**IoT TDD Review file**

**3GPP TSG-RAN WG2 Meeting #131 R2-2506558**

Bengaluru, India, 25 - 29 Aug 2025

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **36.331** | **CR** | **5138** | **rev** | **1** | **Current version:** | **18.6.0** |  |
|  | | | | | | | | |
| *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 | **X** | Core Network |  |

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|  | | | | | | | | | | |
| ***Title:*** | Introduction of IoT NTN TDD mode | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | IoT\_NTN\_TDD-Core | | | | |  | ***Date:*** | | | 2025-09-05 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-19 |
|  | *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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19) Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | To introduce Rel-19 IoT NTN TDD mode to TS 36.331 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Introduce Rel-19 IoT NTN TDD mode to TS 36.331 based on the following agreements:   1. For IoT NTN TDD mode, support k-Mac with a value range up to 1023 ms (add corresponding a restriction in the field description). 2. The SI-message transmission can be postponed to the next valid D frame within the SI-Window 3. For the timer of ra-ResponseWindowSize and mac-ContentionResolutionTimer, the absolute value limitation for FDD (i.e., 10.24s) is used for IoT NTN TDD. 4. Introduce the following definition for IoT-NTN TDD mode in the impacted RAN2 specifications: IoT-NTN TDD mode: allows use of NB-IoT channels with TDD mode for NTN with fixed values of D non-overlapping usable contiguous DL subframes and set of U usable contiguous UL subframes separated by fixed guard period (can revisit this based on the TP being prepared by RAN1) 5. TDD radio frame offset between serving cell and neighbor cell(s) can be provided via SIB33 to the UE for neighbor cell measurement. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Rel-19 IoT NTN TDD mode is not supported. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.1, 5.2.1.2a, 5.2.3a, 6.7.2, 6.7.3.1, 6.7.3.2, 6.7.3.7a | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **x** |  | Other core specifications | | | | TS 36.321 CR 1592  TS 36.304 CR 0883  TS 36.300 CR 1426  TS 36.306 CR 1914 | | |
| ***affected:*** | |  | **x** | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

**A2X communication**: A communication to support A2X services leveraging PC5 reference points, as defined in TS 23.256 [115]. A2X services are realized by various types of A2X applications, e.g., BRID or DAA.

**Aerial UE:** UE performing Aerial UE communication, as defined in TS 36.300 [9], clause 23.17 and TS 23.256 [115].

**Anchor carrier:** In NB-IoT, a carrier where the UE assumes that NPSS/NSSS/NPBCH/SIB-NB for FDD or NPSS/NSSS/NPBCH for TDD are transmitted.

**Bandwidth Reduced:** Refers to operation in downlink and uplink with a limited channel bandwidth of 6 PRBs.

**CEIL:** Mathematical function used to 'round up' i.e. to the nearest integer having a higher or equal value.

**Cellular IoT EPS Optimisation**: Provides improved support of small data transfer, as defined in TS 24.301 [35].

**Commercial Mobile Alert System:** Public Warning System that delivers *Warning Notifications* provided by *Warning Notification Providers* to CMAS capable UEs.

**Common access barring parameters:** The common access barring parameters refer to the access class barring parameters that are broadcast in *SystemInformationBlockType2* outside the list of PLMN specific parameters (i.e. in *ac-BarringPerPLMN-List*).

**Control plane CIoT 5GS optimisation:** Enables support of efficient transport of user data (IP, Ethernet or unstructured) or SMS messages over control plane via the AMF without triggering data radio bearer establishment, as defined in TS 24.501 [95].

**Control plane CIoT EPS optimisation**: Enables support of efficient transport of user data (IP, non-IP or SMS) over control plane via the MME without triggering data radio bearer establishment, as defined in TS 24.301 [35].

**Control plane EDT**: Early Data Transmission used with the Control plane CIoT EPS optimisation or Control plane CIoT 5GS optimisation.

**Coverage-based paging**: In NB-IoT allows UE to use paging carriers configured for lower levels of coverage enhancement than maximum coverage enhancement supported in the cell as described in TS 36.300 [9].

**CSG member cell:** A cell broadcasting the identity of the selected PLMN, registered PLMN or equivalent PLMN and for which the Permitted CSG list of the UE includes an entry comprising cell's CSG ID and the respective PLMN identity.

**DAPS bearer**: A bearer whose radio protocols are located in both the source eNB and the target eNB during a DAPS handover to use both source eNB and target eNB resources.

