UE is not required to conduct reception/transmission from/to the corresponding serving cells during the gap occasion according to the same principles as described for per-UE measurement gaps in clause 9.1.2. Otherwise, the UE can be scheduled for reception/transmission of signals in all the serving cells during the gap occasion.

If per-FR Pre-MG pattern is activated then the UE is not required to conduct reception/transmission from/to the corresponding serving cells during the gap occasion on the same FR according to the same principles as described for per-FR measurement gaps in clause 9.1.2. Otherwise, the UE can be scheduled for reception/transmission of signals in all the serving cells during the gap occasion in the same FR.

**--- end of change#6: 9.1.X1------**

**--- start of change #7: 9.1.X2 (R4-2202611, R4-2202612, R4-2206880, R4-2206881)------**

### 9.1.X2 Concurrent measurement gaps

#### 9.1.X2.1 Introduction

When UE supports concurrent measurement gap pattern capability, network can provide multiple measurement gaps configured by RRC message(s) as specified in TS 38.331 [2].

#### 9.1.X2.2 Requirements

If the UE requires measurement gaps to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports concurrent measurement gap patterns but does not support independent measurement gap patterns for different frequency ranges as specified in Table 5.1-1 in [18, 19, 20], in order for the requirements in the following clauses to apply the network can provide at most two per-UE measurement gap patterns for monitoring of all frequency layers.

If the UE requires measurement gaps to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports both concurrent measurement gap patterns and independent measurement gap patterns for different frequency ranges as specified in Table 5.1-1 in [18, 19, 20], in order for the requirements in the following clauses to apply the network can provide the following measurement gap patterns’combinations for monitoring of all frequency layers. The supported measurement gap combination configurations for UE supporting both concurrent measurement gap patterns and independent measurement gap patterns for different frequency ranges are specified in Table 9.1.2B-1,

**Table 9.1.X2-1: The number of Gap Combination Configurations by UE supporting both concurrent measurement gap patterns and independent measurement gap patterns**

|  |  |  |  |
| --- | --- | --- | --- |
| **Gap Combination**  **Configuration Id** | **The number of simultaneous configured measurement gap patterns** | | |
| **Per-FR1 measurement gap** | **Per-FR2 measurement gap** | **Per-UE measurement gap** |
| 0 | 2 | 1 | 0 |
| 1 | 1 | 2 | 0 |
| 2 | 0 | 0 | 2 |
| 3Note 1 | 1 | 0 | 1 |
| 4Note 1 | 0 | 1 | 1 |
| 5Note 1 | 1 | 1 | 1 |
| Note 1: Gap Combination Configuration Id #3, #4, #5 will be only applied when the per-UE measurement gap is associated to measure PRS for any RSTD, PRS-RSRP, and UE Rx-Tx time difference measurement defined in TS 38.215 [4]. | | | |

For UE configured with the SA operation, when monitoring of multiple inter-RAT E-UTRAN carrier frequency layers and inter-frequency NR carrier frequency layers as configured by PCell using gaps, each monitored carrier frequency layer, including following measurement types:

- a measurement object with SSB based measurement,

- a measurement object with CSI-RS based measurement,

- E-UTRA inter-RAT measurement object,

- E-UTRAN inter-RAT RSTD measurement,

- NR PRS-based measurements,

can be only associated to one measurement gap pattern provided the network configures the concurrent measurement gap patterns.

When UE supports concurrent measurement gap patterns, each measurement gap pattern supported by the UE is listed in Table 9.1.2-1 based on the applicability specified in table 9.1.2-2 and 9.1.2-3.

The requirements in clause 9.1.2 are also applicable for the UE capable of and configured with multiple concurrent measurement gap patterns within each measurement gap pattern.

##### 9.1.X2.3 Collision between concurrent measurement gaps

Collisions between occasions of two concurrent measurement gaps may occur as specified in this clause if the two measurement gaps are

- two per-UE measurement gaps, or

- two per-FR measurement gaps in the same FR, or

- one per-UE measurement gap and one per-FR measurement gap.

When UE is configured with concurrent measurement gaps, two measurement gap occasions are considered colliding if at least one of the following conditions is met:

- the two occasions are fully or partially overlapping in time domain, or

- the distance between the two occasions is equal to or smaller than [4]ms.

The distance between two measurement gap occasions is defined as the time difference between the ending point of the first occasion and the starting point of the second occasion, where the first measurement gap occasion occurs earlier in time than the second measurement gap occasion.

*Editor Notes: RAN4 is further discussing the issue when more than two measurement gap occasions are overlapped sequentially.*

In case of collision between two measurement gap occasions, the UE shall perform measurements in the occasion of the measurement gap with higher priority, and the occasion of the measurement gap with lower priority is considered to be dropped. The UE shall be able to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI in the corresponding NR serving cells in the slots that are not interrupted according to requirements in clause 9.1.2B.4.

##### 9.1.X2.4 Measurement gap related requirements of concurrent measurement gaps

A slot is considered as interrupted if it is interrupted by an occasion of any of the configured concurrent measurement gaps following the measurement gap interruption requirements in clause 9.1.2, except for a dropped measurement gap occasion.

**--- end of change #7: 9.1.X2------**

**--- start of change #8: 9.1.X3 (R4-2202628，R4-2202636,R4-2202631, R4-2202633)------**

### 9.1.X3 Network controlled small gap

#### 9.1.X3.1 Introduction

The UE capable of network controlled small gap (NCGG) pattern can be configured with a NCSG pattern via RRC signalling [2].

This clause contains the general requirements on the UE regarding to Network Controlled Small Gap (NCSG).

The requirements in this clause are applicable for UE configured with SA NR, [EN-DC, NE-DC or NR-DC] operation mode.

It is up to UE implementation whether or not the UE is able to conduct transmission in the following slot(s),

- when [NCSGTA] is not applied, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after the last each of the interrupted slots after VIL1 and VIL2.

- when [NCSGTA] is applied and the SCS of the UL carrier is other than 15kHz, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after the last each of the interrupted slots after VIL1 and VIL2.

- when [NCSGTA] is applied and the SCS of the UL carrier is 15kHz, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after the slot partially overlapped with each of the interrupted slots after VIL1 and VIL2.

where UL slot denotes that all the symbols in the slot are uplink symbols, and L=1 if  for the UL transmission is less than the length of one slot; L=2 otherwise.

Note: Network is supposed to take into account the possible difference between the estimated TA at network and actual TA at UE when scheduling UE in the above slot(s).

The interruptions of NCSG in number of slots are listed in Table 9.1.X3-1 on all serving cells when per-UE NCSG is configured or on FR1 serving cells when per-FR FR1 NCSG is configured to [per-FR measurement gap] capable UE. In case that the UE capable of [per-FR measurement gap] is configured with per-FR FR2 NCSG, numbers of interrupted slots on FR2 serving cells are listed in Table9.1.X3-2. There are two interruptions in each NCSG occasion, VIL1 before ML and VIL2 after ML, in NR standalone (with single carrier or NR CA). Each of them has number of interrupted slots captured in Table 9.1.X3-1 and Table9.1.X3-2.

Table 9.1.X3-1: Number of interrupted slots on all serving cells for per-UE NCSG or FR1 serving cells for FR1 NCSG during each VIL in NR standalone operation (with single carrier, NR CA)

|  |  |  |
| --- | --- | --- |
| NR  SCS | Number of interrupted slots on serving cells | |
| When MG timing advance of 0ms is applied | When MG timing advance of 0.5ms is applied |
| (kHz) | VIL=1ms | VIL=1ms |
| 15 | 1 | 2 |
| 30 | 2 | 2 |
| 60 | 4 | 4 |
| 120 | 8 | 8 |
| NOTE 1: NR SCS of 120 kHz is only applicable to the case with per-UE NCSG.  NOTE 2: Non-overlapped half-slots occur before and after the VIL. Whether a UE can receive and/or transmit in those half-slots is up to UE implementation. | | |

**Table 9.1.X3-2: Number of interrupted slots on FR2 serving cells for FR2 NCSG during each VIL in NR standalone operation (with single carrier, NR CA)**

|  |  |  |  |
| --- | --- | --- | --- |
| NR | Number of interrupted slots on serving cells | | |
| SCS | When MG timing advance of 0ms is applied | [When MG timing advance of 0.25 ms is applied] | When MG timing advance of 0.75ms is applied |
| (kHz) | VIL=0.75ms | VIL=0.75ms | VIL=0.75ms |
| 60 | 3 | 3 | 3 |
| 120 | 6 | 6 | 6 |
| NOTE 1: Non-overlapped half-slots occur before and after the VIL. Whether a UE can receive and/or transmit in those half-slots is up to UE implementation. | | | |

#### 9.1.X3.2 Requirements applicability

Requirements in clause 9.1.2C apply for UE capable of NCSG in standalone NR in both FR1 and FR2 (including FR1+FR2 CA), provided UE is configured with only NCSG and no other measurement gap is configured, and UE is configured with

* SSB based intra-frequency measurement (including measurement on de-activated SCC and measurement on dormant SCell), and/or
* SSB based inter-frequency measurement, and/or
* Inter-RAT E-UTRAN measurement.

Requirements in clause 9.1.2C do not apply if UE is configured with

* Inter-RAT GSM measurement, or
* Inter-RAT UTRAN measurement, or
* PRS measurement.

9.1.X3.3 Requirements

The UE shall support NCSG patterns defined in Table 9.1.2C-1 that are relevant to the UE’s measurement capabilities. ML is the measurement length. During the VIL1 and VIL2, the UE is not expected to transmit and receive any data. Where, VIL1 is the visible interruption length before the ML and VIL2 is the visible interruption length after the ML. During ML, whether the UE is expected to transmit and receive data on the corresponding serving carrier(s) depends on the scheduling restriction requirements specified in clause 9.x.y. The NCSG configuration parameters VIL1, ML, VIL2 and VIRP are illustrated in Figure 9.1.2C-1.

**VIL1**

**VIL2**

**ML**

**…**

**…**

**VIL1**

**VIL2**

**Time**

**VIRP**

**ML**

Figure 9.1.X3-1: Illustration of NCSG configuration parameters: VIL1, ML, VIL2 and VIRP

Table 9.1.X3.3-1: NCSG Configurations supported by the UE

|  |  |  |
| --- | --- | --- |
| NCSG Pattern Id | Measurement Length during which there is no gap (ML, ms) | Visible interruption Repetition Period  (VIRP, ms) |
| 0 | 5 | 40 |
| 1 | 5 | 80 |
| 2 | 2 | 40 |
| 3 | 2 | 80 |
| 4 | 5 | 20 |
| 5 | 5 | 160 |
| 6 | 3 | 20 |
| 7 | 3 | 40 |
| 8 | 3 | 80 |
| 9 | 3 | 160 |
| 10 | 2 | 20 |
| 11 | 2 | 160 |
| 12 | 5 | 20 |
| 13 | 5 | 40 |
| 14 | 5 | 80 |
| 15 | 5 | 160 |
| 16 | 3 | 20 |
| 17 | 3 | 40 |
| 18 | 3 | 80 |
| 19 | 3 | 160 |
| 20 | 1 | 20 |
| 21 | 1 | 40 |
| 22 | 1 | 80 |
| 23 | 1 | 160 |

**--- end of change#8: 9.1.X3 ------**

**--- start of change #9: 9.1.5 (R4-2202605, R4-2207084)------**

### 9.1.5 Carrier-specific scaling factor

This clause specifies the derivation of carrier-specific scaling factor (CSSF) values, which scales the measurement delay requirements given in clause 9.2, 9.2A, 9.3, 9.3A 9.4, and NR PRS-based positioning measurements in clause 9.9 and CSI-RS based L3 measurement in clause 9.10 when UE is configured to monitor multiple measurement objects. The CSSF values are categorized into CSSFoutside\_gap,i andCSSFwithin\_gap,i, for the measurements conducted outside measurement gaps and within measurement gaps, respectively.

If [concurrent measurement gaps] are configured by the network, subject to UE capability, the term concurrent measurement gap(s) in the following clauses refer to non-dropped measurement gap occasions after accounting for measurment gap collisions as specified in clause [9.1.X2.3] from all the configured measurement gap patterns.

#### 9.1.5.1 Monitoring of multiple layers outside gaps

The carrier-specific scaling factor CSSFoutside\_gap,i for measurement object *i* derived in this chapter is applied to following measurement types for single measurement gap or each measurement gap within concurrent measurement gaps:

- SSB-based intra-frequency measurement with no measurement gap in clause 9.2.5 and 9.2A.5, when none of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap or concurrent measurement gaps.

- SSB-based intra-frequency measurement with no measurement gap in clause 9.2.5 and 9.2A.5, when part of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap or concurrent measurement gaps.

- CSI-RS based intra-frequency measurement in clause xxx, when none of CSI-RS resources for L3 measurement of this intra-frequency measurement object are overlapped by the measurement gap or concurrent measurement gaps.

- CSI-RS based intra-frequency measurement in clause xxx, when all CSI-RS resources for L3 measurement of this intra-frequency measurement object are partially overlapped by the measurement gap or concurrent measurement gaps.

- SSB-based inter-frequency measurement with no measurement gap in clause 9.3.9, when none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or concurrent measurement gaps, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

SSB-based inter-frequency measurement with no measurement gap in clause 9.3.9, when part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or concurrent measurement gaps, if it is a CA capable UE and this UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

The carrier-specific scaling factor CSSFoutside\_gap,i for measurement object *i* derived in this chapter is applied to following measurement types for single measurement gap:

- For a UE in E-UTRA-NR dual connectivity operation, NR SSB-based inter-RAT measurement object configured by the E-UTRAN PCell on an NR serving carrier

- the SSB is completely contained in the active BWP of the UE, and

- none or part of the SMTC occasions of this inter-RAT measurement object are overlapped by the measurement gap;

- Intra-frequency RSSI and channel occupancy measurement with no measurement gap on a carrier subject to CCA when SMTC and RMTC are overlapping and RMTCs are not fully overlapped with measurement gap.

For a UE in E-UTRA-NR dual connectivity operation, if a measurement object configured by PSCell and an NR inter-RAT measurment object configured by E-UTRAN PCell are on the same serving carrier, they shall be counted as one intra-frequency measurement object, provided that they meet the measurement object merging conditions [in clause 9.1.3.2].

The number of frequency layers for SSB measurements shall include the total number of MOs with

- *ssb-ConfigMobility* configured, or

- *ssb-ConfigMobility* not configured but *csi-rs-ResourceConfigMobility* configured with *associatedSSB*.

If *ssbfrequency, smtc1, smtc2* and *ssbSubcarrierSpacing* are same in multiple MOs, the multiple MOs are counted as one SSB frequency layer.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, CSSFoutside\_gap,i and requirements derived from CSSFoutside\_gap,i are not specified.

The UE cell identification and measurement periods derived based on CSSFoutside\_gap,i in clauses 9.2.5.1, 9.2.5.2 and 9.10.2 may be extended for measurement objects of which the cell identification and measurement periods are overlapped with Tmeasure\_SFTD1 specified in clause 9.3.8 when no measurement gaps are provided.

The requirements in this clause apply provided that

- There are no PCell nor PSCell in FR2, or

- The SMTC on all CCs and inter-frequency layers without measurement gap in FR2 have the same offset, and one of following conditions is met

- If *smtc2* is configured on any FR2 CC,

- All CCs have the same configuration for *smtc1*, and

- All CCs configured with *smtc2* have the same configuration for *smtc2*

- If *smtc2* is not configured on any FR2 CC,

- The total number of different SMTC periodicities on all serving CCs and inter-frequency layers without measurement gap does not exceed 4

- The starting point of the first 5ms window for CSI-RS measurement as defined in clause 9.10.1 on all CCs in FR2 is same and one of following conditions is met

- If any CSI-RS resource is configured in the second 5ms window for CSI-RS measurement as defined in clause 9.10.1 on any FR2 CC,

- All CCs with CSI-RS resources only in the first 5ms window have the same CSI-RS resource periodcity, and

- All CCs with CSI-RS resources both in the first and the second 5ms window have the same CSI-RS resource periodcity

- If no CSI-RS resource is configured in the second 5ms window for CSI-RS measurement as defined in clause 9.10.1 on any FR2 CC,

- The total number of different CSI-RS resources periodicities on all serving CCs does not exceed 3

Note: Longer delays for cell identification and measurement periods derived based on CSSFoutside\_gap,i in clauses 9.2.5.1, 9.2.5.2, can be expected, if the UE is configured with more than 4 different SMTC periodicities on FR2 serving carriers. The longer delay applies for the FR2 intra-frequency measurement objects with the longest SMTC periodicity/periodicities.

**<<Omitted the unchanged clauses>>**

#### 9.1.5.2 Monitoring of multiple layers within gaps

The carrier-specific scaling factor CSSFwithin\_gap,i for a measurement object *i* derived in this chapter is applied to following measurement types for single measurement gap or each measurement gap within concurrent measurement gaps:

- SSB-based intra-frequency measurement object with no measurement gap in clause 9.2.5 and 9.2A.5, when all of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap or concurrent measurement gaps.

- SSB-based intra-frequency measurement object with measurement gap in clause 9.2.6 and 9.2A.6.

-- CSI-RS based inter-frequency measurement in clause xxx, when CSI-RS resources for L3 measurement of this inter-frequency measurement object are overlapped by the measurement gap or concurrent measurement gaps.

- CSI-RS based inter-frequency measurement in clause xxx, when CSI-RS resources for L3 measurement of this inter-frequency measurement object are partially overlapped by the measurement gap or concurrent measurement gaps.

SSB-based inter-frequency measurement object with measurement gap in clause 9.3.4.

- SSB-based inter-frequency measurement object without measurement gap for UE capable of *interFrequencyMeas-NoGap* in clause 9.3.9, when

- all of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or concurrent measurement gaps, or

- part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or concurrent measurement gaps, and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network but it is not a CA capable UE, or

- part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or concurrent measurement gaps., but the flag *interFrequencyConfig-NoGap-r16* is not configured by the Network.

The carrier-specific scaling factor CSSFwithin\_gap,i for a measurement object *i* derived in this chapter is applied to following measurement types for single measurement gap:

- Intra-frequency RSSI/CO measurement with measurement gap in clause 9.2A.7.

- Intra-frequency RSSI/CO measurement with no measurement gap in clause 9.2A.7 when all of the RMTC occasions of this intra-frequency RSSI/CO measurement are overlapped by the measurement gap(s).

- Inter-frequency RSSI/CO measurement in clause 9.3A.8 and 9.3A.9.

- E-UTRA Inter-RAT measurement object in clauses 9.4.2 and 9.4.3.

-- For a UE in E-UTRA-NR dual connectivity operation, NR SSB-based Inter-RAT measurement object configured by the E-UTRAN PCell (TS 36.133 [15] clause 8.17.4) on an NR serving carrier

- the SSB is not completely contained in the active BWP of the UE, or

- all of the SMTC occasions of this inter-RAT measurement object are overlapped by the measurement gap;

- NR SSB-based Inter-RAT measurement object configured by the E-UTRAN PCell (TS 36.133 [15] clause 8.17.4) on an NR non-serving carrier.

- E-UTRAN Inter-frequency measurement object configured by the E-UTRAN PCell (TS 36.133 [15] clause 8.17.3) and by the E-UTRAN PSCell (TS 36.133 [15] clause 8.19.3).

- E-UTRAN Inter-frequency RSTD measurement configured by the E-UTRAN PCell (TS 36.133 [15] clause 8.17.15).

- UTRA Inter-RAT measurement object configured by the E-UTRAN PCell (TS 36.133 [15] clauses 8.17.5 to 8.17.12).

- GSM Inter-RAT measurements configured by the E-UTRAN PCell (TS 36.133 [15] clauses 8.17.13 and 8.17.14).

The UE is expected to conduct the measurement of this measurement object *i* only within the measurement gaps. [If UE is configured with [concurrent measurement gaps] and association between measurement object i and certain measurement gaps is provided, UE is expected to conduct the measurement of this measurement object *i* only within the associated measurement gaps.]

*Editor’s note: FFS whether to remove [ ] or revise the sentence in [ ] after RAN2 concludes the implementation on RRC association.*

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, CSSFwithin\_gap,i and requirements derived from CSSFoutside\_gap,i are not specified.

Number of SSB layers should include SSB for mobility and that as associated SSB for CSI-RS mobility. the ssbfrequency is counted only once if the ssbfrequency for mobility and associated SSB are the same, or ssbfrequency and smtc in multiple MOs are the same.

Editor’s note: FFS how to add the layer corresponding to the associated SSB for a MO with only CSI-RS measurement configured

**<<Omitted the unchanged clauses>>**

##### 9.1.5.2.2 SA mode: carrier-specific scaling factor for SSB, CSI-RS-based L3 measurements and RSSI and channel occupancy measurements performed within gaps

When one or more measurement objects are monitored within measurement gaps, the carrier specific scaling factor for a target measurement object with index *i* is designated as CSSFwithin\_gap,i and is derived as described in this clause.

If a UE capable of [multiple independent and concurrent gaps] is configured with [concurrent gaps], the carrier specific scaling factor is calculated separately for each gap pattern, [provided that the association between measurement objects and gap pattern is configured by network. Only the measurement objects associated to the same measurement gap pattern are counted when deriving CSSFwithin\_gap,I for a target measurement object with index *i*.]. In case of collision between concurrent measurement gaps, some measurement gap occasions may be dropped according to clause [9.1.X2.x]. The dropped gap occasions will not be used in deriving CSSFwithin\_gap,i.

*Editor’s note: FFS whether to remove [ ] or revise the sentence in [ ] after RAN2 concludes the implementation on RRC association.*

If measurement object *i* refers to a long-periodicity measurement which is any of:

- an E-UTRA RSTD measurement with periodicity Tprs>160ms or with periodicity Tprs=160ms but *prs-MutingInfo-r9* is configured, or

- an NR measurement for positioning frequency layer i with Tavailable\_PRS,i >160ms, where Tavailable\_PRS,i is defined in clauses 9.9.2.5, 9.9.3.5 and 9.9.4.5 for RSTD, PRS-RSRP and UE Rx-Tx time difference measurements, respectively.

then CSSFwithin\_gap,i=1. Otherwise, the CSSFwithin\_gap,i for other measurement objects (including E-UTRA RSTD measurement with periodicity Tprs=160ms) participate in the gap competition and the CSSFwithin\_gap,i are derived as below.

Table 9.1.5.2.2-1: void

When multiple positioning frequency layers are configured,

* for each positioning frequency layer *i*, CSSFwithin\_gap,i is derived with the following steps assuming no other positioning frequency layer is configured.
* for each RRM frequency layer *i*, CSSFwithin\_gap,i is derived as follows:
  + an intermediate CSSFwithin\_gap,i,k is derived with the following steps assuming only positioning frequency layer *k* is configured, and
  + CSSFwithin\_gap,i= max(CSSFwithin\_gap,i,k), where *k*=0…K-1, and K is the number of configured positioning frequency layers.

For each measurement gap *j* not used for a long-periodicity measurement defined above, count the total number of intra-frequency measurement objects and inter-frequency/inter-RAT measurement objects and NR PRS measurements on all positioning frequency layers which are candidates to be measured within the gap *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in a gap if its SMTC duration is fully covered by the MGL excluding RF switching time. For intra-frequency NR measurement objects, if the higher layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

- An NR measurement object with CSI-RS measurement configured is a candidate to be measured in a gap if the window confining all CSI-RS resources are fully covered by the MGL excluding RF switching time.

- An NR measurement object with RSSI and channel occupancy measurement is a candidate to be measurement in a gap if the RMTC duration is fully covered by MGL excluding RF switching time.

- An inter-frequency SFTD measurement object, if to be measured with measurement gaps, is a candidate to be measured in all measurement gaps.

- A positioning frequency layer is counted as candidate for a MG occasion if at least one PRS resource on that positioning frequency layer is fully covered by the MGL excluding RF switching time.

- For UEs which support and are configured with per FR gaps, the counting is done on a per FR basis, and for UEs which are configured with per UE gaps the counting is done on a per UE basis. For UEs which support and are configured with per FR gaps, the CSSF requirements do not apply when NR PRS measurement in one FR gap collides with SSB/CSI-RS/PRS measurements in the other FR gap in time domain.

- Mintra,i,j: Number of intra-frequency measurement objects, including both SSB, CSI-RS based and RSSI/CO measurements, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise Mintra,i,j equals 0.

- Minter,i,j : Number of NR inter-frequency layers including both SSB and CSI-RS based, EUTRA inter-RAT and UTRA inter-RAT frequency layers, up to one positioning frequency layer, RSSI/CO measurements, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise Minter,i,j equals 0.

- A measurement object *i* in Mintra,i,j and in Minter,i,j is counted twice if the measurement object is configured with both RMTC and SMTC which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate

- Mtot,i,j = Mintra,i,j + Minter,i,j : Total number of intra-frequency, inter-frequency and inter-RAT frequncy layers and up to one NR PRS measurement on any one positioning frequency layer, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise Mtot,i,j equals 0.

For each measurement gap *j* used for a long-periodicity measurement defined above, Mintra,i,j = Minter,i,j = Mtot,i,j =0. The carrier specific scaling factor CSSFwithin\_gap,i is given by:

If *measGapSharingScheme* is equal sharing, CSSFwithin\_gap,i= max(ceil(Ri×Mtot,i,j)), where *j*=0…(160/MGRP)-1

If *measGapSharingScheme* is not equal sharing and

- measurement object *i* is an intra-frequency measurement object, CSSFwithin\_gap,i is the maximum among

- ceil(Ri×Kintra×Mintra,i,j) in gaps where Minter,i,j≠0, where *j*=0…(160/MGRP)-1

- ceil(Ri×Mintra,i,j) in gaps where Minter,i,j=0, where *j*=0…(160/MGRP)-1

- measurement object *i* is an inter-frequency or inter-RAT measurement object or NR PRS measurement on any one positioning frequency layer, CSSFwithin\_gap,i is the maximum among

- ceil(Ri×Kinter×Minter,i,j) in gaps where Mintra,i,j ≠0, where *j*=0…(160/MGRP)-1

- ceil(Ri×Minter,i,j)in gaps where Mintra,i,j=0, where *j*=0…(160/MGRP)-1

Where Ri is the maximal ratio of the number of measurement gap where measurement object *i* is a candidate to be measured over the number of measurement gap where measurement object *i* is a candidate and not used for a long-periodicity measurement defined above.

CSSFwithin\_gap,k=1 during TDetect, E-UTRAN FDD specified in clause 9.4.4.1.2.2 and TDetect, E-UTRAN TDD specified in clause 9.4.4.2.2.2, where k is the carrier frequency where the UE is performing cell detection of the inter-RAT E-UTRA OTDOA assistance data reference cell when acquiring the subframe and slot timing of the cell according to clause 9.4.4. In this case, the UE cell identification and measurement periods derived based on CSSFwithin\_gap,i in clauses 9.2.5.1, 9.2.5.2, 9.2.6.2, 9.2.6.3, 9.3.4, 9.3.5, 9.4.2.2, 9.4.2.3 and 9.10.2 may be extended for measurement objects of which the cell identification and measurement periods are overlapped with TDetect, E-UTRAN FDD and TDetect, E-UTRAN TDD.

**<<Omitted the unchanged clauses>>**

**---end of change #9:9.1.5 ---**

**---Start of change #10: 9.1.5.3 (R4-2202634,R4-2206897) ---**

#### 9.1.5.X1 Monitoring of multiple layers within NCSG

The measurement requirements derived from CSSFwithin\_ncsg,i defined in this clause are applicable provided that network provides NCSG pattern for measurement.

The carrier-specific scaling factor CSSFwithin\_ncsg,i for a measurement object *i* derived in this clause is applied to following measurement types:

- SSB-based intra-frequency measurement object without measurement gap as defined in clause 9.2.1 corresponding to an activated serving cell, when all of the SMTC occasions of this intra-frequency measurement object are overlapped by the NCSG;

- SSB-based intra-frequency measurement object with NCSG as defined in clause 9.2.1 corresponding to an activated serving cell (in non-dormancy);

- SSB-based intra-frequency measurement object corresponding to a deactivated serving cell or to an activated serving cell in dormancy, when all or part of the SMTC occasions of this intra-frequency measurement object are overlapped by the NCSG;

- SSB-based inter-frequency measurement object without measurement gap as defined in clause 9.3.1, when all of the SMTC occasions of this inter-frequency measurement object are overlapped by the NCSG;

- SSB-based inter-frequency measurement object with NCSG as defined in clause 9.3.1;

- E-UTRA inter-RAT measurement object, when the measurement can be performed with no measurement gap but NCSG as defined in clause [*TBD*];

UE is expected to conduct the measurement of this measurement object *i* only within the NCSG.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present for an intra-frequency measurement object, and *smtc1* is fully overlapping with NCSG and *smtc2* is partially overlapping with NCSG, requirements derived from CSSFwithin\_ncsg,i and CSSFoutside\_gap,i are not applicable.

##### 9.1.5.X1.1 SA mode: carrier-specific scaling factor for measurements performed within NCSG

When one or more measurement objects are monitored within NCSG, the carrier specific scaling factor for a target measurement object with index *i* is designated as CSSFwithin\_ncsg,i and is derived as described in this clause.

For each NCSG occasion *j*, count the total number of intra-frequency measurement objects and inter-frequency/inter-RAT measurement objects which are candidates to be measured within the occaison *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in an NCSG occasion if its SMTC duration is fully covered by the ML. For intra-frequency NR measurement objects, if the higher layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

- An inter-RAT E-UTRA measurement object configured is a candidate to be measured in all NCSG occasions.

- Mintra,i,j: Number of intra-frequency measurement objects which are candidates to be measured in NCSG occasion *j* where the measurement object *i* is also a candidate. Otherwise Mintra,i,j equals 0.

- Minter,i,j : Number of NR inter-frequency measurement objects and E-UTRA inter-RAT measurement objects which are candidates to be measured in NCSG occasion *j* where the measurement object *i* is also a candidate. Otherwise Minter,i,j equals 0.

- Mtot,i,j = Mintra,i,j + Minter,i,j : Total number of intra-frequency, inter-frequency and inter-RAT measurement objects which are candidates to be measured in NCSG occasion *j* where the measurement object *i* is also a candidate. Otherwise Mtot,i,j equals 0.

For UEs which support and are configured with per FR NCSG, the above counting is done on a per FR basis, and for UEs which are configured with per UE NCSG the counting is done on a per UE basis.

The carrier specific scaling factor CSSFwithin\_gap,i is given by:

If *measGapSharingScheme* is equal sharing, CSSFwithin\_ncsg,i= max(Mtot,i,j), where *j*=0…(160/VIRP)-1

If *measGapSharingScheme* is not equal sharing and

- measurement object *i* is an intra-frequency measurement object, CSSFwithin\_ncsg,i is the maximum among

- ceil(Kintra×Mintra,i,j) in NCSG occasions where Minter,i,j≠0, where *j*=0…(160/VIRP)-1

- Mintra,i,j in NCSG occasions where Minter,i,j=0, where *j*=0…(160/VIRP)-1

- measurement object *i* is an inter-frequency or inter-RAT measurement object, CSSFwithin\_ncsg,i is the maximum among

- ceil(Kinter×Minter,i,j) in NCSG occasions where Mintra,i,j ≠0, where *j*=0…(160/VIRP)-1

- Minter,i,j in NCSG occasions where Mintra,i,j=0, where *j*=0…(160/VIRP)-1

**---end of change #10: 9.1.5.3 (R4-2202634) ---**

**--- start of change #20: 9.2.5 (R4-2206896)---**

9.2.1 Introduction

A measurement is defined as a SSB based intra-frequency measurement provided the centre frequency of the SSB of the serving cell indicated for measurement and the centre frequency of the SSB of the neighbour cell are the same, and the subcarrier spacing of the two SSBs are also the same.

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

The UE can perform intra-frequency SSB based measurements without measurement gaps (either legacy measurement gap or NCSG) if

- the UE indicates ‘no-gap’ via *intraFreq-needForGap* for intra-frequency measurement, or

- the SSB is completely contained in the active BWP of the UE, or

- the active downlink BWP is initial BWP[3]

For UE supporting [NCSG feature] and indicating [TBD] for intra-frequency measurement,

An intra-frequency SSB measurement is defined as measurement without gap if

- the UE indicates [‘no-gap-no-interruption’] via [TBD] for intra-frequency measurement, and

- the SSB is not completely contained in the active BWP of the UE, and

- the active downlink BWP is not an initial BWP [3]

The delay requirements are specified in clause 9.2.5

An intra-frequency SSB measurement is defined as measurement with NCSG if

- the UE indicates [‘no-gap-with-interruption’] via [TBD] for intra-frequency measurement, and

- the SSB is not completely contained in the active BWP of the UE, and

- the active downlink BWP is not an initial BWP [3]

When network configures NCSG, the delay requirements are specified in clause 9.2.7

When network configures measurement gap, the delay requirements are specified in clause 9.2.6

An intra-frequency SSB measurement is defined as measurement with gap if

- the UE indicates [‘gap’] via [TBD] for intra-frequency measurement, and

- the SSB is not completely contained in the active BWP of the UE, and

- the active downlink BWP is not an initial BWP [3]

When network configures measurement gap, the delay requirements are specified in clause 9.2.6

The UE can perform intra-frequency SSB based measurement corresponding to a deactivated SCell or dormant SCell with NCSG

For intra-frequency SSB based measurements with NCSG, UE may cause scheduling restriction as specified in clause 9.2.7.3.

For intra-frequency SSB based measurements without measurement gaps, UE may cause scheduling restriction as specified in clause 9.2.5.3.

SSB based measurements are configured along with one or two measurement timing configuration(s) (SMTC(s)) which provides periodicity, duration and offset information on a window of up to 5ms where the measurements are to be performed. For intra-frequency connected mode measurements, up to two measurement window periodicities may be configured. A single measurement window offset and measurement duration are configured per intra-frequency measurement object.

When measurement gaps are needed, the UE is not expected to detect SSB which start earlier than the gap starting time + switching time, nor detect SSB which end later than the gap end – switching time. Switching time is 0.5ms for frequency range FR1 and 0.25ms for frequency range FR2.

The requirements in this clause shall also apply, when the UE is configured to perform SRS carrier based switching and using measurement gaps.

The measurement requirements defined for an activated SCell with a non-dormant active BWP defined in this clause shall also apply to an activated SCell with dormant BWP as active BWP.

**---end fo change #20---**

**--- start of change #11: 9.2.5 (R4-2202617, R4-2202613,R4-2206875, R4-2206885, R4-2206894)------**

### 9.2.5 Intrafrequency measurements without measurement gaps

#### 9.2.5.1 Intrafrequency cell identification

The UE shall be able to identify a new detectable intra-frequency cell within Tidentify\_intra\_without\_index if the UE is not indicated to report SSB based RRM measurement result with the associated SSB index(*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE is indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra frequency cell within Tidentify\_intra\_with\_index. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within Tidentify\_intra\_without\_index. It is assumed that *deriveSSB-IndexFromCell* is always enabled for FR1 TDD and FR2.

Tidentify\_intra\_without\_index = (TPSS/SSS\_sync\_intra + T SSB\_measurement\_period\_intra) ms

Tidentify\_intra\_with\_index = (TPSS/SSS\_sync\_intra + T SSB\_measurement\_period\_intra + TSSB\_time\_index\_intra) ms

Where:

TPSS/SSS\_sync\_intra: it is the time period used in PSS/SSS detection given in table 9.2.5.1-1, 9.2.5.1-2, 9.2.5.1-4 (deactivated SCell) or 9.2.5.1-5 (deactivated SCell)

TSSB\_time\_index\_intra: it is the time period used to acquire the index of the SSB being measured given in table 9.2.5.1-3 or 9.2.5.1-6 (deactivated SCell)

T SSB\_measurement\_period\_intra: equal to a measurement period of SSB based measurement given in table 9.2.5.2-1, table 9.2.5.2-2 table 9.2.5.2-3 (deactivated SCell) or 9.2.5.2-4(deactivated SCell)

CSSFintra: it is a carrier specific scaling factor and is determined

according to CSSFoutside\_gap,i in clause 9.1.5.1 for measurement conducted outside measurement gaps, i.e. when intra-frequency SMTC is fully non overlapping or partially overlapping with measurement gaps or NCSG, or according to CSSFwithin\_gap,i in clause 9.1.5.2 for measurement conducted within measurement gaps, i.e. when intra-frequency SMTC is fully overlapping with measurement gaps, or according to CSSFwithin\_ncsg,i in clause 9.1.5.x for measurement conducted within NCSG, i.e. when intra-frequency SMTC is fully overlapping with NCSG.

For a UE that supports Pre-MG, an SMTC occasion is only considered to be overlapped by Pre-MG if the Pre-MG is activated.

if the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc2*; Otherwise the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

Mpss/sss\_sync\_w/o\_gaps : For a UE supporting FR2 power class 1 or 5, Mpss/sss\_sync\_w/o\_gaps =40. For a UE supporting power class 2, Mpss/sss\_sync\_w/o\_gaps =24. For a UE supporting FR2 power class 3, Mpss/sss\_sync\_w/o\_gaps =24. For a UE supporting FR2 power class 4, Mpss/sss\_sync\_w/o\_gaps =24

Mmeas\_period\_w/o\_gaps : For a UE supporting power class 1 or 5, Mmeas\_period\_w/o\_gaps =40. For a UE supporting FR2 power class 2, Mmeas\_period\_w/o\_gaps =24. For a UE supporting power class 3, Mmeas\_period\_w/o\_gaps =24. For a UE supporting power class 4, Mmeas\_period\_w/o\_gaps =24.

When UE is not configured with concurrent measurement gaps, or UE is not supporting [concurrent measurement gaps]:

When intra-frequency SMTC is fully non overlapping with measurement gaps or intra-frequency SMTC is fully overlapping with MGs, Kp=1

When intra-frequency SMTC is partially overlapping with measurement gaps, Kp = 1/(1- (SMTC period /MGRP)), where SMTC period < MGRP. When intra-frequency SMTC is partially overlapping with the ML of NCSG, Kp = 1/(1- (SMTC period /VIRP)), where SMTC period < VIRP. For calculation of Kp, if the high layer signalling (TS 38.331 [2]) of *smtc2* is configured, for cells indicated in the *pci-List* parameter in *smtc2*, the SMTC periodicity corresponds to the value of higher layer parameter *smtc2*; for the other cells, the SMTC periodicity corresponds to the value of higher layer parameter *smtc1.*

When UE supports [concurrent measurement gap] and is configured with concurrent measurement gaps,

Kp is the scaling factor for an SSB frequency layer to be measured without measurement gaps. Kp = Ntotal / Navailable, where Navailable and Ntotal are calculated as follows:

* + For a window W of duration max(SMTC period, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gap and/or per-FR measurement gap within the same FR as the SSB frequency layer, and starting from the beginning of any SMTC occasion:
    - Ntotal is the total number of SMTC occasions within the window, including those overlapped with measurement gap occasions within the window, and
    - Navailable is the number of SMTC occasions that are not overlapped with any non-dropped MG occasion within the window W, after accounting for measurement gap collisions by applying the measurement gap collision rule in section 9.1.2B.3.
  + Kp = 1 when Navailable = 0.

If the higher layer signaling in TS38.331 [2] signalling of *smtc2* is present and smtc1 is fully overlapping with measurement gaps and smtc2 is partially overlapping with measurement gaps, requirements are not specified for Tidentify\_intra\_without\_index or Tidentify\_intra\_with\_index

For FR2,

Klayer1\_measurement=1,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap are not fully overlapped by intra-frequency SMTC occasions, or

- if all of the reference signal configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap and fully-overlapped by intra-frequency SMTC occasions are not overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the RSSI symbols, given that *SSB-ToMeasure* and *SS-RSSI-Measurement* are configured, where SSB symbols are indicated by the union set of SSB-ToMeasure from all the configured measurement objects on the same serving carrier which can be merged.and RSSI symbols are indicated by *SS-RSSI-Measurement*;

Klayer1\_measurement=1.5, otherwise.

If the above-mentioned reference signal configured for L1-RSRP measurement is aperiodic CSI-RS resource, longer cell identification delay would be expected.