**Dual Connectivity**: A UE in RRC\_CONNECTED is configured with Dual Connectivity when configured with a Master and a Secondary Cell Group.

**Early Data Transmission:** Allows one uplink data transmission optionally followed by one downlink data transmission during the random access procedure as specified in TS 36.300 [9]. The S1 connection is established or resumed upon reception of the uplink data and may be released or suspended along with the transmission of the downlink data. Early data transmission refers to both CP-EDT and UP-EDT.

**Early Security Reactivation:** Re-activation of AS security prior to the transmission of *RRCConnectionResumeRequest* message when a UE is provided with an NCC value during suspension.

**Earth-moving cell**: An NTN cell moving on the ground. It can be provisioned by beam(s) whose coverage area slides over the Earth's surface (e.g., the case of NGSO satellites generating fixed or non-steerable beams).

**Ephemeris:** A set of parameters that describe the movement of an NTN node over time.

**E-UTRA-NR Dual Connectivity:** A form of dual connectivity in which a UE in RRC\_CONNECTED is configured with MCG cells using E-UTRA and SCG cells using NR as defined in TS 37.340 [81].

**EU-Alert:** Public Warning System that delivers Warning Notifications provided by Warning Notification Providers using the same AS mechanisms as defined for CMAS.

**Field:** The individual contents of an information element are referred as fields.

**FLOOR:** Mathematical function used to 'round down' i.e. to the nearest integer having a lower or equal value.

**FR1:** Frequency range 1 as defined in clause 5.1 of TS 38.101-1 [85].

**FR2:** Frequency range 2 as defined in clause 5.1 of TS 38.101-2 [100].

**Geosynchronous Orbit:** Earth-centred orbit at approximately 35,786 kilometres in altitude above Earth's surface and synchronised with Earth's rotation. A geostationary orbit is a non-inclined geosynchronous orbit, i.e. in the Earth's equator plane.

**Information element:** A structural element containing a single or multiple fields is referred as information element.

**IoT NTN TDD:** A mode of operation that allows use of NB-IoT FDD channels in TDD fashion, as defined in TS 36.300 [9].

**Korean Public Alert System (KPAS):** Public Warning System that delivers Warning Notifications provided by Warning Notification Providers using the same AS mechanisms as defined for CMAS.

**Master Cell Group**: For a UE not configured with DC, the MCG comprises all serving cells. For a UE configured with DC, the MCG concerns a subset of the serving cells comprising of the PCell and zero or more secondary cells.

**Mixed Operation Mode:** In NB-IoT FDD, multi-carrier operation where the anchor carrier is in standalone mode while the non-anchor carrier is in inband or guardand mode, and vice versa. See TS 36.300 [9].

**MBMS service:** MBMS bearer service as defined in TS 23.246 [56] (i.e. provided via an MRB or an SC-MRB).

**NB-IoT:** NB-IoT allows access to network services via E-UTRA with a channel bandwidth limited to 200 kHz.

**NB-IoT UE:** A UE that uses NB-IoT.

**NCSG:** Network controlled small gap as defined in TS 36.133 [16].

**Non-geosynchronous orbit:** Earth-centred orbit with an orbital period that does not match Earth's rotation on its axis. This includes Low Earth Orbit (LEO) and Medium Earth Orbit (MEO).

**Non-terrestrial networks:** An E-UTRAN consisting of eNBs, which provide non-terrestrial LTE access to UEs by means of an NTN payload embarked on a space-borne NTN vehicle and an NTN Gateway.

**NR-E-UTRA Dual Connectivity (NE-DC):** A form of dual connectivity in which a UE in RRC\_CONNECTED is configured with MCG cells using NR and SCG cells using E-UTRA as defined in TS 37.340 [81].

**Non-anchor carrier:** In NB-IoT, a carrier where the UE does not assume that NPSS/NSSS/NPBCH/SIB-NB for FDD or NPSS/NSSS/NPBCH for TDD are transmitted.

**NR Carrier Frequency:** Frequency referring to the position of resource element RE=#0 (subcarrier #0) of resource block RB#10 of the SS block.

**NR sidelink communication**: AS functionality enabling at least V2X Communication as defined in TS 23.287 [104] and/or A2X Communication as defined in TS 23.256 [115], between two or more nearby UEs, using NR technology but not traversing any network node.

**Primary Cell**: The cell, operating on the primary frequency, in which the UE either performs the initial connection establishment procedure or initiates the connection re-establishment procedure, or the cell indicated as the primary cell in the handover procedure.