If MCG DRX is in use, cell identification requirements for intra-frequency measurement in MCG specified in Table 9.2.5.1-1, Table 9.2.5.1-2, Table 9.2.5.1-3, Table 9.2.5.1-4, Table 9.2.5.1-5 and Table 9.2.5.1-6 shall depend on the MCG DRX cycle. If SCG DRX is in use, cell identification requirements for intra-frequency measurement in SCG specified in Table 9.2.5.1-1, Table 9.2.5.1-2, Table 9.2.5.1-3, Table 9.2.5.1-4, Table 9.2.5.1-5 and Table 9.2.5.1-6 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

Table 9.2.5.1-1: Time period for PSS/SSS detection, (Frequency range FR1)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max( 600ms, ceil( 5 x Kp) x SMTC period )Note 1 x CSSFintra |
| DRX cycle≤ 320ms | max( 600ms, ceil(M2 Note 2x 5 x Kp) x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | ceil(5 x Kp) x DRX cycle x CSSFintra |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified  NOTE 2: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1.  NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[intraRAT-MeasurementEnhancement-r16]* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell. | |

Table 9.2.5.1-2: Time period for PSS/SSS detection, (Frequency range FR2)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max(600ms, ceil(Mpss/sss\_sync\_w/o\_gaps x Kp x Klayer1\_measurement)x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 320ms | max(600ms, ceil(1.5 x Mpss/sss\_sync\_w/o\_gaps x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | ceil(Mpss/sss\_sync\_w/o\_gaps x Kp x Klayer1\_measurement) x DRX cycle x CSSFintra |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified | |

**Table 9.2.5.1-3: Time period for time index detection (FR1)**

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | max(120ms, ceil( 3 x Kp )x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 320ms | max(120ms, ceil (M2 Note 2 x 3 x Kp) x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | Ceil(3 x Kp) x DRX cycle x CSSFintra |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified  NOTE 2: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1  NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[intraRAT-MeasurementEnhancement-r16]* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell. | |

**Table 9.2.5.1-4: Time period for PSS/SSS detection, deactivated SCell (FR1)**

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | Ceil(5 x Kp) x measCycleSCell x CSSFintra |
| DRX cycle≤ 320ms | Ceil(5 x Kp) x max(measCycleSCell, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Ceil(5 x Kp) x max(measCycleSCell, DRX cycle) x CSSFintra |

**Table 9.2.5.1-5: Time period for PSS/SSS detection, deactivated SCell (FR2)**

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | Ceil(Mpss/sss\_sync\_w/o\_gaps x Kp) x measCycleSCell x CSSFintra |
| DRX cycle≤ 320ms | Ceil(Mpss/sss\_sync\_w/o\_gaps x Kp) x max(measCycleSCell, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Ceil(Mpss/sss\_sync\_w/o\_gaps x Kp) x max(measCycleSCell, DRX cycle) x CSSFintra |

**Table 9.2.5.1-6: Time period for time index detection, deactivated SCell (FR1)**

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | Ceil(3 x Kp) x measCycleSCell x CSSFintra |
| DRX cycle≤ 320ms | Ceil(3 x Kp) x max(measCycleSCell, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Ceil(3 x Kp) x max(measCycleSCell, DRX cycle) x CSSFintra |

Table 9.2.5.1-7: Void

Table 9.2.5.1-8: Void

#### 9.2.5.2 Measurement period

The measurement period for intra-frequency measurements without gaps is as shown in table 9.2.5.2-1, 9.2.5.2-2, 9.2.5.2-3 (deactivated SCell) or 9.2.5.2-4(deactivated SCell). When *highSpeedMeasFlag-r16* is configured, T SSB\_measurement\_period\_intra is specified in Table 9.2.5.2-5.

If the higher layer signaling in TS38.331 [2] signalling of *smtc2* is present and smtc1 is fully overlapping with measurement gaps and smtc2 is partially overlapping with measurement gaps, requirements are not specified for TSSB\_measurement\_period\_intra

For a UE that supports Pre-MG, an SMTC occasion is only considered to be overlapped by Pre-MG if the Pre-MG is activated.

If MCG DRX is in use, measurement period requirements for intra-frequency measurement in MCG specified in Table 9.2.5.2-1, Table 9.2.5.2-2, Table 9.2.5.2-3 and Table 9.2.5.2-4 shall depend on the MCG DRX cycle. If SCG DRX is in use, measurement period requirements for intra-frequency measurement in SCG specified in Table 9.2.5.2-1, Table 9.2.5.2-2, Table 9.2.5.2-3 and Table 9.2.5.2-4 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

For FR2, a longer measurement period is allowed, if aperiodic CSI-RS resource is measured for L1-RSRP measurement on any FR2 serving frequency in the same band, and the CSI-RS resource is outside measurement gap and overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the RSSI symbols. If *SSB-ToMeasure* or *SS-RSSI-Measurement* is configured, the SSB symbols are indicated by the union set of *SSB-ToMeasure* from all the configured measurement objects on the same band which can be merged and the RSSI symbols are indicated by *SS-RSSI-Measurement*.

Table 9.2.5.2-1: Measurement period for intra-frequency measurements without gaps (FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(200ms, ceil( 5 x Kp) x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 320ms | max(200ms, ceil(1.5x 5 x Kp) x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | ceil( 5 x Kp ) x DRX cycle x CSSFintra |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified | |

Table 9.2.5.2-2: Measurement period for intra-frequency measurements without gaps (FR2)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(400ms, ceil(Mmeas\_period\_w/o\_gaps x Kp x Klayer1\_measurement) x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 320ms | max(400ms, ceil(1.5x Mmeas\_period\_w/o\_gaps x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | ceil(Mmeas\_period\_w/o\_gaps xKp x Klayer1\_measurement ) x DRX cycle x CSSFintra |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified | |

Table 9.2.5.2-3: Measurement period for intra-frequency measurements without gaps (deactivated SCell) (FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | Ceil(5 x Kp) x measCycleSCell x CSSFintra |
| DRX cycle≤ 320ms | Ceil(5 x Kp) x max(measCycleSCell, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Ceil(5 x Kp) x max(measCycleSCell, DRX cycle) x CSSFintra |

**Table 9.2.5.2-4: Measurement period for intra-frequency measurements without gaps (deactivated SCell) (FR2)**

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | Ceil(Mmeas\_period\_w/o\_gaps x Kp) x measCycleSCell x CSSFintra |
| DRX cycle≤ 320ms | Ceil(Mmeas\_period\_w/o\_gaps x Kp) x max(measCycleSCell, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Ceil(Mmeas\_period\_w/o\_gaps x Kp) x max(measCycleSCell, DRX cycle) x CSSFintra |

Table 9.2.5.2-5: T SSB\_measurement\_period\_intra When *highSpeedMeasFlag-r16* is configured (Frequency range FR1

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX Note 2 | max(200ms, ceil( 5 x Kp) x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 160ms | max(200ms, ceil(5 x M2 Note 2 x Kp) x max(SMTC period,DRX cycle)) x CSSFintra |
| 160ms < DRX cycle≤ 320ms | ceil(4 x M2 Note 2 x Kp) x DRX cycle x CSSFintra |
| DRX cycle>320ms | ceil( Y Note 3 x Kp ) x DRX cycle x CSSFintra |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified  NOTE 2: M2 = 1.5 if SMTC period > 40 ms, otherwise M2=1  NOTE 3: Y=3 when SMTC period <= 40ms, Y=5 when SMTC period > 40ms  NOTE 4: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[intraRAT-MeasurementEnhancement-r16]* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell. | |

#### 9.2.5.3 Scheduling availability of UE during intra-frequency measurements

UE shall be capable of measuring without measurement gaps when the SSB is completely contained in the active bandwidth part of the UE. When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols indicated by the union set of SSB-ToMeasure from all the configured measurement objects on the same serving carrier which can be merged[2], if it is configured; otherwise, all *L* SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included.

For a UE that supports Pre-MG, the requirements in 9.2.5.3 also apply when a Pre-MG is deactivated.

For UE supporting concurrent measurement gaps, when multiple gaps are configured, the requirements in 9.2.5.3 are also applied to the slots that are not interrupted according to requirements in clause 9.1.X2.3.

**<<Omitted the unchanged clauses>>**

### 9.2.6 Intra-frequency measurements with measurement gaps

#### 9.2.6.1 Void

#### 9.2.6.2 Intra-frequency cell identification

When a measurement gap is provided or an activated Pre-MG is provided without any pre-MG status changed during the measurement period, the he UE shall be able to identify a new detectable intra frequency cell within Tidentify\_intra\_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), or the UE has been indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra frequency cell within Tidentify\_intra\_with\_index. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within Tidentify\_intra\_without\_index. It is assumed that *deriveSSB-IndexFromCell* is always enabled for FR1 TDD and FR2.

Tidentify\_intra\_without\_index = TPSS/SSS\_sync\_intra + T SSB\_measurement\_period\_intra ms

Tidentify\_intra\_with\_index = TPSS/SSS\_sync\_ntra + T SSB\_measurement\_period\_intra + TSSB\_time\_index\_intra ms

Where:

TPSS/SSS\_sync\_intra: it is the time period used in PSS/SSS detection given in table 9.2.6.2-1 or 9.2.6.2-2.

TSSB\_time\_index\_intra: it is the time period used to acquire the index of the SSB being measured given in table 9.2.6.2-3.

T SSB\_measurement\_period\_intra: equal to a measurement period of SSB based measurement given in table 9.2.6.3-1 or 9.2.6.3-2.

CSSFintra: it is a carrier specific scaling factor and is determined according to CSSFwithin\_gap,i in clause 9.1.5.2 for measurement conducted within measurement gaps.

Kgap is the scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern. Kgap = 1 when the UE is not configured with concurrent measurement gaps or not supporting [concurrent measurement gaps]. Otherwise, Kgap = Ntotal / Navailable, where Navailable and Ntotal are calculated as follows:

* + For a window W of duration max(SMTC period, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gap and per-FR measurement gap within the same FR as the SSB frequency layer, and starting from the beginning of any SMTC occasion:
    - Ntotal is the total number of SMTC occasions that are covered by instances of the associated measurement gap within the window W, including those overlapped with other measurement gap occasions within the window, and
    - Navailable is the number of SMTC occasions that are covered by instances of the non-dropped associated measurement gap within the window W after accounting for measurement gap collisions by applying the measurement gap collision rule in section 9.1.2B.3.
  + When concurrent measurement gaps are configured, requirements in this clause do not apply if Navailable =0.

Mpss/sss\_sync\_with\_gaps : For a UE supporting FR2 power class 1 or 5, Mpss/sss\_sync with\_gaps=40. For a UE supporting FR2 power class 2, Mpss/sss\_sync with\_gaps =24. For a UE supporting FR2 power class 3, Mpss/sss\_sync with\_gaps =24. For a UE supporting power class 4, Mpss/sss\_sync with\_gaps =24

Mmeas\_period\_ with\_gaps: For a UE supporting power class 1 or 5, Mmeas\_period\_ with\_gaps =40. For a UE supporting power class 2, Mmeas\_period\_ with\_gaps =24. For a UE supporting power class 3, Mmeas\_period\_ with\_gaps =24. For a UE supporting power class 4, Mmeas\_period with\_gaps =24.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and smtc1 is fully overlapping with measurement gaps and smtc2 is partially overlapping with measurement gaps, requirements are not specified for Tidentify\_intra\_without\_index or Tidentify\_intra\_with\_index.

If MCG DRX is in use, cell identification requirements for intra-frequency measurement in MCG specified in Table 9.2.6.2-1, Table 9.2.6.2-2, and Table 9.2.6.2-3 shall depend on the MCG DRX cycle. If SCG DRX is in use, cell identification requirements for intra-frequency measurement in SCG specified in Table 9.2.6.2-1, Table 9.2.6.2-2, and Table 9.2.6.2-3 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

Table 9.2.6.2-1: Time period for PSS/SSS detection (FR1)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max(600ms, 5 x Kgap max(MGRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(600ms, ceil(M2Note 1x 5 x Kgap) x max(MGRP, SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | Ceil( 5 x Kgap ) x max(MGRP, DRX cycle) x CSSFintra |
| NOTE 1: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1.  NOTE 2: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[intraRAT-MeasurementEnhancement-r16]* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.  NOTE 3: For a UE supporting concurrent measurement gaps, if multiple concurrent gaps are configured, the MGRP is the periodicity of the MG pattern associated to the intra-frequency layer. | |

**Table 9.2.6.2-2: Time period for PSS/SSS detection (FR2)**

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max(600ms, Mpss/sss\_sync\_with\_gaps x Kgap x max(MGRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(600ms, ceil(1.5x Mpss/sss\_sync\_with\_gaps x Kgap) x max(MGRP, SMTC period, DRX cycle))x CSSFintra |
| DRX cycle>320ms | Ceil( Mpss/sss\_sync\_with\_gaps x Kgap ) x max(MGRP, DRX cycle) x CSSFintra |
| NOTE 1: For a UE supporting concurrent gaps, if multiple concurrent gaps are configured, the MGRP is the periodicity of the MG pattern associated to the intra-frequency layer. | |

Table 9.2.6.2-3: Time period for time index detection (Frequency range FR1)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | max(120ms, ceil(3 x x Kgap ) max(MGRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(120ms, ceil(M2Note 1x 3 x Kgap) x max(MGRP, SMTC period,DRX cycle) x CSSFintra) |
| DRX cycle>320ms | Ceil(3 x Kgap )x max(MGRP, DRX cycle) x CSSFintra |
| NOTE 1: *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1.  NOTE 2: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[intraRAT-MeasurementEnhancement-r16]* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.  NOTE 3: For a UE supporting concurrent gaps, if multiple concurrent gaps are configured, the MGRP is the periodicity of the MG pattern associated to the intra-frequency layer. | |

Table 9.2.6.2-7: Void

Table 9.2.6.2-8: Void

#### 9.2.6.3 Intrafrequency Measurement Period

The requirements in this clause apply when a measurement gap is provided or when an activated Pre-MG is provided without any pre-MG status changed during the measurement period.

The measurement period for FR1 intrafrequency measurements with gaps is as shown in table 9.2.6.3-1.

The measurement period for FR2 intrafrequency measurements with gaps is as shown in table 9.2.6.3-2.

When *highSpeedMeasFlag-r16* is configured, T SSB\_measurement\_period\_intra is specified in Table 9.2.6.3-3.

If MCG DRX is in use, measurement period requirements for intra-frequency measurement in MCG specified in Table 9.2.6.3-1 and Table 9.2.6.3-2, shall depend on the MCG DRX cycle. If SCG DRX is in use, measurement period requirements for intra-frequency measurement in SCG specified in Table 9.2.6.3-1and Table 9.2.6.3-2, shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

For either an FR1 or FR2 serving cell, longer measurement period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

Table 9.2.6.3-1: Measurement period for intra-frequency measurements with gaps(FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(200ms, ceil(5 x Kgap )x max(MGRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(200ms, ceil(1.5x 5 x Kgap) x max(MGRP, SMTC period,DRX cycle))x CSSFintra |
| DRX cycle>320ms | Ceil(5 x Kgap ) x max(MGRP, DRX cycle) x CSSFintra |
| NOTE 1: For a UE supporting concurrent gaps, if multiple concurrent gaps are configured, the MGRP is the periodicity of the MG pattern associated to the intra-frequency layer. | |

Table 9.2.6.3-2: Measurement period for intra-frequency measurements with gaps(FR2)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(400ms, ceil(Mmeas\_period with\_gaps x Kgap ) x max(MGRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(400ms, ceil(1.5 x Mmeas\_period with\_gaps x Kgap) x max(MGRP, SMTC period, DRX cycle)) Note 1 x CSSFintra |
| DRX cycle>320ms | Ceil( Mmeas\_period with\_gaps x Kgap ) x max(MGRP, DRX cycle) x CSSFintra |
| NOTE 1: For a UE supporting concurrent gaps, if multiple concurrent gaps are configured, the MGRP is the periodicity of the MG pattern associated to the intra-frequency layer. | |

Table 9.2.6.3-3: Measurement period When *highSpeedMeasFlag-r16* is configured (Frequency Range FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(200ms, ceil( 5 x Kgap ) x max(MGRP, SMTC period)) Note 1 x CSSFintra |
| DRX cycle≤ 160ms | max(200ms, ceil(M2Note 2 x 5 x Kgap) x max(MGRP, SMTC period,DRX cycle)) x CSSFintra |
| 160ms < DRX cycle≤ 320ms | max(200ms, ceil(M2Note 2 x 4 x Kgap) x max(MGRP, DRX cycle)) x CSSFintra |
| DRX cycle>320ms | Ceil(Y Note 3 x Kgap ) x max(MGRP, DRX cycle) x CSSFintra |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified  NOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1  NOTE 3: Y=3 when SMTC <= 40ms, Y=5 when SMTC > 40ms  NOTE 4: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[intraRAT-MeasurementEnhancement-r16]* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.  NOTE 5: For a UE supporting concurrent gaps, if multiple concurrent gaps are configured, the MGRP is the periodicity of the MG pattern associated to the intra-frequency layer. | |

**--- end of change #11: 9.2.5&6------**

**--- Start of change #12:9.2.7 (R4-2202627, R4-2202635)---**

### 9.2.X1 Intra-frequency measurements with NCSG

#### 9.2.X1.1 Intra-frequency cell identification

For the UE supporting NCSG, if NCSG is provided, the UE shall be able to identify a new detectable intra frequency cell within Tidentify\_intra\_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), or the UE has been indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra frequency cell within Tidentify\_intra\_with\_index. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within Tidentify\_intra\_without\_index. It is assumed that *deriveSSB-IndexFromCell* is always enabled for FR1 TDD and FR2.

Tidentify\_intra\_without\_index = TPSS/SSS\_sync\_intra + T SSB\_measurement\_period\_intra ms

Tidentify\_intra\_with\_index = TPSS/SSS\_sync\_ntra + T SSB\_measurement\_period\_intra + TSSB\_time\_index\_intra ms

Where:

TPSS/SSS\_sync\_intra: it is the time period used in PSS/SSS detection given in table 9.2.7.1-1, 9.2.7.1-2, 9.2.7.1-4 (deactivated Scell) or 9.2.7.1-5 (deactivated Scell).

TSSB\_time\_index\_intra: it is the time period used to acquire the index of the SSB being measured given in table 9.2.7.1-3 or 9.2.7.1-6 (deactivated Scell).

T SSB\_measurement\_period\_intra: equal to a measurement period of SSB based measurement given in table 9.2.7.2-1, 9.2.7.2-2, 9.2.7.2-3, 9.2.7.2-4 (deactivated Scell) or 9.2.7.2-5 (deactivated Scell).

CSSFintra: it is a carrier specific scaling factor and is determined according to CSSFwithin\_ncsg,i in clause 9.1.5.x for measurement conducted within NCSG.

Mpss/sss\_sync\_with\_gaps : For a UE supporting FR2 power class 1 or 5, Mpss/sss\_sync with\_gaps=40. For a UE supporting FR2 power class 2, Mpss/sss\_sync with\_gaps =24. For a UE supporting FR2 power class 3, Mpss/sss\_sync with\_gaps =24. For a UE supporting power class 4, Mpss/sss\_sync with\_gaps =24

Mmeas\_period\_ with\_gaps: For a UE supporting power class 1 or 5, Mmeas\_period\_ with\_gaps =40. For a UE supporting power class 2, Mmeas\_period\_ with\_gaps =24. For a UE supporting power class 3, Mmeas\_period\_ with\_gaps =24. For a UE supporting power class 4, Mmeas\_period with\_gaps =24.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and smtc1 is fully overlapping with NCSG and smtc2 is partially overlapping with NCSG, requirements are not specified for Tidentify\_intra\_without\_index or Tidentify\_intra\_with\_index.

Table 9.2.X1.1-1: Time period for PSS/SSS detection with NCSG (FR1)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max(600ms, 5 x max(VIRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(600ms, ceil(M2Note 1x 5) x max(VIRP, SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | 5 x max(VIRP, DRX cycle) x CSSFintra |
| NOTE 1: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1.  NOTE 2: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[intraRAT-MeasurementEnhancement-r16]* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell. | |

**Table 9.2.X1.1-2: Time period for PSS/SSS detection with NCSG (FR2)**

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | max(600ms, Mpss/sss\_sync\_with\_gaps x max(VIRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(600ms, ceil(1.5x Mpss/sss\_sync\_with\_gaps) x max(VIRP, SMTC period, DRX cycle))x CSSFintra |
| DRX cycle>320ms | Mpss/sss\_sync\_with\_gaps x max(VIRP, DRX cycle) x CSSFintra |

Table 9.2.X1.1-3: Time period for time index detection with NCSG (FR1)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | max(120ms, 3 x max(VIRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(120ms, ceil(M2Note 1x 3) x max(VIRP, SMTC period,DRX cycle) x CSSFintra) |
| DRX cycle>320ms | 3 x max(VIRP, DRX cycle) x CSSFintra |
| NOTE 1: *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1.  NOTE 2: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[intraRAT-MeasurementEnhancement-r16]* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell. | |

Table 9.2.X1.1-4: Time period for PSS/SSS detection with NCSG (deactivated SCell) (FR1)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | 5 x max(measCycleSCell, VIRP) x CSSFintra |
| DRX cycle≤ 320ms | 5 x max(measCycleSCell, VIRP, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | 5 x max(measCycleSCell, VIRP, DRX cycle) x CSSFintra |

**Table 9.2.X1.1-5: Time period for PSS/SSS detection with NCSG (deactivated SCell) (FR2)**

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_intra |
| No DRX | Mpss/sss\_with\_ncsg x max(measCycleSCell, VIRP) x CSSFintra |
| DRX cycle≤ 320ms | Mpss/sss\_with\_ncsg x max(measCycleSCell, VIRP, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Mpss/sss\_with\_ncsg x max(measCycleSCell, VIRP, DRX cycle) x CSSFintra |

Table 9.2.X1.1-6: Time period for time index detection with NCSG (deactivated SCell) (FR1)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_intra |
| No DRX | 3 x max(measCycleSCell, VIRP) x CSSFintra |
| DRX cycle≤ 320ms | 3 x max(measCycleSCell, VIRP, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | 3 x max(measCycleSCell, VIRP,DRX cycle) x CSSFintra |

#### 9.2.X1.2 Measurement period

When *highSpeedMeasFlag-r16* is configured, the measurement period with NCSG is specified in Table 9.2.7.2-3.