**Primary Secondary Cell**: The SCG cell in which the UE is instructed to perform random access or initial PUSCH transmission if random access procedure is skipped when performing the SCG change procedure.

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

**PUCCH SCell:** An SCell configured with PUCCH.

**Quasi-earth fixed cell:** An NTN cell fixed with respect to a certain geographic area on the earth during a certain time duration. This can be provided by beam(s) covering one geographic area for a finite period and a different geographic area during another period (e.g., the case of NGSO satellites generating steerable beams).

**RLC bearer configuration:** The lower layer part of the radio bearer configuration comprising the RLC and logical channel configurations.

**Satellite:** A space-borne vehicle orbiting the Earth that carries the NTN payload.

**Secondary Cell**: A cell, operating on a secondary frequency, which may be configured once an RRC connection is established and which may be used to provide additional radio resources. Except for the case of (NG)EN-DC, the PSCell is considered to be an SCell.

**Secondary Cell Group**: For a UE configured with DC, the subset of serving cells not part of the MCG, i.e. comprising of the PSCell and zero or more other secondary cells.

**Secondary Timing Advance Group**: Timing Advance Group neither containing the PCell nor the PSCell. A secondary timing advance group contains at least one cell with configured uplink.

**Serving Cell**: For a UE in RRC\_CONNECTED not configured with CA/ DC there is only one serving cell comprising of the primary cell. For a UE in RRC\_CONNECTED configured with CA/ DC the term 'serving cells' is used to denote the set of one or more cells comprising of the primary cell and all secondary cells.

**Sidelink**: UE to UE interface for sidelink communication, V2X sidelink communication, A2X sidelink communication and sidelink discovery. The sidelink corresponds to the PC5 interface as defined in TS 23.303 [68].

**Sidelink communication**: AS functionality enabling ProSe Direct Communication as defined in TS 23.303 [68], between two or more nearby UEs, using E-UTRA technology but not traversing any network node. In this version, the terminology "sidelink communication" without "V2X" or "A2X" prefix only concerns PS unless specifically stated otherwise.

**Sidelink discovery**: AS functionality enabling ProSe Direct Discovery as defined in TS 23.303 [68], using E-UTRA technology but not traversing any network node.

**Sidelink operation**: Includes sidelink communication, V2X sidelink communication, A2X sidelink communication and sidelink discovery.

**Split SRB**: in MR-DC, an SRB between the MN and the UE, allowing selection of either the direct path or the path via the SN as well as duplication of RRC PDUs across both paths as defined in TS 37.340 [81].

**Timing Advance Group**: A group of serving cells that is configured by RRC and that, for the cells with an UL configured, use the same timing reference cell and the same Timing Advance value. A Timing Advance Group only includes cells of the same cell group i.e. it either includes MCG cells or SCG cells.

**Transmission using PUR:** Allows one uplink data transmission using preconfigured uplink resource from RRC\_IDLE mode as specified in TS 36.300 [9]. Transmission using PUR refers to both CP transmission using PUR and UP transmission using PUR.

**UE Inactive AS Context:** UE Inactive AS Context is stored when the connection is suspended and restored when the connection is resumed. It includes information as defined in clause 5.3.8.7.

**UE in CE:** Refers to a UE that is capable of using coverage enhancement, and requires coverage enhancement mode to access a cell or is configured in a coverage enhancement mode.

**User plane CIoT 5GS optimisation:** Enables support for change from 5GMM-IDLE mode to 5GMM-CONNECTED mode without the need for using the Service Request procedure, as defined in TS 24.501 [95].

**User plane CIoT EPS optimisation**: Enables support for change from EMM-IDLE mode to EMM-CONNECTED mode without the need for using the Service Request procedure, as defined in TS 24.301 [35].

**User plane EDT:** Early Data Transmission used with the User plane CIoT EPS optimisation or User plane CIoT 5GS optimisation.

**V2X sidelink communication**: AS functionality enabling V2X Communication as defined in TS 23.285 [78], between nearby UEs, using E-UTRA technology but not traversing any network node.

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1], TS 36.300 [9] 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 [1] or TS 36.300 [9].