For either an FR1 or FR2 serving cell, longer measurement period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

Table 9.2.X1.2-1: Measurement period for intra-frequency measurements with NCSG (FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(200ms, 5 x max(VIRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(200ms, ceil(1.5x 5) x max(VIRP, SMTC period,DRX cycle))x CSSFintra |
| DRX cycle>320ms | 5 x max(VIRP, DRX cycle) x CSSFintra |

Table 9.2.X1.2-2: Measurement period for intra-frequency measurements with NCSG (FR2)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(400ms, Mmeas\_period with\_gaps x max(VIRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320ms | max(400ms, ceil(1.5 x Mmeas\_period with\_gaps) x max(VIRP, SMTC period, DRX cycle)) Note 1 x CSSFintra |
| DRX cycle>320ms | Mmeas\_period with\_gaps x max(VIRP, DRX cycle) x CSSFintra |

Table 9.2.X1.2-3: Measurement period with NCSG When *highSpeedMeasFlag-r16* is configured (FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | max(200ms, 5 x max(VIRP, SMTC period)) Note 1 x CSSFintra |
| DRX cycle≤ 160ms | max(200ms, ceil(M2Note 2 x 5) x max(VIRP, SMTC period,DRX cycle)) x CSSFintra |
| 160ms < DRX cycle≤ 320ms | max(200ms, ceil(M2Note 2 x 4) x max(VIRP, DRX cycle)) x CSSFintra |
| DRX cycle>320ms | Y Note 3 x max(VIRP, DRX cycle) x CSSFintra |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified  NOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1  NOTE 3: Y=3 when SMTC <= 40ms, Y=5 when SMTC > 40ms  NOTE 4: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[intraRAT-MeasurementEnhancement-r16]* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell. | |

Table 9.2.X1.2-4: Measurement period for intra-frequency measurements without NCSG (deactivated SCell) (FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | 5 x max(measCycleSCell, VIRP) x CSSFintra |
| DRX cycle≤ 320ms | 5 x max(measCycleSCell, VIRP, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | 5 x max(measCycleSCell, VIRP, DRX cycle) x CSSFintra |

**Table 9.2.X1.2-5: Measurement period for intra-frequency measurements without NCSG (deactivated SCell) (FR2)**

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_intra |
| No DRX | Mmeas\_period with\_gaps x max(measCycleSCell, VIRP) x CSSFintra |
| DRX cycle≤ 320ms | Mmeas\_period with\_gaps x max(measCycleSCell, VIRP, 1.5xDRX cycle) x CSSFintra |
| DRX cycle> 320ms | Mmeas\_period with\_gaps x max(measCycleSCell, VIRP, DRX cycle) x CSSFintra |

* Note: Requirements for measurement on deactivated SCC in this clause do not apply if SMTC on the deactivated SCC is fully non-overlapped with NCSG, and the requirements for measurement on deactivated SCC specified in clause 9.2.5 apply.

#### 9.2.X1.3 Scheduling availability during intra-frequency measurement with NCSG

Scheduling availability specified in 9.2.5.3 applies to scheduling availability during intra-frequency measurement with NCSG.

**--- end of change #12: 9.2.X1 (R4-2202627, R4-2202635)---**

**--- start of change #21: 9.3.1 (R4-2206896)---**

9.3.1 Introduction

A measurement is defined as an SSB based inter-frequency measurement provided it is not defined as an intra-frequency measurement according to clause 9.2.

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

A measurement is defined as an inter-frequency SSB based measurements without measurement gaps (either legacy measurement gap or NCSG) for UE capable of *interFrequencyMeas-NoGap* provided

- the UE supports *interFrequencyMeas-Nogap-r16* [15], and

- the SSB is completely contained in the active BWP of the UE

For UE supporting [NCSG feature] and indicating [TBD] for inter-frequency measurement,

An inter-frequency SSB measurement is defined as measurement without gap if

- the UE indicates [‘no-gap-no-interruption’] via [TBD] for inter-frequency measurement, and

- the SSB is not completely contained in the active BWP of the UE

The delay requirements are specified in clause 9.3.9.

An inter-frequency SSB measurement is defined as measurement with NCSG if

- the UE indicates [‘no-gap-with-interruption’] via [TBD] for inter-frequency measurement, and

- the SSB is not completely contained in the active BWP of the UE

When network configures NCSG, the delay requirements are specified in clause 9.3.10.

When network configures measurement gap, the delay requirements are specified in clauses 9.3.4 and 9.3.5.

An inter-frequency SSB measurement is defined as measurement with gap if

- the UE indicates [‘gap’] via [TBD] for inter-frequency measurement, and

- the SSB is not completely contained in the active BWP of the UE

When network configures measurement gap, the delay requirements are specified in clauses 9.3.4 and 9.3.5.

For inter-frequency SSB based measurements with NCSG, UE may cause scheduling restriction as specified in clause 9.3.10.3.

For inter-frequency SSB based measurements without measurement gaps, UE may cause scheduling restriction as specified in clause 9.3.5.3.

SSB based measurements are configured along with a measurement timing configuration (SMTC) per carrier, which provides periodicity, duration and offset information on a window of up to 5ms where the measurements on the configured inter-frequency carrier are to be performed. For inter-frequency connected mode measurements, one measurement window periodicity may be configured per inter-frequency measurement object.

When measurement gaps are needed, the UE is not expected to detect SSB on an inter-frequency measurement object which start earlier than the gap starting time + switching time, nor detect SSB which ends later than the gap end – switching time. When the inter-frequency cells are in FR2 and the per-FR gap is configured to the UE in EN-DC, SA NR, NE-DC and NR-DC, or the serving cells are in FR2, the inter-frequency cells are in FR2 and the per-UE gap is configured to the UE in SA NR and NR-DC, the switching time is 0.25ms. Otherwise the switching time is 0.5ms.

The requirements in this clause shall also apply, when the UE is configured to perform SRS carrier based switching and using measurement gaps.

Longer measurement period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

**---end of change #21----**

**--- start of #13: change 9.3.4 (R4-2202621, R4-2202608, R4-2206877)------**

### 9.3.4 Inter-frequency measurement with measurement gaps

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 frequency cell within Tidentify\_inter\_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 frequency cell within Tidentify\_inter\_with\_index. The UE shall be able to identify a new detectable inter frequency SS block of an already detected cell within Tidentify\_inter\_without\_index.

Tidentify\_inter\_without\_index = (TPSS/SSS\_sync\_inter + T SSB\_measurement\_period\_inter) ms

Tidentify\_inter\_with\_index = (TPSS/SSS\_sync\_inter + T SSB\_measurement\_period\_inter + TSSB\_time\_index\_inter) ms

Where:

TPSS/SSS\_sync\_inter: it is the time period used in PSS/SSS detection given in table 9.3.4-1 and table 9.3.4-2.

TSSB\_time\_index\_inter: it is the time period used to acquire the index of the SSB being measured given in table 9.3.4-3 and table 9.3.4-4.

TSSB\_measurement\_period\_inter: equal to a measurement period of SSB based measurement given in table 9.3.5-1 and table 9.3.5-2.

Mpss/sss\_sync\_inter: For a UE supporting FR2 power class 1 or 5, Mpss/sss\_sync\_inter = 64 samples. For a UE supporting FR2 power class 2, Mpss/sss\_sync\_inter = 40 samples. For a UE supporting FR2 power class 3, Mpss/sss\_sync\_inter = 40 samples. For a UE supporting FR2 power class 4, Mpss/sss\_sync\_inter = 40 samples.

MSSB\_index\_inter: For a UE supporting FR2 power class 1 or 5, MSSB\_index\_inter = 40 samples. For a UE supporting FR2 power class 2, MSSB\_index\_inter = 24 samples. For a UE supporting FR2 power class 3, MSSB\_index\_inter = 24 samples. For a UE supporting FR2 power class 4, MSSB\_index\_inter = 24 samples.

Mmeas\_period\_inter: For a UE supporting FR2 power class 1 or 5, Mmeas\_period\_inter =64 samples. For a UE supporting FR2 power class 2, Mmeas\_period\_inter=40 samples. For a UE supporting FR2 power class 3, Mmeas\_period\_inter =40 samples. For a UE supporting FR2 power class 4, Mmeas\_period\_inter = 40 samples.

CSSFinter: it is a carrier specific scaling factor and is determined according to CSSFwithin\_gap,i in clause 9.1.5.2 for measurement conducted within measurement gaps.

Kgap is a scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern. Kgap = 1 when the UE is not configured with concurrent measurement gaps. Otherwise, Kgap = Ntotal / Navailable, where Navailable and Ntotal are calculated as follows:

* + For a window W of duration max(SMTC period, MGRP\_max), where MGRP\_max is the maximum MGRP across all configured per-UE measurement gap(s) and per-FR measurement gap(s) within the same FR, and starting from the beginning of any SMTC occasion:
    - Ntotal is the total number of SMTC occasions that are covered by instances of the associated measurement gap within the window W, including those overlapped with other measurement gap occasions within the window, and
    - Navailable is the number of SMTC occasions that are covered by instances of the non-dropped associated measurement gap within the window W, after accounting for collisions between the measurement gaps by applying the measurement gap collision rule in section 9.1.2B.3.

Kgap is only applicable for UE supporting [concurrent gaps]. When concurrent measurement gaps are configured, requirements in this clause do not apply if Navailable =0.

**Table 9.3.4-1: Time period for PSS/SSS detection (Frequency range FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX | Max(600ms, Ceil(8 \* Kgap) × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(8\*1.5 \* Kgap) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(8 \* Kgap) × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: For a UE supporting concurrent gaps, the MRGP above is the MRGP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement gaps are configured. | |

**Table 9.3.4-2: Time period for PSS/SSS detection, (Frequency range FR2)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX | Max(600ms, Ceil(Kgap × Mpss/sss\_sync\_inter) × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(1.5 \* Kgap × Mpss/sss\_sync\_inter) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(Kgap × Mpss/sss\_sync\_inter) × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: For a UE supporting concurrent gaps, the MRGP above is the MRGP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement gaps are configured. | |

**Table 9.3.4-3: Time period for time index detection (Frequency range FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_inter** |
| No DRX | Max(120ms, Ceil(3 \* Kgap)× Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(120ms, Ceil(3 × 1.5 \* Kgap) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(3 \* Kgap)× DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: For a UE supporting concurrent gaps, the MRGP above is the MRGP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement gaps are configured. | |

**Table 9.3.4-4: Time period for time index detection (Frequency range FR2)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_inter** |
| No DRX | Max(200ms, Ceil(Kgap × MSSB\_index\_inter)× Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(1.5 \* Kgap × MSSB\_index\_inter) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(Kgap ×MSSB\_index\_inter) × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: For a UE supporting concurrent gaps, the MRGP above is the MRGP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement gaps are configured. | |

#### 9.3.4.1 Void

#### 9.3.4.2 Void

### 9.3.5 Inter-frequency measurements

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 SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.4, 10.1.5, 10.1.9, 10.1.10, 10.1.14 and 10.1.15, respectively, as shown in table 9.3.5-1 and 9.3.5-2:

**Table 9.3.5-1: Measurement period for inter-frequency measurements with gaps (Frequency FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, Ceil(8 \* Kgap) × Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(8 × 1.5 \* Kgap) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(8 \* Kgap) × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: For a UE supporting concurrent gaps, the MRGP above is the MRGP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement gaps are configured. | |

**Table 9.3.5-2: Measurement period for inter-frequency measurements with gaps (Frequency FR2)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(400ms, Ceil(Kgap × Mmeas\_period\_inter)× Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(400ms, Ceil(1.5 \* Kgap × Mmeas\_period\_inter) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(Kgap × Mmeas\_period\_inter) × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: For a UE supporting concurrent gaps, the MRGP above is the MRGP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement gaps are configured. | |

**<<Omitted the unchanged clauses>>**

### 9.3.9 Inter frequency measurements without measurement gaps

#### 9.3.9.1 Inter frequency Cell identification

If UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network, UE shall be able to identify a new detectable inter frequency cell within Tidentify\_inter\_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 frequency cell within Tidentify\_inter\_with\_index. The UE shall be able to identify a new detectable inter frequency SS block of an already detected cell within Tidentify\_inter\_without\_index. It is assumed that when UE performs inter-frequency measurements without measurement gaps in a TDD bands on FR1 and FR2, the following conditions are met:

- SFN and frame boundary across serving cell and inter-frequency neighbor cells is aligned, and

- the timing of SSBs across serving cell and inter-frequency neighbor cells are aligned Tidentify\_inter\_without\_index = (TPSS/SSS\_sync\_inter + T SSB\_measurement\_period\_inter) ms

Tidentify\_inter\_with\_index = (TPSS/SSS\_sync\_inter + T SSB\_measurement\_period\_inter + TSSB\_time\_index\_inter) ms

Where:

TPSS/SSS\_sync\_inter: it is the time period used in PSS/SSS detection given in table 9.3.9.1-1 and table 9.3.9.1-2.

TSSB\_time\_index\_inter: it is the time period used to acquire the index of the SSB being measured given in table 9.3.9.1-3.

T SSB\_measurement\_period\_inter: equal to a measurement period of SSB based measurement given in table 9.3.9.2-1 and table 9.3.9.2-2.

CSSFinter: it is a carrier specific scaling factor and is determined according to CSSFoutside\_gap,i in clause 9.1.5.1 for measurement conducted outside measurement gaps or NCSG, i.e. when interfrequency SMTC is fully non overlapping or partially overlapping with measurement gaps or according to CSSFwithin\_gap,i in clause 9.1.5.2 for measurement conducted within measurement gaps, i.e. when interfrequency SMTC is fully overlapping with measurement gaps, or according to CSSFwithin\_ncsg,i in clause 9.1.5.x for measurement conducted within NCSG, i.e. when inter-frequency SMTC is fully overlapping with NCSG.

Mpss/sss\_sync\_inter: For a UE supporting FR2 power class 1 or 5, Mpss/sss\_sync\_inter = 40 samples. For a UE supporting FR2 power class 2, Mpss/sss\_sync\_inter = 24 samples. For a UE supporting FR2 power class 3, Mpss/sss\_sync\_inter = 24 samples. For a UE supporting FR2 power class 4, Mpss/sss\_sync = 24 samples.

MSSB\_index\_inter: For a UE supporting power class 1 or 5, MSSB\_index\_inter = 40 samples. For a vehicle mounted UE supporting power class 2, Mpss/sss\_sync\_inter = 24 samples. For a UE supporting power class 3, MSSB\_index\_inter = 24 samples. For a UE supporting power class 4, Mmeas\_period\_inter = 24 samples.

Mmeas\_period\_inter: For a UE supporting FR2 power class 1 or 5, Mmeas\_period\_inter =40 samples. For a vehicle mounted UE supporting FR2 power class 2, Mpss/sss\_sync\_inter=24 samples. For a UE supporting FR2 power class 3, Mmeas\_period\_inter =24 samples. For a UE supporting FR2 power class 4, Mmeas\_period\_inter = 24 samples.

Kp is a scaling factor for an SSB frequency layer to be measured without measurement gaps. Kp = Ntotal / Navailable, where Navailable and Ntotal are calculated as follows:

* + For a window W of duration max(SMTC period, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the SSB frequency layer, and starting at the beginning of any SMTC occasion:
    - Ntotal is the total number of SMTC occasions within the window, including those overlapped with MG occasions within the window, and
    - Navailable is the number of SMTC occasions that are not overlapped with any MG occasion within the window W, after accounting for MG collisions by applying the selected gap collision rule provided that concurrent measurement gaps are configured.
  + Kp = 1 when Navailable = 0.

For calculation of Kp, if the high layer signalling (TS 38.331 [2]) of *smtc2* is configured, for cells indicated in the *pci-List* parameter in *smtc2*, the SMTC periodicity corresponds to the value of higher layer parameter *smtc2*; for the other cells, the SMTC periodicity corresponds to the value of higher layer parameter *smtc1.*~~]~~ Kp is only applicable for UE supporting [concurrent gaps].

When interfrequency SMTC is fully non overlapping with measurement gaps or interfrequency SMTC is fully overlapping with MGs, Kp=1.

When interfrequency SMTC is partially overlapping with measurement gaps, Kp = 1/(1- (SMTC period /MGRP)), where SMTC period < MGRP. When inter-frequency SMTC is partially overlapping with the VIL of NCSG, Kp = 1/(1- (SMTC period /VIRP)), where SMTC period < VIRP.

For FR2,

Klayer1\_measurement=1,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap are not fully overlapped by intra-frequency SMTC occasions, or

- if all of the reference signal configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap and fully-overlapped by intra-frequency SMTC occasions are not overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the RSSI symbols, given that *SSB-ToMeasure* and *SS-RSSI-Measurement* are configured, where SSB symbols are indicated by *SSB-ToMeasure* and RSSI symbols are indicated by *SS-RSSI-Measurement*;

Klayer1\_measurement=1.5, otherwise.

If the above-mentioned reference signal configured for L1-RSRP measurement is aperiodic CSI-RS resource, longer cell identification delay would be expected.

Table 9.3.9.1-1: Time period for PSS/SSS detection, (FR1)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_inter |
| No DRX | max( 600ms, ceil( 5 x Kp) x SMTC period )Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max( 600ms, ceil(1.5x 5 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320ms | ceil(5 x Kp) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified  NOTE 2: Kp is applicable for UE supporting [concurrent gaps] | |

Table 9.3.9.1-2: Time period for PSS/SSS detection, (FR2)

|  |  |
| --- | --- |
| DRX cycle | TPSS/SSS\_sync\_inter |
| No DRX | max(600ms, ceil(Mpss/sss\_sync\_inter x Kp x Klayer1\_measurement)x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max(600ms, ceil(1.5 x Mpss/sss\_sync\_inter x Kp x Klayer1\_measurement)x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320ms | ceil(Mpss/sss\_sync\_inter x Kp x Klayer1\_measurement) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified  NOTE 2: Kp is applicable for UE supporting [concurrent gaps] | |

Table 9.3.9.1-3: Time period for time index detection (FR1)

|  |  |
| --- | --- |
| DRX cycle | TSSB\_time\_index\_inter |
| No DRX | max(120ms, ceil( 3 x Kp )x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max(120ms, ceil (1.5 x 3 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320ms | Ceil(3 x Kp) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified  NOTE 2: Kp is applicable for UE supporting [concurrent gaps] | |

#### 9.3.9.2 Measurement period

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 clauses 10.1.4, 10.1.5, 10.1.9, 10.1.10, 10.1.14 and 10.1.15, respectively, as shown in table 9.3.9.2-1 and 9.3.9.2-2, if UE supports inter-frequency measurement without measurement gaps:

Table 9.3.9-1: Measurement period for inter-frequency measurements without gaps ((FR1)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_inter |
| No DRX | max(200ms, ceil( 5 x Kp) x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max(200ms, ceil(1.5x 5 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320ms | ceil( 5 x Kp ) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified | |

Table 9.3.9-2: Measurement period for inter-frequency measurements without gaps (FR2)

|  |  |
| --- | --- |
| DRX cycle | T SSB\_measurement\_period\_inter |
| No DRX | max(400ms, ceil(Mmeas\_period\_inter x Kp x Klayer1\_measurement) x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 320ms | max(400ms, ceil(1.5x Mmeas\_period\_inter x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320ms | ceil(Mmeas\_period\_inter xKp x Klayer1\_measurement) x DRX cycle x CSSFinter |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified | |

**<<Omitted the unchanged clauses>>**

**---end of change #13: 9.3---**

**--- Start of change #14: 9.3.X1-1 (R4-2202627, R4-2202635, R4-2206892)---**

### 9.3.X1 Inter-frequency measurement with NCSG

#### 9.3. X1.1 Inter-frequency cell identification

For the UE supporting NCSG, if NCSG is provided, the UE shall be able to identify a new detectable inter frequency cell within Tidentify\_inter\_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 frequency cell within Tidentify\_inter\_with\_index. The UE shall be able to identify a new detectable inter frequency SS block of an already detected cell within Tidentify\_inter\_without\_index.

Tidentify\_inter\_without\_index = (TPSS/SSS\_sync\_inter + T SSB\_measurement\_period\_inter) ms

Tidentify\_inter\_with\_index = (TPSS/SSS\_sync\_inter + T SSB\_measurement\_period\_inter + TSSB\_time\_index\_inter) ms

Where:

TPSS/SSS\_sync\_inter: it is the time period used in PSS/SSS detection given in table 9.3.10.1-1 and table 9.3.10.1-2.