1xRTT CDMA2000 1x Radio Transmission Technology

A2X Aircraft-to-Everything

AB Access Barring

ACDC Application specific Congestion control for Data Communication

ACK Acknowledgement

AILC Assistance Information bit for Local Cache

AM Acknowledged Mode

ANDSF Access Network Discovery and Selection Function

ARQ Automatic Repeat Request

AS Access Stratum

ASN.1 Abstract Syntax Notation One

AUL Autonomous Uplink

BCCH Broadcast Control Channel

BCD Binary Coded Decimal

BCH Broadcast Channel

BL Bandwidth reduced Low complexity

BLER Block Error Rate

BR Bandwidth Reduced

BR-BCCH Bandwidth Reduced Broadcast Control Channel

BRID Broadcast Remote Identification

CA Carrier Aggregation

CAS Cell Acquisition Subframes

CBP Coverage-Based Paging

CBR Channel Busy Ratio

CCCH Common Control Channel

CCO Cell Change Order

CE Coverage Enhancement

CFI Control Format Indicator

CG Cell Group

CHO Conditional Handover

CIoT Cellular IoT

CMAS Commercial Mobile Alert Service

CP Control Plane

CPA Conditional PSCell Addition

CPC Conditional PSCell Change

CP-EDT Control Plane EDT

C-RNTI Cell RNTI

CRS Cell-specific Reference Signal

CSFB CS fallback

CSG Closed Subscriber Group

CSI Channel State Information

DAA Detect And Avoid

DAPS Dual Active Protocol Stack

DC Dual Connectivity

DCCH Dedicated Control Channel

DCI Downlink Control Information

DCN Dedicated Core Networks

DFN Direct Frame Number

DL Downlink

DL-SCH Downlink Shared Channel

DRB (user) Data Radio Bearer

DRX Discontinuous Reception

DTCH Dedicated Traffic Channel

EAB Extended Access Barring

ECEF Earth-Centered, Earth-Fixed

ECI Earth-Centered Inertial

eDRX Extended DRX

EDT Early Data Transmission

EHPLMN Equivalent Home Public Land Mobile Network

eIMTA Enhanced Interference Management and Traffic Adaptation

ENB Evolved Node B

EN-DC E-UTRA NR Dual Connectivity with E-UTRAN connected to EPC

EPC Evolved Packet Core

EPDCCH Enhanced Physical Downlink Control Channel

EPS Evolved Packet System

ETWS Earthquake and Tsunami Warning System

E-UTRA Evolved Universal Terrestrial Radio Access

E-UTRA/5GC E-UTRA connected to 5GC

E-UTRA/EPC E-UTRA connected to EPC

E-UTRAN Evolved Universal Terrestrial Radio Access Network

FDD Frequency Division Duplex

FFS For Further Study

GERAN GSM/EDGE Radio Access Network

GNSS Global Navigation Satellite System

G-RNTI Group RNTI

GSM Global System for Mobile Communications

GSO Geosynchronous Orbit

GWUS Group Wake Up Signal

HARQ Hybrid Automatic Repeat Request

HFN Hyper Frame Number

HPLMN Home Public Land Mobile Network

HRPD CDMA2000 High Rate Packet Data

HSDN High Speed Dedicated Network

H-SFN Hyper SFN

IAB Integrated Access and Backhaul

IAB-DU IAB-node DU

IAB-MT IAB Mobile Termination

IDC In-Device Coexistence

IE Information element

IMEI International Mobile Equipment Identity

IMSI International Mobile Subscriber Identity

IoT Internet of Things

ISM Industrial, Scientific and Medical

kB Kilobyte (1000 bytes)

L1 Layer 1

L2 Layer 2

L3 Layer 3

LAA Licensed-Assisted Access

LWA LTE-WLAN Aggregation

LWAAP LTE-WLAN Aggregation Adaptation Protocol

LWIP LTE-WLAN Radio Level Integration with IPsec Tunnel

MAC Medium Access Control

MBMS Multimedia Broadcast Multicast Service

MBSFN Multimedia Broadcast multicast service Single Frequency Network

MCG Master Cell Group

MCOT Maximum Channel Occupancy Time

MCPTT Mission Critical Push To Talk

MDT Minimization of Drive Tests

MIB Master Information Block

MO Mobile Originating

MPDCCH MTC Physical Downlink Control Channel

MRB MBMS Point to Multipoint Radio Bearer

MR-DC Multi-Radio Dual Connectivity

MRO Mobility Robustness Optimisation

MSI MCH Scheduling Information

MT Mobile Terminating

MTSI Multimedia Telephony Service for IMS

MUSIM Multi-Universal Subscriber Identity Module

MUST MultiUser Superposition Transmission

N/A Not Applicable

NACC Network Assisted Cell Change

NAICS Network Assisted Interference Cancellation/Suppression

NAS Non Access Stratum

NB-IoT NarrowBand Internet of Things

NE-DC NR E-UTRA Dual Connectivity

(NG)EN-DC E-UTRA NR Dual Connectivity (i.e. covering both EN-DC and NGEN-DC)

NGEN-DC E-UTRA NR Dual Connectivity with E-UTRAN connected to 5GC

NGSO Non-Geosynchronous Orbit

NPBCH Narrowband Physical Broadcast channel

NPDCCH Narrowband Physical Downlink Control channel

NPDSCH Narrowband Physical Downlink Shared channel

NPRACH Narrowband Physical Random Access channel

NPSS Narrowband Primary Synchronization Signal

NPUSCH Narrowband Physical Uplink Shared channel

NR NR Radio Access

NRS Narrowband Reference Signal

NSSAI Network Slice Selection Assistance Information

NSSS Narrowband Secondary Synchronization Signal

NTN Non-Terrestrial Network

OS OFDM Symbol

P2X Pedestrian-to-Everything

PCCH Paging Control Channel

PCell Primary Cell

PDCCH Physical Downlink Control Channel

PDCP Packet Data Convergence Protocol

PDU Protocol Data Unit

PLMN Public Land Mobile Network

PMK Pairwise Master Key

PO Paging Occasion

posSIB Positioning SIB

ProSe Proximity based Services

PS Public Safety (in context of sidelink), Packet Switched (otherwise)

PSCell Primary Secondary Cell

PSK Pre-Shared Key

PTAG Primary Timing Advance Group

PUCCH Physical Uplink Control Channel

PUR Preconfigured Uplink Resource

QCI QoS Class Identifier

QoE Quality of Experience

QoS Quality of Service

RACH Random Access CHannel

RAI Release Assistance Indication

RAT Radio Access Technology

RB Radio Bearer

RCLWI RAN Controlled LTE-WLAN Integration

RLC Radio Link Control

RLOS Restricted Local Operator Services

RMTC RSSI Measurement Timing Configuration

RN Relay Node

RNA RAN-based Notification Area

RNAU RAN-based Notification Area Update

RNTI Radio Network Temporary Identifier

ROHC RObust Header Compression

RPLMN Registered Public Land Mobile Network

RRC Radio Resource Control

RSCP Received Signal Code Power

RSRP Reference Signal Received Power

RSRQ Reference Signal Received Quality

RSS Resynchronisation signal

RSSI Received Signal Strength Indicator

SAE System Architecture Evolution

SAP Service Access Point

SBAS Satellite Based Augmentation System

SC Sidelink Control

SCell Secondary Cell

SCG Secondary Cell Group

SC-MRB Single Cell MRB

SC-RNTI Single Cell RNTI

SD-RSRP Sidelink Discovery Reference Signal Received Power

SFN System Frame Number

SHR Successfull Handover Report

SI System Information

SIB System Information Block

SI-RNTI System Information RNTI

SL Sidelink

SLSS Sidelink Synchronisation Signal

SMC Security Mode Control

SMTC SS/PBCH Block Measurement Timing Configuration

SPDCCH Short PDCCH

SPS Semi-Persistent Scheduling

SPT Short Processing Time

SPUCCH Short PUCCH

SR Scheduling Request

SRB Signalling Radio Bearer

S-RSRP Sidelink Reference Signal Received Power

SSAC Service Specific Access Control

SSTD SFN and Subframe Timing Difference

STAG Secondary Timing Advance Group

S-TMSI SAE Temporary Mobile Station Identifier

STTI Short TTI

TA Tracking Area

TAG Timing Advance Group

TDD Time Division Duplex

TDM Time Division Multiplexing

TLE Two-Line Element

TM Transparent Mode

TN Terrestrial Network

TPC-RNTI Transmit Power Control RNTI

T-RPT Time Resource Pattern of Transmission

TTI Transmission Time Interval

TTT Time To Trigger

UDC Uplink Data Compression

UE User Equipment

UICC Universal Integrated Circuit Card

UL Uplink

UL-SCH Uplink Shared Channel

UM Unacknowledged Mode

UP User Plane

UP-EDT User Plane EDT

UTC Coordinated Universal Time

UTRAN Universal Terrestrial Radio Access Network

V2X Vehicle-to-Everything

VoLTE Voice over Long Term Evolution

WLAN Wireless Local Area Network

WT WLAN Termination

WUS Wake-up Signal

In the ASN.1, lower case may be used for some (parts) of the above abbreviations e.g. c-RNTI.