TSSB\_time\_index\_inter: it is the time period used to acquire the index of the SSB being measured given in table 9.3.10.1-3 and table 9.3.10.1-4.

TSSB\_measurement\_period\_inter: equal to a measurement period of SSB based measurement given in table 9.3.10.2-1 and table 9.3.10.2-2.

Mpss/sss\_sync\_inter: For a UE supporting FR2 power class 1 or 5, Mpss/sss\_sync\_inter = 64 samples. For a UE supporting FR2 power class 2, Mpss/sss\_sync\_inter = 40 samples. For a UE supporting FR2 power class 3, Mpss/sss\_sync\_inter = 40 samples. For a UE supporting FR2 power class 4, Mpss/sss\_sync\_inter = 40 samples.

MSSB\_index\_inter: For a UE supporting FR2 power class 1 or 5, MSSB\_index\_inter = 40 samples. For a UE supporting FR2 power class 2, MSSB\_index\_inter = 24 samples. For a UE supporting FR2 power class 3, MSSB\_index\_inter = 24 samples. For a UE supporting FR2 power class 4, MSSB\_index\_inter = 24 samples.

Mmeas\_period\_inter: For a UE supporting FR2 power class 1 or 5, Mmeas\_period\_inter =64 samples. For a UE supporting FR2 power class 2, Mmeas\_period\_inter=40 samples. For a UE supporting FR2 power class 3, Mmeas\_period\_inter =40 samples. For a UE supporting FR2 power class 4, Mmeas\_period\_inter = 40 samples.

CSSFinter: it is a carrier specific scaling factor and is determined according to CSSFwithin\_ncsg,i in clause 9.1.5.x for measurement conducted within NCSG.

**Table 9.3.** **X1.1-1: Time period for PSS/SSS detection with NCSG (FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX | Max(600ms, 8 × Max(VIRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(8\*1.5) × Max(VIRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 8 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

**Table 9.3.** **X1.1-2: Time period for PSS/SSS detection with NCSG (FR2)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_inter** |
| No DRX | Max(600ms, Mpss/sss\_sync\_inter × Max(VIRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(600ms, (1.5 × Mpss/sss\_sync\_inter) × Max(VIRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Mpss/sss\_sync\_inter × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

**Table 9.3.** **X1.1-3: Time period for time index detection with NCSG (FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_inter** |
| No DRX | Max(120ms, 3 × Max(VIRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(120ms, Ceil(3 × 1.5) × Max(VIRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 3 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

**Table 9.3.** **X1.1-4: Time period for time index detection with NCSG (FR2)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_inter** |
| No DRX | Max(200ms, MSSB\_index\_inter × Max(VIRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, (1.5 × MSSB\_index\_inter) × Max(VIRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | MSSB\_index\_inter × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

#### 9.3. X1.2 Measurement period

When NCSG are provided for inter frequency measurements, 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 clauses 10.1.4, 10.1.5, 10.1.9, 10.1.10, 10.1.14 and 10.1.15, respectively, as shown in table 9.3. X1.2-1 and 9.3. X1.2-2:

**Table 9.3. X1.2-1: Measurement period for inter-frequency measurements with NCSG (FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(200ms, 8 × Max(VIRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(8 × 1.5) × Max(VIRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | 8 × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

**Table 9.3. X1.2-2: Measurement period for inter-frequency measurements with NCSG (FR2)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **T SSB\_measurement\_period\_inter** |
| No DRX | Max(400ms, Mmeas\_period\_inter × Max(VIRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(400ms, (1.5 × Mmeas\_period\_inter) × Max(VIRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Mmeas\_period\_inter × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

#### 9.3. X1.3 Scheduling availability during inter-frequency measurement with NCSG

When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols indicated by the union set of *SSB-ToMeasure* from all the configured measurement objects on the same serving carrier which can be merged[2], if it is configured; otherwise, all *L* SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included.

[An MO is considered as without frame boundary alignment when deriving scheduling restriction if any of the following alignment enablement conditions applicable to the MO are not satisfied:

*Editor note: conditions are under discussion*]

##### 9.3. X1.3.1 Scheduling availability of UE performing measurements in TDD bands on FR1

When the UE performs inter-frequency measurements with NCSG in a TDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement when (1) *simultaneousRxTxInterBandCA* is not supported for the target measurement band and the serving cell’s band, or (2) target measurement and the serving cell are on the same band

The UE is not expected to transmit PUCCH/PUSCH/SRS on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and △t serving cell symbol after each consecutive SSB symbols to be measured within SMTC window duration, if [deriveSSB-IndexFromCell-inter] is enabled for MO *i*, [and the alignment enabling conditions are satisfied.] △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.8.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if deriveSSB-IndexFromCell-inter is not enabled for MO *i,* [or the alignment enabling conditions are not satisfied],

When the UE performs inter-frequency measurements with NCSG in a TDD band, the following restrictions apply due to SS-RSRQ measurement when *simultaneousRxTxInterBandCA* is not supported for the target measurement band and the serving cell band

The UE is not expected to transmit PUCCH/PUSCH/SRS on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and RSSI measurement symbols, and △t serving cell symbol after each consecutive SSB symbols to be measured and RSSI measurement symbols within SMTC window duration, if [deriveSSB-IndexFromCell-inter] is enabled for MO *i*, [and the alignment enabling conditions are satisfied.] △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.8.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if deriveSSB-IndexFromCell-inter is not enabled for MO *i,* [or the alignment enabling conditions are not satisfied].

If the high layer in TS 38.331 [2] signalling of *smtc2*is configured, the SMTC periodicityfollows *smtc2*; Otherwise SMTC periodicity follows *smtc1.*

When TDD intra-band carrier aggregation or TDD inter-band carrier aggregation without *simultaneousRxTxInterBandCA* support is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When the UE performs inter-frequency measurements with NCSG in a TDD band and *simultaneousRxTxInterBandCA* is supported for the target measurement band and a serving cell’ band, no scheduling restriction applies to the serving cell.

##### 9.3. X1.3.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If [*deriveSSB-IndexFromCell-inter*] is enabled

The UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and △t serving cell symbol after each consecutive SSB symbols to be measured within SMTC window duration, if [deriveSSB-IndexFromCell-inter] is enabled for MO *i*, [and the alignment enabling conditions are satisfied.] △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.8.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if deriveSSB-IndexFromCell-inter is not enabled for MO *i,* [or the alignment enabling conditions are not satisfied],

If the high layer signalling of *smtc2*is configured in TS 38.331 [2], the SMTC periodicityfollows *smtc2*; Otherwise the SMTC periodicity follows *smtc1.*

When intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

##### 9.3. X1.3.3 Scheduling availability of UE performing measurements on FR2

When (1) UE does not support IBM between target measurement band and serving cell’s band(s) nor *simultaneousRxTxInterBandCA*, or (2) target measurement and a serving cell are on the same band, the following scheduling restriction applies to the serving cell due to SS-RSRP or SS-SINR measurement on an FR2 inter-frequency cell with NCSG:

The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and △t serving cell symbol after each consecutive SSB symbols to be measured within SMTC window duration, if [deriveSSB-IndexFromCell-inter] is enabled for MO *i*, [and the alignment enabling conditions are satisfied.] △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.8.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if deriveSSB-IndexFromCell-inter is not enabled for MO *i,* [or the alignment enabling conditions are not satisfied],

and due to SS-RSRQ measurement on an FR2 inter-frequency cell with NCSG

The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and RSSI measurement symbols, and △t serving cell symbol after each consecutive SSB symbols to be measured and RSSI measurement symbols within SMTC window duration, if [deriveSSB-IndexFromCell-inter] is enabled for MO *i*, [and the alignment enabling conditions are satisfied.] △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.8.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if deriveSSB-IndexFromCell-inter is not enabled for MO *i,* [or the alignment enabling conditions are not satisfied].

When UE does ont support IBM between target measurement band and serving cell’s band(s) nor *simultaneousRxTxInterBandCA*, the following scheduling restriction applies to the serving cell due to SS-RSRP or SS-SINR measurement on an FR2 inter-frequency cell with NCSG

The UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and △t serving cell symbol after each consecutive SSB symbols to be measured within SMTC window duration, if [deriveSSB-IndexFromCell-inter] is enabled for MO *i*, [and the alignment enabling conditions are satisfied.] △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.8.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if deriveSSB-IndexFromCell-inter is not enabled for MO *i,* [or the alignment enabling conditions are not satisfied],

and due to SS-RSRQ measurement on an FR2 inter-frequency cell with NCSG

The UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and RSSI measurement symbols, and △t serving cell symbol after each consecutive SSB symbols to be measured and RSSI measurement symbols within SMTC window duration, if [deriveSSB-IndexFromCell-inter] is enabled for MO *i*, [and the alignment enabling conditions are satisfied.] △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.8.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if deriveSSB-IndexFromCell-inter is not enabled for MO *i,* [or the alignment enabling conditions are not satisfied].

When UE supports IBM between target measurement band and serving cell’s band(s) but not *simultaneousRxTxInterBandCA*, the following scheduling restriction applies to the serving cell due to SS-RSRP or SS-SINR measurement on an FR2 inter-frequency cell with NCSG

The UE is not expected to transmit PUCCH/PUSCH/SRS on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and △t serving cell symbol after each consecutive SSB symbols to be measured within SMTC window duration, if [deriveSSB-IndexFromCell-inter] is enabled for MO *i*, [and the alignment enabling conditions are satisfied.] △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.8.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if deriveSSB-IndexFromCell-inter is not enabled for MO *i,* [or the alignment enabling conditions are not satisfied],

and due to SS-RSRQ measurement on an FR2 inter-frequency cell with NCSG

The UE is not expected to transmit PUCCH/PUSCH/SRS on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and RSSI measurement symbols, and △t serving cell symbol after each consecutive SSB symbols to be measured and RSSI measurement symbols within SMTC window duration, if [deriveSSB-IndexFromCell-inter] is enabled for MO *i*, [and the alignment enabling conditions are satisfied.] △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.8.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if deriveSSB-IndexFromCell-inter is not enabled for MO *i,* [or the alignment enabling conditions are not satisfied].

If the high layer signalling of *smtc2*is configured in TS 38.331 [2], the SMTC periodicityfollows *smtc2*; Otherwise the SMTC periodicity follows *smtc1.*

When UE supports IBM between target measurement band and serving cell’s band(s) and *simultaneousRxTxInterBandCA*, no scheduling restriction applies to the serving cell.

If following conditions are met:

- The UE has been notified about system information update through paging,

- The gap between the UE’s reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, the UE is expected to receive the PDCCH that the UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, the UE is expected to receive PDSCH that corresponds to the PDCCH that the UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured.

##### 9.3. X1.3.4 Scheduling availability of UE performing measurements on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to measurements performed on FR2 serving cell frequency layer.

There are no scheduling restrictions on FR2 serving cell(s) due to measurements performed on FR1 serving cell frequency layer.

**--- end of change #14: 9.3.X1 (R4-2202627, R4-2202635)---**

**--- start of change #15: 9.4 (R4-2202620, R4-2202606, R4-2206882, R4-2206894)---**

## 9.4 Inter-RAT measurements

### 9.4.1 Introduction

The requirements in this clause are specified for NR−E-UTRAN FDD and NR−E-UTRAN TDD measurements and are applicable without an explicit E-UTRAN neighbour cell list containing physical layer cell identities, for a UE:

- in RRC\_CONNECTED state, and

- configured

- with SA or NR-DC operation mode or configured in NE-DC operation mode by PCell with NR−E-UTRAN FDD or TDD measurement (RSRP, RSRQ, RS-SINR, RSTD, or E-CID RSRP and RSRQ) on E-UTRA non-serving frequency carrier, or

- with SA operation mode on NR carrier frequencies with CCA by PCell with NR−E-UTRAN FDD or TDD measurement (RSRP, RSRQ, RS-SINR) on E-UTRA non-serving frequency carrier, and

- configured with an appropriate measurement gap pattern or NCSG according to Table 9.1.2-3.

The requirements in this clause for concurrent measurement gaps are only applied for UE in NR SA operation mode.

When the UE is in NE-DC operation mode and an NR−E-UTRAN FDD or TDD measurement (RSRP, RSRQ, RS-SINR, or E-CID RSRP and RSRQ) configured by NR PCell is on a E-UTRA serving frequency carrier, then the corresponding E-UTRA intra-frequency measurements requirements specified in clause 8.19 of TS 36.133 [15] shall apply.

When *highSpeedMeasFlag-r16* is configured but UE does not support either *measurementEnhancement-r16 or* [*interRAT-MeasurementEnhancement-r16*], the UE is not required to meet the requirements specified in Table 9.4.2.3-2 and Table 9.4.3.3-2.

*Editor’s note: the exact signalling names in the above brackets and in Table 9.4.2.3-2 and Table 9.4.3.3-2 are subject to RAN2 definitions and the brackets shall be replaced by the correct signalling names according to RAN2 specification.*

Parameter TInter1 used in inter-RAT requirements in clause 9.4 is specified in Table 9.4.1-11 1 when measurement gap is used, and in Table 9.4.1-2 when NCSG is used.

Table 9.4.1-1: Minimum available time for inter-RAT measurements measurements when measurement gap is configured

|  |  |  |  |
| --- | --- | --- | --- |
| Gap Pattern Id | MeasurementGap Length (MGL, ms) | Measurement Gap Repetition Period  (MGRP, ms) | Minimum available time for inter-frequency and inter-RAT measurements during 480 ms period  (Tinter1, ms) |
| 0 | 6 | 40 | 60 |
| 1 | 6 | 80 | 30 |
| 2 | 3 | 40 | 24Note 1 |
| 3 | 3 | 80 | 12Note 1 |
| 4 | 6 | 20 | 120 Note 1 |
| 6 | 4 | 20 | 72 Note 1,3,6 |
| 7 | 4 | 40 | 36 Note 1,4,6 |
| 8 | 4 | 80 | 18Note 1,5,6 |
| 10 | 3 | 20 | 48 Note 1 |
| NOTE 1: When determining UE requirements using Tinter1 for gap pattern IDs 2, 3, 4, 6, 7, 8, 10, Tinter1 = 60 for gap pattern IDs 2, 4, 6, 7, 10, and Tinter1 = 30 for gap pattern IDs 3 and 8 shall be used.  NOTE 2: Measurement gaps pattern configurations applicability is as specified in Table 9.1.2-1.  NOTE 3: When this gap pattern is used, the Tinter for E-UTRA inter-frequency measurements is 48 ms corresponding to the first 3 ms of the 4 ms gap.  NOTE 4: When this gap pattern is used, the Tinter for E-UTRA inter-frequency measurements is 24 ms corresponding to the first 3 ms of the 4 ms gap.  NOTE 5: When this gap pattern is used, the Tinter for E-UTRA inter-frequency measurements is 12 ms corresponding to the first 3 ms of the 4 ms gap.  NOTE 6: This gap pattern is applicable for E-UTRA inter-frequency measurements only if gap based NR measurements are also configured.  NOTE 7: If multiple concurrent gaps are configured, the MGRP is the periodicity of the MG pattern associated to the E-UTRA inter-RAT frequency layers. | | | |

Table 9.4.1-2: Minimum available time for inter-RAT measurements when NCSG is configured

|  |  |  |  |
| --- | --- | --- | --- |
| NCSG Pattern Id | Measurement Length (ML, ms) | Visible Interruption Repetition Period  (VIRP, ms) | Minimum available time for inter-frequency and inter-RAT measurements during 480 ms period  (Tinter1, ms) |
| 0 | 5 | 40 | 60 |
| 1 | 5 | 80 | 30 |
| 2 | 2 | 40 | 24Note 1 |
| 3 | 2 | 80 | 12Note 1 |
| 4 | 5 | 20 | 120 Note 1 |
| 6 | 3 | 20 | 72 Note 1,3 |
| 7 | 3 | 40 | 36 Note 1,3 |
| 8 | 3 | 80 | 18Note 1,3 |
| 10 | 2 | 20 | 48 Note 1 |
| NOTE 1: When determining UE requirements using Tinter1 for NCSG pattern IDs 2, 3, 4, 6, 7, 8, 10, Tinter1 = 60 for NCSG pattern IDs 2, 4, 6, 7, 10, and Tinter1 = 30 for NCSG pattern IDs 3 and 8 shall be used.  NOTE 2: NCSG pattern configurations applicability is as specified in Table 9.1.2C-1.  NOTE 3: This NCSG pattern is applicable for E-UTRA inter-frequency measurements only if NCSG based NR measurements are also configured. | | | |

A UE configured with gap pattern ID 2, 3 or 10 shall be able to detect a target cell, provided that

- the E-UTRA subframe #0 or #5 of the target E-UTRAN cell begins not earlier than 500 μs from the start of the measurement gap, and

- the E-UTRA subframe #0 or #5 of the target E-UTRAN cell ends not later than 500 μs before the end of the measurement gap in case of FDD and not later than 750 μs 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, provided that

- the E-UTRA subframe #0 or #5 of the target E-UTRAN cell begins not earlier than 500 μs from the start of the measurement gap, and

- the E-UTRA subframe #0 or #5 of the target E-UTRAN cell ends no later than 1500 μs before the end of the measurement gap in case of FDD and no later than 1750 μs before the end of measurement gap in case of TDD.

### 9.4.2 NR − E-UTRAN FDD measurements

#### 9.4.2.1 Introduction

The requirements are applicable for NR−E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements.

In the requirements, an E-UTRAN FDD cell is considered to be detectable when:

- RSRP related conditions in the accuracy requirements in clause 10.2.2 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

- RSRQ related conditions in the accuracy requirements in clause 10.2.3 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

- RS-SINR related conditions in the accuracy requirements in clause 10.2.5 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.19 of TS 36.133 [15].

#### 9.4.2.2 Requirements when no DRX is used

When the UE requires measurement gaps or NCSG to identify and measure inter-RAT cells and an appropriate measurement gap pattern or NCSG is scheduled, or when the UE is capable of concurrent measurement gap patterns and concurrent measurement gap patterns are scheduled, or an appropriate pre-MG is scheduled and activated, the UE shall be able to identify a new detectable FDD cell within TIdentify, E-UTRAN FDD according to the following expression:

,

where:

TBasicIdentify = 480 ms,

TInter1 is defined in clause 9.4.1,

CSSFinterRAT = CSSFwithin\_gap,i when measurement gaps are configured, or CSSFwithin\_ncsg,i when NCSGs are configured, is the scaling factor for the measured inter-RAT E-UTRA carrier *i* which is calculated as specified in clause 9.1.5.2.

[For a UE supporting concurrent measurement gaps, Kgap\_EUTRA: it is the scaling factor for an E-UTRAN frequency layer to be measured within the associated measurement gap pattern. Kgap = 1 when the UE is not configured with concurrent measurement gaps. Otherwise, Kgap\_EUTRA = Ntotal / Navailable for UE configured with concurrent measurement gaps.]

* For a window W of duration MGRP\_max, where MGRP\_max is the maximum MGRP across all configured per-UE measurement gap(s) and per-FR measurement gap(s) for FR1, and starting from the beginning of any associated gap occasion:
  + Ntotal is the total number of associated gap occasions within the window, including those overlapped with other MG occasions within the window, and
  + Navailable is the number of non-dropped associated measurement gap occasions after accounting for collisions between the measurement gaps by applying the measurement gap collision rule in section 9.1.2B.3.
* Requirements do not apply for UE configured with concurrent measurement gaps, if Navailable =0

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasure, E-UTRAN FDD defined in Table 9.4.2.2-1.

**Table 9.4.2.2-1:** M**easurement period and measurement bandwidth**

|  |  |  |
| --- | --- | --- |
| **Configuration** | **Physical Layer Measurement period: TMeasure, E-UTRAN FDD [ms]** | **Measurement bandwidth [RB]** |
| 0 | 480 x [CSSFinterRAT x Ceil(Kgap\_EUTRA)] | 6 |
| 1 (Note 1) | 240 x [CSSFinterRAT x Ceil(Kgap\_EUTRA)] | 50 |
| NOTE 1: This configuration is optional.  NOTE 2: Kgap\_EUTRA is only applicable for a UE supporting concurrent measurement gaps. Otherwise Kgap\_EUTRA =1 | | |

The UE shall be capable of identifying and performing NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN FDD cells per E-UTRA FDD carrier frequency layer during each layer 1 measurement period, for up to 7 E-UTRA FDD carrier frequency layers.

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN FDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2. The NR – E-UTRAN FDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3. The NR – E-UTRAN FDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

#### 9.4.2.3 Requirements when DRX is used

When DRX is in use and an appropriate measurement gap pattern or NCSG is configured, or when the UE is capable of concurrent measurement gap patterns and concurrent measurement gap patterns are configured, or an appropriate pre-MG is scheduled and activated, the UE shall be able to identify a new detectable E-UTRAN FDD cell within TIdentify, E-UTRAN FDD specified in Table 9.4.2.3-1. When *highSpeedMeasFlag-r16* is configured and UE supports the enhanced inter-RAT E-UTRAN measurement requirements, the UE shall be able to identify a new detectable E-UTRAN FDD cell within TIdentify, E-UTRAN FDD specified in Table 9.4.2.3-2.

[For a UE supporting concurrent measurement gaps, Kgap\_EUTRA: it is the scaling factor for an E-UTRAN frequency layer to be measured within the associated measurement gap pattern. Kgap = 1 when the UE is not configured with concurrent measurement gaps. Otherwise, Kgap\_EUTRA = Ntotal / Navailable for UE configured with concurrent measurement gaps.]

* For a window W of duration MGRP\_max, where MGRP\_max is the maximum MGRP across all configured per-UE measurement gap(s) and per-FR measurement gap(s) for FR1, and starting from the beginning of any associated gap occasion:
  + Ntotal is the total number of associated gap occasions within the window, including those overlapped with other MG occasions within the window, and
  + Navailable is the number of non-dropped associated measurement gap occasions after accounting for collisions between the measurement gaps by applying the measurement gap collision rule in section 9.1.2B.3.
* Requirements do not apply for UE configured with concurrent measurement gaps, if Navailable =0

Table 9.4.2.3-1: Requirement to identify a newly detectable E-UTRAN FDD cell

|  |  |  |
| --- | --- | --- |
| **DRX cycle length (s)** | **TIdentify, E-UTRAN FDD (s) (DRX cycles)** | |
|  | Gap/NCSG period = 40 ms, 20 ms | Gap/NCSG period = 80 ms |
| ≤0.16 | Non-DRX requirements in clause 9.4.2.2 apply | Non-DRX requirements in clause 9.4.2.2 apply |
| 0.256 | 5.12\* CSSFinterRAT x Ceil(Kgap\_EUTRA) (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) | 7.68\* CSSFinterRAT x Ceil(Kgap\_EUTRA) (30\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| 0.32 | 6.4\* CSSFinterRAT x Ceil(Kgap\_EUTRA) (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) | 7.68\* CSSFinterRAT x Ceil(Kgap\_EUTRA) (24\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| 0.32< DRX-cycle ≤10.24 | Note1 (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) | Note1 (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| NOTE 1: The time depends on the DRX cycle length.  NOTE 2: CSSFinterRAT is as defined in clause 9.4.2.2.  NOTE 3: Kgap\_EUTRA is only applicable for a UE supporting concurrent measurement gaps. Otherwise Kgap\_EUTRA =1  NOTE 4: If multiple concurrent gaps are configured, the gap period is the periodicity of the MG pattern associated to the E-UTRA inter-RAT frequency layer. | | |

Table 9.4.2.3-2: Requirement to identify a newly detectable E-UTRAN FDD cell when *highSpeedMeasFlag-r16* is configured

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | TIdentify, E-UTRAN FDD (s) (DRX cycles) | |
|  | Gap/NCSG period = 40 ms, 20 ms | Gap/NCSG period = 80 ms |
| ≤0.16 | Non-DRX requirements in clause 9.4.2.2 apply | Non-DRX requirements in clause 9.4.2.2 apply |
| 0.16<DRx cycle<=0.32 | Note 1(15\*CSSFinterRAT x Ceil((Kgap\_EUTRA)) |  |
| 0.32<DRx cycle <= 0.64 | Note 1(10\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |  |
| DRx cycle = 1.024 | Note 1(10\*CSSFinterRAT x Ceil( Kgap\_EUTRA)) | Note 1(10\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| DRx cycle = 1.28 | Note 1(8\*CSSFinterRAT x Ceil( Kgap\_EUTRA)) | Note 1(8\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| 1.28< DRX-cycle ≤10.24 | Note1 (20\*CSSFinterRAT x Ceil( Kgap\_EUTRA)) | Note1 (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| NOTE 1: The time depends on the DRX cycle length.  NOTE 2: CSSFinterRAT is as defined in clause 9.4.2.2.  NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[interRAT-MeasurementEnhancement-r16].*  NOTE 4: Kgap\_EUTRA is only applicable for a UE supporting concurrent measurement gaps. Otherwise Kgap\_EUTRA =1  NOTE 5: If multiple concurrent gaps are configured, the gap period is the periodicity of the MG pattern associated to the E-UTRA inter-RAT frequency layer. | | |

When DRX is in use, the UE shall be capable of performing NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN FDD cells per E-UTRA FDD frequency layer during each layer 1 measurement period, for up to 7 E-UTRA FDD carrier frequency layers, and the UE physical layer shall be capable of reporting NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period Tmeasure, E-UTRAN FDD specified in Table 9.4.2.3-2.

**Table 9.4.2.3-2: Requirement to measure E-UTRAN FDD cells**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tmeasure, E-UTRAN FDD (s) (DRX cycles)** |
| ≤0.08 | Non-DRX requirements in clause 9.4.2.2 apply |
| 0.08< DRX-cycle ≤10.24 | Note1 (5\* CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| NOTE 1: The time depends on the DRX cycle length.  NOTE 2: CSSFinterRAT is as defined in clause 9.4.2.2.  NOTE 3: Kgap\_EUTRA is only applicable for a UE supporting concurrent measurement gaps. Otherwise Kgap\_EUTRA =1 | |

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN FDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2. The NR – E-UTRAN FDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3. The NR – E-UTRAN FDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

#### 9.4.2.4 Measurement reporting requirements

##### 9.4.2.4.1 Periodic Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

##### 9.4.2.4.2 Event-Triggered Periodic Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

The first report in event-triggered periodic measurement reporting shall meet the requirements specified in clause 9.4.2.4.3.

##### 9.4.2.4.3 Event-Triggered Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, 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, E-UTRAN FDD defined in clauses 9.4.2.2 and 9.4.2.3 without DRX and with DRX, respectively.When L3 filtering is used, an additional delay can be expected.

If a cell which has been detectable at least for the time period TIdentify, E-UTRAN FDD becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than TMeasure, E-UTRAN FDD provided the timing to that cell has not changed more than ± 50 Ts while measurement gap or NCSG has not been available and the L3 filter has not been used.

### 9.4.3 NR − E-UTRAN TDD measurements

#### 9.4.3.1 Introduction

The requirements are applicable for NR−E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements.

In the requirements, an E-UTRAN TDD cell is considered to be detectable when:

- RSRP related conditions in the accuracy requirements in clause 10.2.2 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

- RSRQ related conditions in the accuracy requirements in clause 10.2.3 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

RS-SINR related conditions in the accuracy requirements in clause 10.2.5 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.19 of TS 36.133 [15].

#### 9.4.3.2 Requirements when no DRX is used

When the UE requires measurement gaps or NCSG to identify and measure inter-RAT cells and an appropriate measurement gap pattern or NCSG is scheduled, or when the UE is capable of concurrent measurement gap patterns and concurrent measurement gap patterns are scheduled, or an appropriate pre-MG is scheduled and activated, the UE shall be able to identify a new detectable TDD cell within TIdentify, E-UTRAN TDD according to the following expression:

- When configuration 0 or configuration 1 in Table 9.4.3.2-1 is applied,

,

- When configuration 2 or configuration 3 in Table 9.4.3.2-1 is applied,

,

where:

TBasicIdentify = 480 ms,

TInter1 is defined in clause 9.4.1,

CSSFinterRAT = CSSFwithin\_gap,i when measurement gaps are configured, or CSSFwithin\_ncsg,i when NCSGs are configured, is the scaling factor for the measured inter-RAT E-UTRA carrier *i* which is calculated as specified in clause 9.1.5.2.

[For a UE supporting concurrent measurement gaps, Kgap\_EUTRA: it is the scaling factor for an E-UTRAN frequency layer to be measured within the associated measurement gap pattern. Kgap = 1 when the UE is not configured with concurrent measurement gaps. Otherwise, Kgap\_EUTRA = Ntotal / Navailable for UE configured with concurrent measurement gaps.]

* For a window W of duration MGRP\_max, where MGRP\_max is the maximum MGRP across all configured per-UE measurement gap(s) and per-FR measurement gap(s) for FR1, and starting from the beginning of any associated gap occasion:
  + Ntotal is the total number of associated gap occasions within the window, including those overlapped with other MG occasions within the window, and
  + Navailable is the number of non-dropped associated measurement gap occasions after accounting for collisions between the measurement gaps by applying the measurement gap collision rule in section 9.1.2B.3.
* Requirements do not apply for UE configured with concurrent measurement gaps, if Navailable =0

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of TMeasure, E-UTRAN TDD defined in Table 9.4.3.2-1.

Table 9.4.3.2-1: TMeasure, E-UTRAN TDD for different configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Configuration | Measurement bandwidth (RB) | Number of UL/DL sub-frames per half frame (5 ms) | | DwPTS | | TMeasure, E-UTRAN TDD (ms) |
|  |  | DL | UL | Normal CP | Extended CP |  |
| 0 | 6 | 2 | 2 |  |  | 480 x CSSFinterRAT x Ceil(Kgap\_EUTRA) |
| 1 (Note 1) | 50 | 2 | 2 |  |  | 240 x CSSFinterRAT x Ceil(Kgap\_EUTRA) |
| 2 | 6 | 1 | 3 |  |  | 720 x CSSFinterRAT x Ceil(Kgap\_EUTRA) |
| 3 (Note 1) | 50 | 1 | 3 |  |  | 480 x CSSFinterRAT x Ceil(Kgap\_EUTRA) |
| NOTE 1: This configuration is optional.  NOTE 2: Void  NOTE 3: Kgap\_EUTRA is only applicable for a UE supporting concurrent measurement gaps. Otherwise Kgap\_EUTRA =1 | | | | | | |

The UE shall be capable of identifying and performing NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN TDD cells per E-UTRA TDD carrier frequency layer during each layer 1 measurement period, for up to 7 E-UTRA TDD carrier frequency layers.

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN TDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2. The NR – E-UTRAN TDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3. The NR – E-UTRAN TDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

#### 9.4.3.3 Requirements when DRX is used

When DRX is in use and an appropriate measurement gap pattern or NCSG is configured, or when the UE is capable of concurrent measurement gap patterns and concurrent measurement gap patterns are configured, or an appropriate pre-MG is scheduled and activated, the UE shall be able to identify a new detectable E-UTRAN TDD cell within TIdentify, E-UTRAN TDD specified in Table 9.4.3.3-1. When *highSpeedMeasFlag-r16* is configured and UE supports the enhanced inter-RAT E-UTRAN measurement requirements, the UE shall be able to identify a new detectable E-UTRAN TDD cell within TIdentify, E-UTRAN TDD specified in Table 9.4.3.3-2.

[For a UE supporting concurrent measurement gaps, Kgap\_EUTRA: it is the scaling factor for an E-UTRAN frequency layer to be measured within the associated measurement gap pattern. Kgap = 1 when the UE is not configured with concurrent measurement gaps. Otherwise, Kgap\_EUTRA = Ntotal / Navailable for UE configured with concurrent measurement gaps.]

* For a window W of duration MGRP\_max, where MGRP\_max is the maximum MGRP across all configured per-UE measurement gap(s) and per-FR measurement gap(s) for FR1, and starting from the beginning of any associated gap occasion:
  + Ntotal is the total number of associated gap occasions within the window, including those overlapped with other MG occasions within the window, and
  + Navailable is the number of non-dropped associated measurement gap occasions after accounting for collisions between the measurement gaps by applying the measurement gap collision rule in section 9.1.2B.3.
* Requirements do not apply for UE configured with concurrent measurement gaps, if Navailable =0

Table 9.4.3.3-1: Requirement to identify a newly detectable E-UTRAN TDD cell

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | TIdentify, E-UTRAN TDD (s) (DRX cycles) | |
|  | Gap/NCSG period = 40 ms, 20 ms | Gap/NCSG period = 80 ms |
| ≤0.16 | Non-DRX requirements in clause 9.4.3.2 apply | Non-DRX requirements in clause 9.4.3.2 apply |
| 0.256 | 5.12\* CSSFinterRAT x Ceil(Kgap\_EUTRA) (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) | 7.68\* CSSFinterRAT x Ceil(Kgap\_EUTRA) (30\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| 0.32 | 6.4\* CSSFinterRAT x Ceil(Kgap\_EUTRA) (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) | 7.68\* CSSFinterRAT x Ceil(Kgap\_EUTRA) (24\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| 0.32< DRX-cycle ≤10.24 | Note1 (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) | Note1 (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| NOTE 1: The time depends on the DRX cycle length.  NOTE 2: CSSFinterRAT is as defined in clause 9.4.3.2.  NOTE 3: Kgap\_EUTRA is only applicable for a UE supporting concurrent measurement gaps. Otherwise Kgap\_EUTRA =1  NOTE 4: If multiple concurrent gaps are configured, the gap period is the periodicity of the MG pattern associated to the E-UTRA inter-RAT frequency layer. | | |

Table 9.4.3.3-2: Requirement to identify a newly detectable E-UTRAN TDD cell when *highSpeedMeasFlag-r16* is configured

|  |  |  |
| --- | --- | --- |
| DRX cycle length (s) | TIdentify, E-UTRAN TDD (s) (DRX cycles) | |
|  | Gap/NCSG period = 40 ms, 20 ms | Gap/NCSG period = 80 ms |
| ≤0.16 | Non-DRX requirements in clause 9.4.3.2 apply | Non-DRX requirements in clause 9.4.3.2 apply |
| 0.16<DRx cycle<=0.32 | Note 1(15\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |  |
| 0.32<DRx cycle <= 0.64 | Note 1(10\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |  |
| DRx cycle = 1.024 | Note 1(10\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) | Note 1(10\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| DRx cycle = 1.28 | Note 1(8\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) | Note 1(8\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| 1.28< DRX-cycle ≤10.24 | Note1 (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) | Note1 (20\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| NOTE 1: The time depends on the DRX cycle length.  NOTE 2: CSSFinterRAT is as defined in clause 9.4.3.2.  NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[interRAT-MeasurementEnhancement-r16].*  NOTE 4: Kgap\_EUTRA is only applicable for a UE supporting concurrent measurement gaps. Otherwise Kgap\_EUTRA =1  NOTE 4: If multiple concurrent gaps are configured, the gap period is the periodicity of the MG pattern associated to the E-UTRA inter-RAT frequency layer. | | |

When DRX is in use, the UE shall be capable of performing NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN TDD cells per E-UTRA TDD frequency layer during each layer 1 measurement period, for up to 7 E-UTRA TDD carrier frequency layers, and the UE physical layer shall be capable of reporting NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period Tmeasure, E-UTRAN TDD specified in Table 9.4.3.3-2.

Table 9.4.3.3-2: Requirement to measure E-UTRAN TDD cells

|  |  |
| --- | --- |
| DRX cycle length (s) | Tmeasure, E-UTRAN TDD (s) (DRX cycles) |
| ≤0.08 | Non-DRX Requirements in clause 9.4.3.2 apply |
| 0.128 | For configuration 2 Note3, non-DRX requirements in clause 9.4.3.2 apply,  Otherwise: Note1 (5\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| 0.128<DRX-cycle≤10.24 | Note1 (5\*CSSFinterRAT x Ceil(Kgap\_EUTRA)) |
| NOTE 1: The time depends on the DRX cycle length.  NOTE 2: CSSFinterRAT is as defined in clause 9.4.3.2.  NOTE 3: See Table 9.4.3.2-1.  NOTE 4: Kgap\_EUTRA is only applicable for a UE supporting concurrent measurement gaps. Otherwise Kgap\_EUTRA =1 | |

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN TDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2. The NR – E-UTRAN TDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3. The NR – E-UTRAN TDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

#### 9.4.3.4 Measurement reporting requirements

##### 9.4.3.4.1 Periodic Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

##### 9.4.3.4.2 Event-Triggered Periodic Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

The first report in event-triggered periodic measurement reporting shall meet the requirements specified in clause 9.4.3.4.3.

##### 9.4.3.4.3 Event-Triggered Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, 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, E-UTRAN TDD defined in clauses 9.4.3.2 and 9.4.3.3 without DRX and with DRX, respectively.When L3 filtering is used, an additional delay can be expected.

If a cell which has been detectable at least for the time period TIdentify, E-UTRAN TDD becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than TMeasure, E-UTRAN TDD provided the timing to that cell has not changed more than ± 50 Ts while measurement gap or NCSG has not been available and the L3 filter has not been used.

#### 9.4.3.5 Scheduling Availability During NR − E-UTRAN TDD measurements with NCSG

[When UE supports *simultaneousRxTxInterBandENDC* for a band combination, no scheduling restriction is applicable to NR − E-UTRAN TDD measurements with NCSG in this band combination; otherwise UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within NCSG ML.]

**--- end of change #15: 9.4 ---**

**---Start of change #16: 9.5 (R4-2202619,R4-2202630, R4-2206895, R4-2206876)--**

### 9.5.4 L1-RSRP measurement requirements

#### 9.5.4.1 SSB based L1-RSRP Reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of TL1-RSRP\_Measurement\_Period\_SSB.

The value of TL1-RSRP\_Measurement\_Period\_SSB is defined in Table 9.5.4.1-1 for FR1 and Table 9.5.4.1-2 for FR2, where

- M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise

- N= 8.

For a UE that supports either concurrent measurement gaps, pre-MG gaps or NCSG, measurement gaps in this section includes any configured and active gap.

*Editor’s note: the term “[measurement gap]” in this clause could be either the legacy gap or the VIL or NCSG. RAN4 to further study whether a better terminology can be used to replace [measurement gap].*

For FR1, for a UE not supporting [concurrent gaps] or when the UE is not configured with concurrent gaps,

- P=, when in the monitored cell there are [measurement gaps] configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB; and

- P=1 when in the monitored cell there are no [measurement gaps] overlapping with any occasion of the SSB.

For FR2, for a UE not supporting [concurrent gaps] or when the UE is not configured with concurrent gaps,

- P=, when SSB is not overlapped with [measurement gap] and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod).

- P is Psharing factor, when SSB is not overlapped with [measurement gap] and SSB is fully overlapped with SMTC period (TSSB = TSMTCperiod).

- P=, when SSB is partially overlapped with [measurement gap] and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with [measurement gap] and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xRP and TSSB < 0.5\*TSMTCperiod

- P is , when SSB is partially overlapped with [measurement gap] and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is not overlapped with [measurement gap] and TSMTCperiod = xRP and TSSB = 0.5\*TSMTCperiod

- P=, when SSB is partially overlapped with [measurement gap] (TSSB <xRP) and SSB is partially overlapped with SMTC occasion (TSSB < TSMTCperiod) and SMTC occasion is partially or fully overlapped with [measurement gap].

- P is , when SSB is partially overlapped with [measurement gap] and SSB is fully overlapped with SMTC occasion (TSSB = TSMTCperiod) and SMTC occasion is partially overlapped with [measurement gap] (TSMTCperiod < xRP)

When concurrent gaps are configured,

- P value for SSB resource to be measured is defined as

* Ntotal / Noutside\_MG in FR1
* Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0
* Ntotal / Navailable in FR2 with Navailable > 0

- For a window W of duration max(TL1, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any SSB resource occasion:

* Ntotal is the total number of SSB resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and
* Noutside\_MG is the number of SSB resource occasions that are not overlapped with any measurement gap occasion within the window W
* Navailable is the number of SSB resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W
* TL1 is periodicity of the target SSB.

Where:

- Psharing factor = 1, if the SSB configured for L1-RSRP measurement outside gap is

* not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,
* not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- Psharing factor = 3, otherwise.

- TSSB = ssb-periodicityServingCell

- TSMTCperiod = the configured SMTC period

- If the UE is configured with Pre-MG, an SSB or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- When a measurement gap is configured,

* + an SSB or an SMTC occasion is considered to be as overlapped with the [measurement gap] if it overlaps a measurement gap occasion, and
  + xRP = MGRP

- When NCSG is configured,

* an SSB or an SMTC occasion is considered to be as overlapped with the [measurement gap] if
  + - it overlaps the VIL1 or VIL2 of NCSG, or
    - it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

and

* + xRP = VIRP
* When concurrent gaps are configured, an SSB or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to [9.1.2B].

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, TSMTCperiod corresponds to the value of higher layer parameter *smtc2*; Otherwise TSMTCperiod corresponds to the value of higher layer parameter *smtc1*. TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and [measurement gap] configurations does not meet pervious conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer L1 RSRP measurement period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

Table 9.5.4.1-1: Measurement period TL1-RSRP\_Measurement\_Period\_SSB for FR1

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(K \*M\*P)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX |
| Note 1: TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  Note 2: K = 1 when TSSB ≤ 40 ms and *highSpeedMeasFlag-r16* are configured; otherwise K = 1.5.  Note 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[intraRAT-MeasurementEnhancement-r16].* | |

Table 9.5.4.1-2: Measurement period TL1-RSRP\_Measurement\_Period\_SSB for FR2

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB (ms) |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil(1.5\*M\*P\*N)\*TDRX |
| Note: TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting. | |

#### 9.5.4.2 CSI-RS based L1-RSRP Reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured CSI-RS resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of TL1-RSRP\_Measurement\_Period\_CSI-RS.

The value of TL1-RSRP\_Measurement\_Period\_CSI-RS is defined in Table 9.5.4.2-1 for FR1 and in Table 9.5.4.2-2 for FR2, where

- For periodic and semi-persistent CSI-RS resources, M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise

- For aperiodic CSI-RS resources M=1

- For periodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply if *qcl-InfoPeriodicCSI-RS* is configured for all the resources in the resource set and for each resource one RS has QCL-TypeD with

- SSB for L1-RSRP measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For periodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / Nres\_per\_set), where Nres\_per\_set is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured with QCL-TypeD for all resources in the resource set.

- For semi-persistent CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set and for each resource one RS has QCL-TypeD with

- SSB for L1-RSRP measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For semi-persistent CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / Nres\_per\_set), where Nres\_per\_set is number of resources in the resource set. The requirements apply provided TCI state is provided with QCL-TypeD for all resources in the resource set in the MAC CE activating the resource set.

- For aperiodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided *qcl-info* is configured for all resources in the resource set and for each resource one RS has QCL-TypeD with

- SSB for L1-RSRP measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For aperiodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=1. UE is not required to meet the accuracy requirements in clause 10.1.19.2 and 10.1.20.2 if number of resources in the resource set is smaller than *maxNumberRxBeam*. The requirements apply provided *qcl-info* is configured with QCL-TypeD for all resources in the resource set.

For a UE that supports either concurrent measurement gaps, pre-MG gaps or NCSG, measurement gaps in this section includes any configured and active gap.

*Editor’s note: the term “[measurement gap]” in this clause could be either the legacy gap or the VIL or NCSG. RAN4 to further study whether a better terminology can be used to replace [measurement gap].*

For FR1, for a UE not supporting [concurrent gaps] or when the UE is not configured with concurrent gaps,

- P=, when in the monitored cell there are [measurement gaps] configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

- P=1 when in the monitored cell there are no [measurement gaps] overlapping with any occasion of the CSI-RS.

For FR2, for a UE not supporting [concurrent gaps] or when the UE is not configured with concurrent gaps,

- P=1, when CSI-RS is not overlapped with a [measurement gap] and also not overlapped with SMTC occasion.

- P=, when CSI-RS is partially overlapped with [measurement gap] and CSI-RS is not overlapped with SMTC occasion (TCSI-RS < xRP)

- P=, when CSI-RS is not overlapped with [measurement gap] and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod).

- P=Psharing factor, when CSI-RS is not overlapped with [measurement gap] and CSI-RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod).

- P=1, when aperiodic CSI-RS resource is not overlapped with [measurement gap]

- P=, when CSI-RS is partially overlapped with [measurement gap] and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with [measurement gap] and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xRP and TCSI-RS < 0.5\*TSMTCperiod

- P=, when CSI-RS is partially overlapped with [measurement gap] and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with [measurement gap] and TSMTCperiod = xRP and TCSI-RS = 0.5\*TSMTCperiod

- P=, when CSI-RS is partially overlapped with [measurement gap] (TCSI-RS < xRP) and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is partially or fully overlapped with [measurement gap].

- P=, when CSI-RS is partially overlapped with [measurement gap] and CSI-RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod) and SMTC occasion is partially overlapped with [measurement gap] (TSMTCperiod < xRP)

When concurrent gaps are configured,

- P value for a CSI-RS resource to be measured is defined as

* Ntotal / Noutside\_MG in FR1
* Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0
* Ntotal / Navailable in FR2 with Navailable > 0

- For a window W of duration max(TL1, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any CSI-RS resource occasion:

* Ntotal is the total number of CSI-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and
* Noutside\_MG is the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
* Navailable is the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W
* TL1 is periodicity of the target CSI-RS.

Where:

Psharing factor = 1, if the CSI-RS configured for L1-RSRP measurement outside gap is

* not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,
* not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

Psharing factor = 3, otherwise.

TSMTCperiod = the configured SMTC period.

TCSI-RS = the periodicity of CSI-RS configured for L1-RSRP measurement

If the UE is configured with Pre-MG, a CSI-RS or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

When a measurement gap is configured,

* + a CSI-RS or an SMTC occasion is considered to be as overlapped with the [measurement gap] if it overlapps a measurement gap occasion, and
  + xRP = MGRP

When NCSG is configured,

* a CSI-RS or an SMTC occasion is considered to be as overlapped with the [measurement gap] if
  + - it overlaps the VIL1 or VIL2 of NCSG, or
    - it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

and

* + xRP = VIRP

When concurrent gaps are configured, a CSI-RS or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to [9.1.2B].

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, TSMTCperiod corresponds to the value of higher layer parameter *smtc2*; Otherwise TSMTCperiod corresponds to the value of higher layer parameter *smtc1*. TSMTCperiod is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

Note: The overlap between CSI-RS for L1-RSRP measurement and SMTC means that CSI-RS for L1-RSRP measurement is within the SMTC window duration.

Longer evaluation period would be expected if the combination of CSI-RS, SMTC occasion and measurement gap configurations does not meet pervious conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period Tidentify\_CGI when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer L1 RSRP measurement period would be expected during the period Tidentify\_CGI,E-UTRAN when the UE is requested to decode an LTE CGI.

Table 9.5.4.2-1: Measurement period TL1-RSRP\_Measurement\_Period\_CSI-RS for FR1

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_CSI-RS (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(K \*M\*P)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX |
| Note 1: TCSI-RS is the periodicity of CSI-RS configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3.  Note 3: K = 1 when TCSI-RS ≤ 40 ms and *highSpeedMeasFlag-r16* are configured; otherwise K = 1.5.  Note 4: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[intraRAT-MeasurementEnhancement-r16].* | |

Table 9.5.4.2-2: Measurement period TL1-RSRP\_Measurement\_Period\_CSI-RS for FR2

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_CSI-RS (ms) |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | ceil(M\*P\*N)\*TDRX |
| Note 1: TCSI-RS is the periodicity of CSI-RS configured for L1-RSRP measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3. | |

**<<Omitted the unchanged clauses>>**

### 9.5A.4 L1-RSRP measurement requirements

#### 9.5A.4.1 SSB based L1-RSRP Reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP The UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of TL1-RSRP\_Measurement\_Period\_SSB\_CCA.

The value of TL1-RSRP\_Measurement\_Period\_SSB\_CCA is defined in Table 9.5A.4.1-1 for FR1, where

- M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise

For a UE that supports either concurrent measurement gaps, pre-MG gaps or NCSG, measurement gaps in this section includes any configured and active gap.

*Editor’s note: the term “[measurement gap]” in this clause could be either the legacy gap or the VIL or NCSG. RAN4 to further study whether a better terminology can be used to replace [measurement gap].*

For FR1, for a UE not supporting [concurrent gaps] or when the UE is not configured with concurrent gaps,

- P=, when in the monitored cell there are [measurement gaps] configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB; and

- P=1 when in the monitored cell there are no [measurement gaps] overlapping with any occasion of the SSB.

For FR1 with concurrent gaps configured,

- P value for an SSB resource to be measured is defined as Ntotal / Noutside\_MG

- For a window W of duration max(TL1, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any SSB resource occasion:

* Ntotal is the total number of SSB resource occasions within the window, including those overlapped with measurement gap occasions within the window, and
* Noutside\_MG is the number of SSB resource occasions that are not overlapped with any measurement gap occasion within the window W

Where:

Psharing factor = 1, if the SSB resource outside gap is

* not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,
* not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

Psharing factor = 3, otherwise.

TSSB = ssb-periodicityServingCell

TSMTCperiod = the configured SMTC1 period or SMTC2 period if configured

If the UE is configured with Pre-MG, an SSB is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

When a measurement gap is configured,

* + an SSB is considered to be as overlapped with the [measurement gap] if it overlaps a measurement gap occasion, and
  + xRP = MGRP

When NCSG is configured,

* + an SSB is considered to be as overlapped with the [measurement gap] if it overlaps the VIL1 or VIL2 of NCSG, and
  + xRP = VIRP

When concurrent gaps are configured, an SSB or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to [9.1.2B].

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, TSMTCperiod corresponds to the value of higher layer parameter *smtc2*; Otherwise TSMTCperiod corresponds to the value of higher layer parameter *smtc1*.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and [measurement gap] configurations does not meet pervious conditions.

UE shall report RSRP\_0 (Not valid) if L1>L1max, where L1 and L1max are defined in Table 9.5A.4.1-1.

Table 9.5A.4.1-1: Measurement period TL1-RSRP\_Measurement\_Period\_SSB\_CCA for FR1

|  |  |
| --- | --- |
| Configuration | TL1-RSRP\_Measurement\_Period\_SSB\_CCA (ms) |
| non-DRX | max(TReport, ceil((M+L1)\*P)\*TSSB) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*(M+L1)\*P)\*max(TDRX,TSSB)) |
| DRX cycle > 320ms | ceil((M+L1)\*P)\*TDRX |
| Note 1: TSSB = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-RSRP measurement. TDRX is the DRX cycle length.  TReport is configured periodicity for reporting.  Note 2: L1=0 if higher layer parameter timeRestrictionForChannelMeasurement is configured. Otherwise, when DRX is not configured L1 is the number of SSBs not available at the UE during TL1-RSRP\_Measurement\_Period\_SSB\_CCA, and when DRX is configured L1 is the number of DRX cycles in which at least one SSB is not available at the UE during TL1-RSRP\_Measurement\_Period\_SSB\_CCA, where L1 ≤ L1max.  Note 3: L1max =7 for Max(TDRX,TSSB) ≤ 40ms assuming TDRX=0 for non-DRX, L1max =5 for 40ms < Max(TDRX, TSSB) ≤ 320ms,  L1max =3 for TDRX > 320ms. | |

**<<Omitted the unchanged clauses>>**

#### 9.8.4.1 L1-SINR reporting with CSI-RS based CMR and no dedicated IMR configured

Dedicated resource configured as IMR for L1-SINR computation, and the UE physical layer shall be capable of reporting L1-SINR measured over the measurement period of TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only.

The value of TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only is defined in Table 9.8.4.1-1 for FR1 and in Table 9.8.4.1-2 for FR2, where

For the value of M,

- For periodic and semi-persistent CSI-RS resources as CMR, M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise;

- For aperiodic CSI-RS resources as CMR, M=1.

For the value of N in FR2

- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply if *qcl-InfoPeriodicCSI-RS* is configured for all the resources in the resource set and for each resource one RS has QCL-TypeD with

- SSB for L1-RSRP or L1-SINR measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / Nres\_per\_set), where Nres\_per\_set is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured for all resources in the resource set.

- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set and for each resource has QCL-TypeD with

- SSB for L1-RSRP or L1-SINR measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / Nres\_per\_set), where Nres\_per\_set is number of resources in the resource set. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set.

- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requriements apply provided *qcl-info* is configured for all resources in the resource set and for each resource has QCL-TypeD with

- SSB for L1-RSRP or L1-SINR measurement, or

- another CSI-RS in resource set configured with repetition ON.

- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=1. UE is not required to meet the accuracy requirements in clause 10.1.28.1 and 10.1.28.3 if number of resources in the resource set is smaller than *maxNumberRxBeam*. The requriements apply provided *qcl-info* is configured for all resources in the resource set.

For a UE that supports either concurrent measurement gaps, pre-MG gaps or NCSG, measurement gaps in this section includes any configured and active gap.

*Editor’s note: the term “[measurement gap]” in this clause could be either the legacy gap or the VIL or NCSG. RAN4 to further study whether a better terminology can be used to replace [measurement gap].*

For the value of P in FR1, for a UE not supporting [concurrent gaps] or when the UE is not configured with concurrent gaps,

- P=, when in the monitored cell there are [measurement gaps] configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

- P=1 when in the monitored cell there are no [measurement gaps] overlapping with any occasion of the CSI-RS.

For the value of P in FR2, for a UE not supporting [concurrent gaps] or when the UE is not configured with concurrent gaps,

- P=1, when CSI-RS is not overlapped with [measurement gap] and also not overlapped with SMTC occasion.

- P=, when CSI-RS is partially overlapped with [measurement gap] and CSI-RS is not overlapped with SMTC occasion (TCSI-RS < xRP)

- P=, when CSI-RS is not overlapped with [measurement gap] and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod).

- P is Psharing factor,, when CSI-RS is not overlapped with [measurement gap] and CSI-RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod).

- P=, when CSI-RS is partially overlapped with [measurement gap] and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with [measurement gap] and

- TSMTCperiod ≠ xRP or

- TSMTCperiod = xRP and TCSI-RS < 0.5\*TSMTCperiod

- P=, when CSI-RS is partially overlapped with [measurement gap] and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is not overlapped with [measurement gap] and TSMTCperiod = xRP and TCSI-RS = 0.5\*TSMTCperiod

- P=, when CSI-RS is partially overlapped with [measurement gap] (TCSI-RS < xRP) and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < TSMTCperiod) and SMTC occasion is partially or fully overlapped with [measurement gap].

- P=, when CSI-RS is partially overlapped with [measurement gap] and CSI-RS is fully overlapped with SMTC occasion (TCSI-RS = TSMTCperiod) and SMTC occasion is partially overlapped with [measurement gap] (TSMTCperiod < xRP)

When concurrent gaps are configured,

- P value for a CSI-RS resource to be measured is defined as

* Ntotal / Noutside\_MG in FR1
* Psharing factor \* Ntotal / Noutside\_MG in FR2 with Navailable = 0
* Ntotal / Navailable in FR2 with Navailable > 0

- For a window W of duration max(TL1, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any CSI-RS resource occasion:

* Ntotal is the total number of CSI-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and
* Noutside\_MG is the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
* Navailable is the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W
* TL1 is periodicity of the target CSI-RS.

Where:

Psharing factor = 1, if the CSI-RS configured for L1-SINR measurement outside gap is

* not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,
* not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

Psharing factor = 3, otherwise.

TSMTCperiod = the configured SMTC1 period or SMTC2 period if configured.

TCSI-RS = the periodicity of CSI-RS configured for L1-SINR measurement

If the UE is configured with Pre-MG, a CSI-RS reourse or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

When a measurement gap is configured,

* + a CSI-RS is considered to be as overlapped with the [measurement gap] if it overlaps a measurement gap occasion, and
  + xRP = MGRP

When NCSG is configured,

* a CSI-RS is considered to be as overlapped with the [measurement gap] if
  + - it overlaps the VIL1 or VIL2 of NCSG, or
    - it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

and

* + xRP = VIRP

When concurrent gaps are configured, a CSI-RS or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to [9.1.2B].

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, TSMTCperiod corresponds to the value of higher layer parameter *smtc2*; Otherwise TSMTCperiod corresponds to the value of higher layer parameter *smtc1*.

Note: The overlap between CSI-RS for L1-SINR measurement and SMTC means that CSI-RS for L1-SINR measurement is within the SMTC window duration.

Longer evaluation period would be expected if the combination of CSI-RS, SMTC occasion and [measurement gap] configurations does not meet pervious conditions.

Table 9.8.4.1-1: Measurement period TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only for FR1

|  |  |
| --- | --- |
| Configuration | TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only (ms) |
| non-DRX | max(TReport, ceil(M\*P)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | ceil(M\*P)\*TDRX |
| Note 1: TCSI-RS is the periodicity of CSI-RS configured for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3. | |

Table 9.8.4.1-2: Measurement period TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only for FR2

|  |  |
| --- | --- |
| Configuration | TL1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only (ms) |
| non-DRX | max(TReport, ceil(M\*P\*N)\*TCSI-RS) |
| DRX cycle ≤ 320ms | max(TReport, ceil(1.5\*M\*P\*N)\*max(TDRX,TCSI-RS)) |
| DRX cycle > 320ms | ceil(M\*P\*N)\*TDRX |
| Note 1: TCSI-RS is the periodicity of CSI-RS configured for L1-SINR measurement. TDRX is the DRX cycle length. TReport is configured periodicity for reporting.  Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3. | |

**---end of change #16: 9.5 ---**

**--- start of change #17 : 9.9 (R4-2202609, R4-2206879) ---**

## 9.9 NR measurements for positioning

### 9.9.1 Introduction

This clause contains requirements for UE capable of performing NR positioning measurements defined in TS 38.215 [4], including RSTD, PRS-RSRP, UE Rx-Tx time difference, and NR E-CID measurements.

For RSTD, PRS-RSRP and UE Rx-Tx time difference measurements, the requirements in clauses 9.9.2, 9.9.3 and 9.9.4 apply provided:

- the UE is configured or pre-configured with measurement gaps

- if the measurement gap is pre-configured, the gap must be activated throughout the measurement period, and

- if concurrent measurement gaps are configured, all positioning frequency layers are associated with only one of the measurement gaps, and

- if the UE does not support PRS measurements with per-FR gaps, the configured or pre-configured gap used to perform the PRS measurements must be of per-UE type, and

- No active BWP switching occurs during the measurement gaps for PRS measurement, and

All measurement requirements specified in clause 9.9.2, 9.9.3 and 9.9.4 shall apply without DRX as well as for any DRX configuration specified in TS 38.331 [2].

UE is not required to perform additional SSB measurement for the SSB configured as QCL source of PRS resources.

UE is only required to measure PRS resources that are fully or partially overlapped with measurement gaps, and the requirements in clause 9.9.2, 9.9.3 and 9.9.4 are applicable to PRS resources that are fully or partially overlapped with measurement gaps.

A PRS resource is considered to be fully (partially) overlapped with measurement gaps if all (some) of its instances are overlapped with a measurement gap occasion. A PRS resource instance is considered to be overlapped with measurement gap occasion if the minimum number of unmuted repetitions of the instance is fully covered by the MGL excluding RF switching time, where the minimum number is given in the accuracy requirements in clause 10.1.23, 10.1.24 and 10.1.25 for RSTD, PRS-RSRP and UE Rx-Tx time difference, respectively.

When UE is configured with measurement for more than one positioning requests, the measurement period for each request may be longer than measurement period when UE is configured with measurement for single positioning request.

### 9.9.2 RSTD measurements

……….

#### 9.9.2.5 Measurements Period Requirements

When physical layer receives last of *NR-TDOA-ProvideAssistanceData* message and *NR-TDOA-RequestLocationInformation* message from LMF via LPP [34]*,* the UE shall be able to measure multiple (up to the UE capability specified in Clause 9.9.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period defined as:

Where ,

is the index of positioning frequency layer,

is total number of positioning frequency layers, and

is the periodicity of the PRS RSTD measurement in positioning frequency layer i

is the measurement period for PRS RSTD measurement in positioning frequency layer *i* as specified below:

,

where:

is the UE Rx beam sweeping factor. In FR1, = 1; and in FR2, = 8.

is the carrier-specific scaling factor for NR PRS-based positioning measurements in positioning frequency layer *i* as defined in clause 9.1.5.2.

is a scaling factor for a positioning frequency layer to be measured within the associated measurement gap pattern, which is defined as = Ntotal / Navailable for UE configured with concurrent measurement gap, and = 1 for UE not configured with concurrent measurement gap.

* + For a window W of duration max(, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioining frequency layer, and starting at the beginning of any associated gap occasions covering the PRS occasion:
    - * Ntotal is the total number of associated gap occasions covering PRS occasions within the window, including those overlapped with other MG occasions within the window, and
      * Navailable is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG collisions by applying the selected gap collision rule
      * Requirements do not apply if Navailable =0.

is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.

is the time duration of available PRS in the positioning frequency layer i to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only the PRS resources unmuted and fully or partially overlapped with MG are considered.

is the number of PRS RSTD samples and = 4.

is the measurement duration for the last PRS RSTD sample in positioning frequency layer *i*, including the sampling time and processing time, = + ,

is the periodicity of the PRS RSTD measurement in positioning frequency layer i defined as:

*=*

Where,

corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34],

*,* the least common multiple between and .

is the repetition periodicity of the measurement gap applicable for measurement in the PRS frequency layer i.

is the periodicity of DL PRS resource with muting on positioning frequency layer *i*.

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities among all DL PRS resource sets in the positioning frequency layer is used to derive , where,

, is the PRS periodicity with muting per PRS resource,

is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

is the scaling factor considering PRS resource muting. , where

is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

* Note: For the purpose of calculating TPRS,i, only the PRS resources fully or partially covered by the MG are considered.

is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34].

is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot* specified in TS 37.355 [34].

The time *s*tarts from the first MG instance aligned with a DL PRS resource(s) in the assistance data after both the *NR-TDOA-ProvideAssistanceData* message and *NR-TDOA-RequestLocationInformation* message are delivered from LMF to the physical layer of UE via LPP [34].

Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

If during the measurement period of one or more positioning frequency layers, the MG pattern is reconfigured, the measurement period can be longer. When PRS-RSRP is configured for DL-TDOA, RSTD and RSRP are performed over the same measurement period.

When PRS-RSRP is configured for DL-TDOA, RSTD and RSRP are performed over the same measurement period.

The measurement requirements in this clause apply, provided no PRS symbols are dropped during the measurement period TRSTD,Total within measurement gaps due to collisions with other signals; otherwise, the measurement period can be longer.

If CSSF changes during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration .

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 9.9.2 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If handover occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements. The RSTD measurement period can be longer. The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23.

Editor’s note: FFS: Applicable requirements at serving cell change which is not HO.

**<<Omitted the unchanged clauses>>**

### 9.9.3 PRS-RSRP measurements

……

#### 9.9.3.5 Measurement Period Requirements

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], the UE shall be able to measure multiple (up to the UE capability specified in Clause 9.9.3.3) PRS-RSRP measurements, defined in TS 38.215 [4], from configured PRS resources for configured TRPs on configured positioning frequency layers, within ms.

where

*i* is the index of positioning frequency layer,

L is total number of positioning frequency layers,

is the periodicity of the PRS-RSRP measurement in positioning frequency layer *i*.

where

is the carrier specific scaling factor for PRS-RSRP measurements specified in clause 9.1.5.2,

[ is a scaling factor for a positioning frequency layer to be measured within the associated measurement gap pattern, which is defined as = Ntotal / Navailable for UE configured with concurrent measurement gap, and = 1 for UE not configured with concurrent measurement gap.

* + For a window W of duration max(, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioining frequency layer, and starting at the beginning of any associated gap occasions covering the PRS occasion:
    - * Ntotal is the total number of associated gap occasions covering PRS occasions within the window, including those overlapped with other MG occasions within the window, and
      * Navailable is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG collisions by applying the selected gap collision rule
      * [Requirements do not apply if Navailable =0.]

is the scaling factor for Rx beam sweeping, and =1 if positioning frequency layer *i* is in FR1 and =8 if positioning frequency layer *i* is in FR2,

is the time duration of available PRS to be measured in the positioning frequency layer i to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only the PRS resources unmuted and fully or partially overlapped with MG are considered.

is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],

is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot* in clause 6.4.3 of TS 37.355 [34],

is the number of PRS-RSRP measurement samples and = 4,

*= +* is the measurement duration for the last PRS-RSRP sample, including the sampling time and processing time,

is the periodicity of PRS-RSRP measurement in positioning frequency layer *i*,

corresponds to durationOfPRS-ProcessingSymbolsInEveryTms in TS 37.355 [34],

the least common multiple between and ,

is the maximum PRS resource periodicity among all PRS resources in positioning frequency layer i,

is the measurement gap repetition period in positioning frequency layer i.

If positioning frequency layer *i* has more than one DL PRS resource set with different PRS periodicities with muting, , the least common multiple of among the DL PRS resource sets is used to derive , where:

is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

is the scaling factor considering PRS resource muting. If bitmap for higher-layer parameter *DL-* is the scaling factor considering PRS resource muting. , where is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

Note: For the purpose of calculating TPRS,i, only the PRS resources fully or partially covered by the MG are considered.

When PRS-RSRP measurements are configured for DL-AoD, the time starts from the first MG instance aligned with DL PRS resources in the assistance data after both the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

When the PRS-RSRP measurement is configured together with RSTD measurement then the PRS-RSRP measurement shall meet the RSTD measurement requirements defined in clause 9.9.2.

When the PRS-RSRP measurement is configured together with UE Rx-Tx time difference measurement then the PRS-RSRP measurement shall meet the UE Rx-Tx time difference measurement requirements defined in clause 9.9.4.

If CSSF changes during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource:

* if the PRS resource is across two sampling duration of N within duration or
* if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If during the measurement period of one or more positioning frequency layers, the MG pattern is reconfigured either per UE request or not per UE request, the measurement period can be longer.

The requirements in this section apply, provided no PRS symbols are dropped during the measurement period within measurement gaps due to collisions with other signals; otherwise, a longer measurement period may be used.

The requirements in clause 9.9.3 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AoD-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If handover occurs while PRS-RSRP measurements are being performed then the UE shall complete the ongoing PRS-RSRP measurements session. The PRS-RSRP measurement period can be longer. The UE shall meet the PRS-RSRP measurement accuracy requirements in clause 10.1.24.

**<<Omitted the unchanged clauses>>**

### 9.9.4 UE Rx-Tx time difference measurements

……

#### 9.9.4.5 Measurement Period Requirements

When physical layer receives last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34]*,* UE shall be able to measure multiple (up to the UE capability specified in clause 9.9.4.3) UE Rx-Tx time difference measurements as defined in TS 38.215 [4] in configured positioning frequency layers within the measurement period ms.

*.*

where is the index of positioning frequency layer,

is the measurement period for UE Rx-Tx time difference measurements in positioning frequency layer *i* as further defined in this clause,

L is total number of positioning frequency layers, and

is the periodicity of the UE Rx-Tx time difference measurement in positioning frequency layer *i* as defined further in this clause.

Where

is the carrier-specific scaling factor for NR PRS-based measurement in the positioning frequency layer *i* as defined in clause 9.1.5.2,

[ is a scaling factor for a positioning frequency layer to be measured within the associated measurement gap pattern, which is defined as = Ntotal / Navailable for UE configured with concurrent measurement gap, and = 1 for UE not configured with concurrent measurement gap.

.

* + For a window W of duration max(, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioining frequency layer, and starting at the beginning of any associated gap occasions covering the PRS occasion:
    - * Ntotal is the total number of associated gap occasions covering PRS occasions within the window, including those overlapped with other MG occasions within the window, and
      * Navailable is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG collisions by applying the selected gap collision rule
      * [Requirements do not apply if Navailable =0.]

is the scaling factor for Rx beam sweeping, and =1 if positioning frequency layer *i* is in FR1 and =8 if positioning frequency layer *i* is in FR2,

is the time duration of available PRS resources in the positioning frequency layer *i*, to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only the PRS resources unmuted and fully or partially overlapped with MG are considered.

is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in clause 4.2.7.2 of TS 37.355 [34],

is UE capability for number of DL PRS resources that it can process in a slot corresponding to *maxNumOfDL-PRS-ResProcessedPerSlot* as specified in clause 6.4.3 of TS 37.355 [34],

is the number of UE Rx-Tx time difference measurement samples and = 4,

is the measurement duration for the last UE Rx-Tx time difference measurement sample in the positioning layer i, including the sampling time and processing time,  *= +*  ,

is periodicity of UE Rx-Tx time difference measurement in positioning frequency layer *i*:

where

corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34],

, the least common multiple between and

is the measurement gap repetition periodicity in positioning frequency layer *i*.

is the PRS resource periodicity in positioning frequency layer *i*. If the positioning frequency layer *i* has more than one DL PRS resource sets with different PRS periodicities with muting, , the least common multiple of among DL PRS resource sets is used to derive , where

is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

is the scaling factor considering PRS resource muting. , where is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap

Note: For the purpose of calculating TPRS,i, only the PRS resources fully or partially covered by the MG are considered.

The time starts from the first MG instance aligned with DL PRS resources in the assistance data after both the *NR-Multi-RTT-RequestLocationInformation* message and *NR-Multi-RTT-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

The UE Rx-Tx time difference measurement period is restarted if HO occurs during the measurement period and after SRS reconfiguration on the target cell is complete.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration or

- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If during the measurement period of one or more positioning frequency layers, the MG pattern is reconfigured either per UE request or not per UE request, the measurement period can be longer.

The requirements in this section apply, provided no PRS symbols are dropped during the measurement period TUERxTx,Total within measurement gaps due to collisions with other signals; otherwise, a longer measurement period may be used.

When PRS-RSRP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRP measurements are performed over the same measurement period.

The requirements in clause 9.9.4 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-Multi-RTT-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

When PSCell or SCell addition or release does not cause SRS reconfiguration during the measurement period, UE continues the UE Rx-Tx time difference measurement, and the measurement period requirements apply.

When PSCell or SCell addition or release causes SRS reconfiguration during the measurement period, UE shall restart the UE Rx-Tx time difference measurement after the SRS reconfiguration on the target cell is complete.

*Editor’s note:* FFS when SRS is reconfigured without cell change during the measurement period, UE shall restart the UE Rx-Tx time difference measurement after the SRS reconfiguration on the target cell is complete.

If UE uplink transmission timing changes due to the network-configured Timing Advance command during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the change in the NTA\_offset defined in Table 7.1.2-2 during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

**--- end of change #17: 9.9 #1 ---**

**--- start of change #18: 9.10 (R4-2202610, R4-2206878) ---**

#### 9.10.2.5 Intra-frequency measurements without measurement gaps

If a UE is configured with the higher layer parameters *CSI-RS-Resource-Mobility* and *associatedSSB*, the CSI-RS based measurement shall include PSS/SSS detection time of associatedSSB, the time period used to acquire the SFN information and CSI-RS based measurement period without gap.

- PSS/SSS detection time of associatedSSB is the intra-frequency TPSS/SSS\_sync\_intra in Clause 9.2.5.1.

- The time period used to acquire the SFN information is TCSI-RS\_SFN\_intra as shown in Table 9.10.2.5-3 for FR1 and is the same as the intra-frequency TSSB\_time\_index\_intra in Clause 9.2.5.1 for FR2. If the UE is indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled), the time period is equal to 0. It is assumed that deriveSSB-IndexFromCell is always enabled for FR1 TDD and FR2.

- If the associatedSSB, which has been detectable at least for the time period Tidentify\_intra\_with\_index defined in clause 9.2.5.1, becomes undetectable for a period ≤ 5 seconds and then the associatedSSB becomes detectable again with the same spatial reception parameter provided the timing to that cell has not changed more than  3200 Tc, PSS/SSS detection time and time period used to acquire the SFN information are equal to 0.

The measurement period for CSI- RS based intra-frequency measurements without gaps is as shown in table 9.10.2.5-1and Table 9.10.2.5-2.

Additionally, for a given CSI-RS resource, if the associated SS/PBCH block is configured but not detected by the UE, or if CSI-RS is configured with associated SSB but not QCL-ed to the associated SSB, the UE is not required to monitor the corresponding CSI-RS resource.

Table 9.10.2.5-1: Measurement period for intrafrequency CSI-RS based measurements without gaps(FR1)

|  |  |
| --- | --- |
| DRX cycle | T CSI-RS\_measurement\_period\_intra |
| No DRX | max(200ms, ceil( 5 x Kp\_CSI-RS) x CSI-RS period) x CSSFintra |
| DRX cycle≤ 320ms | max(200ms, ceil(1.5x 5 x Kp\_CSI-RS) x max(CSI-RS period, DRX cycle)) x CSSFintra |
| DRX cycle>320ms | ceil( 5 x Kp\_CSI-RS) x DRX cycle x CSSFintra |
| NOTE 1: The requirements apply assuming CSI-RS configuration with {D=3 with PRBs ≥ 48}. D is frequency domain density for the 1-port CSI-RS for L3 mobility defined in clause 7.4.1 of TS38.211 [6]. | |

Table 9.10.2.5-2: Measurement period for intrafrequency CSI-RS based measurements without gaps(FR2)

|  |  |
| --- | --- |
| DRX cycle | T CSI-RS\_measurement\_period\_intra |
| No DRX | max(400ms, ceil(Mmeas\_period\_w/o\_gaps x Kp\_CSI-RS) x CSI-RS period) x CSSFintra |
| DRX cycle≤ 320ms | max(400ms, ceil(1.5x Mmeas\_period\_w/o\_gaps x Kp\_CSI-RS) x max(CSI-RS period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | Mmeas\_period\_w/o\_gaps x DRX cycle x CSSFintra |
| NOTE 1: The requirements apply assuming CSI-RS configuration with {D=3 with PRBs ≥ 48}. D is frequency domain density for the 1-port CSI-RS for L3 mobility defined in clause 7.4.1 of TS38.211 [6]. | |

Mmeas\_period\_w/o\_gaps : For a UE supporting power class 1, Mmeas\_period\_w/o\_gaps =40. For a UE supporting FR2 power class 2, Mmeas\_period\_w/o\_gaps =24. For a UE supporting power class 3, Mmeas\_period\_w/o\_gaps =24. For a UE supporting power class 4, Mmeas\_period\_w/o\_gaps =24.

CSSFintra: it is a carrier specific scaling factor and is determined according to CSSFoutside\_gap,i in clause 9.1.5.

[For a UE not supporting [concurrent gap] or for a UE is supporting [concurrent gap] but not configured with concurrent measurement gaps,

- if the intra-frequency CSI-RS resource does not overlap with any measurement gaps, Kp\_CSI-RS=1;

- if some occaions of the intra-frequency CSI-RS resource is overlap with ameasurement gaps, Kp\_CSI-RS = 1/(1- (CSI-RS resource period /MGRP)) , where CSI-RS resource period < MGRP, and the MGRP is the periodicity of the measurement gap.

- Otherwise, if a UE which support concurrent measurement gaps and has been configured with concurrent measurement gaps, Kp\_CSI-RS is the scaling factor for a CSI-RS frequency layer to be measured outside gap which is defined as Kp\_CSI-RS = Ntotal / Navailable

* For a window W of duration max(CSI-RS period, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the CSI-RS frequency layer, and starting at the beginning of any gap occasions covering the CSI-RS resources:
  + Ntotal is the total number of CSI-RS resources within the window, including those overlapped with other MG occasions within the window, and
  + Navailable is the number of CSI-RS resources that are not overlapped with any other non-dropped MG occasion within the window W, after accounting for MG collisions by applying the selected gap collision rule.
* Kp\_CSI-RS = 1 when Navailable = 0

.

Table 9.10.2.5-3: Time period for SFN acquisition for intra-frequency CSI-RS based measurements without gaps(FR1)

|  |  |
| --- | --- |
| DRX cycle | TCSI-RS\_SFN\_intra |
| No DRX | max(200ms, ceil(5 x Kp )x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 320ms | max(2000ms, ceil (1.5 x 5 x Kp) x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320ms | Ceil(5 x Kp) x DRX cycle x CSSFintra |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified  NOTE 2: Kp\_CSI-RS is applicable for a UE supporting concurrent gaps | |

**<<Omitted the unchanged clauses>>**

### 9.10.3 CSI-RS based Inter-frequency measurements

#### 9.10.3.1 Introduction

A measurement is defined as a CSI-RS based inter-frequency measurement provided it is not defined as an intra-frequency measurement according to clause 9.10.2.

If a UE is configured with the higher layer parameter *CSI-RS-Resource-Mobility* and the higher layer parameter *associatedSSB* is configured, the UE shall be able to identify inter-frequency cells indicated for measurement and perform CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements of identified inter-frequency cells.

When measurement gaps are needed, the UE is not expected to detect the associated SSB nor perform measurement of the CSI-RS resource configured in *CSI-RS-Resource-Mobility* on an inter-frequency measurement object which start earlier than the gap starting time + switching time, and ends later than the gap end – switching time. When the inter-frequency cells are in FR2 and the per-FR gap is configured to the UE in EN-DC, SA NR, NE-DC and NR-DC, or the serving cells are in FR2, the inter-frequency cells are in FR2 and the per-UE gap is configured to the UE in SA NR and NR-DC, the switching time is 0.25ms. Otherwise the switching time is 0.5ms.

If a UE is configured with multiple concurrent gaps, the requirements in this clause shall apply when the measurement gap pattern is configured to be associated to the CSI-RS resources of the inter-frequency layer.

**<<Omitted the unchanged clauses>>**

#### 9.10.3.5 Inter frequency measurements with measurement gaps

When measurement gaps are provided, if configured with the higher layer parameters *CSI-RS-Resource-Mobility* and *associatedSSB,* the UE shall be able to identify a new detectable CSI-RS based inter frequency cell within T CSI-RS\_identify\_inter,

T CSI-RS\_identify\_inter = (TPSS/SSS\_sync + T CSI-RS\_measurement\_period\_inter + TCSI-RS\_SFN\_inter) ms

Where:

TPSS/SSS\_sync is the time period used in PSS/SSS detection which is determined according to TPSS/SSS\_sync\_inter in clause9.3.4,

TCSI-RS\_SFN\_inter is the time period used to acquire the SFN information of the cell being measured, which is shown in Table 9.10.3.5-3 for FR1 and equals inter-frequency TSSB\_time\_index\_inter in Clause 9.3.4 for FR2.

TCSI-RS\_measurement\_period\_inter: equal to a measurement period of CSI-RS based measurement given in table 9.10.3.5-1 and table 9.10.3.5-2..

Mmeas\_period\_inter: For a UE supporting FR2 power class 1 or 5, Mmeas\_period\_inter =8×N samples. For a UE supporting FR2 power class 2, Mmeas\_period\_inter=5×N samples. For a UE supporting FR2 power class 3, Mmeas\_period\_inter =5×N samples. For a UE supporting FR2 power class 4, Mmeas\_period\_inter = 5×N samples. Note that scaling factor N = [8].

CSSFinter: it is a carrier specific scaling factor and is determined according to CSSFwithin\_gap,i in clause 9.1.5 for measurement conducted within measurement gaps.

If a UE which supports concurrent measurement gaps has been configured with concurrent measurement gaps, Kp\_CSI-RS is the scaling factor for a CSI-RS frequency layer to be measured within the associated measurement gap which is defined as Kp\_CSI-RS = Ntotal / Navailable. Kp\_CSI-RS = 1 for for UE not configured with concurrent measurement gaps.

* + For a window W of duration max(CSI-RS period, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the CSI-RS frequency layer, and starting at the beginning of any gap occasions covering the CSI-RS resources.:
    - Ntotal is the total number of associated gap occasions covering CSI-RS resources within the window, including those overlapped with other MG occasions within the window, and
    - Navailable is the number of non-dropped associated gap occasions covering CSI-RS resources within the window W, after accounting for MG collisions by applying the selected gap collision rule.
    - Requirements do not apply if Navailable = 0

Additionally, for a given CSI-RS resource, if the associated SSB is configured but not detected by the UE, or if CSI-RS configured with associated SSB but not QCL-ed to the associated SSB, the UE is not required to monitor the corresponding CSI-RS resource.

Table 9.10.3.5-1: Measurement period for CSI-RS based inter-frequency measurements with gaps (FR1)

|  |  |
| --- | --- |
| Condition NOTE1,2 | T CSI-RS\_measurement\_period\_inter |
| No DRX | Max(200ms, ceil(8 × Kp\_CSI-RS) × Max(MGRP, CSI-RS period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(8 × 1.5 × Kp\_CSI-RS)) × Max(MGRP, CSI-RS period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(8 × Kp\_CSI-RS) × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: If UE support concurrent gaps and multiple concurrent gaps are configured, the MGRP is the periodicity of the MG pattern associated to the CSI-RS resources of the inter-frequency layer.  NOTE 4: Kp\_CSI-RS is applicable for a UE supporting concurrent gaps | |

Table 9.10.3.5-2: Measurement period for CSI-RS based inter-frequency measurements with gaps (FR2)

|  |  |
| --- | --- |
| Condition NOTE1,2 | T CSI-RS\_measurement\_period\_inter |
| No DRX | Max(400 ms, ceil( Mmeas\_period\_inter × Kp\_CSI-RS )× Max(MGRP, CSI-RS period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(400 ms, ceil(1.5 × Mmeas\_period\_inter× Kp\_CSI-RS) × Max(MGRP, CSI-RS period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(Mmeas\_period\_inter × Kp\_CSI-RS )× DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: If UE support concurrent gaps and multiple concurrent gaps are configured, the MGRP is the periodicity of the MG pattern associated to the CSI-RS resources of the inter-frequency layer.  NOTE 4: Kp\_CSI-RS is applicable for a UE supporting concurrent gaps | |

Table 9.10.3.5-3: Time period for SFN acuisition for interfrequency CSI-RS based measurements with gaps(FR1)

|  |  |
| --- | --- |
| Condition NOTE1,2 | T CSI-RS\_SFN\_inter |
| No DRX | Max(200ms, ceil(5 × Kp\_CSI-RS )× Max(MGRP, SMTC period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(5 × 1.5 × Kp\_CSI-RS) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(5 × Kp\_CSI-RS )× DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1  NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.  NOTE 3: If UE support concurrent gaps and multiple concurrent gaps are configured, the MGRP is the periodicity of the MG pattern associated to *associatedSSB*.  NOTE 4: Kp\_CSI-RS is applicable for a UE supporting concurrent gaps | |

**--- end of change #18: 9.10 ---**