# 4 General

## 4.1 Introduction

In this specification, (parts of) procedures and messages specified for the UE equally apply to the RN for functionality necessary for the RN. There are also (parts of) procedures and messages which are only applicable to the RN in its communication with the E-UTRAN, in which case the specification denotes the RN instead of the UE. Such RN‑specific aspects are not applicable to the UE.

This specification covers MR-DC i.e. the case in which the UE is configured with resources belonging to another node using NR RAT. The NR related configuration is performed using NR RRC as specified in TS 38.331 [82].

NB-IoT is a non backward compatible variant of E-UTRAN supporting a reduced set of functionality. In this specification, (parts of) procedures and messages specified for the UE equally apply to the UE in NB-IoT. There are also some features and related procedures and messages that are not supported by UEs in NB-IoT.

In particular, the following features are not supported in NB-IoT and corresponding procedures and messages do not apply to the UE in NB-IoT:

- Connected mode mobility (Handover and measurement reporting);

- Inter-RAT cell reselection or inter-RAT mobility in connected mode;

- RRC\_INACTIVE;

- CSG;

- Relay Node (RN);

- Carrier Aggregation (CA);

- Dual connectivity (DC);

- Multi-Radio Dual Connectivity (MR-DC);

- PDCP duplication;

- GBR (QoS);

- ACB, EAB, SSAC and ACDC;

- MBMS, except for MBMS via SC-PTM in Idle mode;

- Measurement logging and reporting for network performance optimisation;

- Public warning systems e.g. CMAS, ETWS and PWS;

- Broadcast of positioning assistance data;

- Real time services (including emergency call);

- CS services and CS fallback;

- In-device coexistence;

- RAN assisted WLAN interworking;

- Network-assisted interference cancellation/suppression;

- Sidelink (including direct communication and direct discovery).

NOTE: In regard to mobility, NB-IoT is a separate RAT from E-UTRAN.

In this specification, there are also (parts of) procedures and messages which are only applicable to UEs in NB-IoT, in which case this is stated explicitly.

This specification is organised as follows:

- clause 4.2 describes the RRC protocol model;

- clause 4.3 specifies the services provided to upper layers as well as the services expected from lower layers;

- clause 4.4 lists the RRC functions;

- clause 5 specifies RRC procedures, including UE state transitions;

- clause 6 specifies the RRC message in a mixed format (i.e. tabular & ASN.1 together);

- clause 7 specifies the variables (including protocol timers and constants) and counters to be used by the UE;

- clause 8 specifies the encoding of the RRC messages;

- clause 9 specifies the specified and default radio configurations;

- clause 10 specifies the RRC messages transferred across network nodes;

- clause 11 specifies the UE capability related constraints and performance requirements.

## 4.2 Architecture

### 4.2.1 UE states and state transitions including inter RAT

A UE is in RRC\_CONNECTED when an RRC connection has been established or in RRC\_INACTIVE (if the UE is connected to 5GC) when RRC connection is suspended. If this is not the case, i.e. no RRC connection is established, the UE is in RRC\_IDLE state. The RRC states can further be characterised as follows:

- **RRC\_IDLE**:

- A UE specific DRX may be configured by upper layers;

- UE controlled mobility;

- The UE:

- Monitors a Paging channel to detect incoming calls (by CN paging), system information change, for ETWS capable UEs, ETWS notification, and for CMAS capable UEs, CMAS notification;

- Performs neighbouring cell measurements and cell (re-)selection;

- Acquires system information;

- Performs logging of available measurements together with location and time for logged measurement configured UEs;

- May perform EDT;

- May perform transmission using PUR;

- Performs idle/inactive measurements for idle/inactive measurement configured UEs.

**- RRC\_INACTIVE**:

- A UE specific DRX may be configured by upper layers or by RRC layer;

- A RAN-based notification area is configured by RRC layer;

- The UE stores the UE Inactive AS context;

- The UE:

- Applies RRC\_IDLE procedures unless specified otherwise;

- Monitors a Paging channel for CN paging using 5G-S-TMSI and RAN paging using fullI-RNTI;

- Performs periodic RAN-based notification area update;

- Performs RAN-based notification area update when moving out of the configured RAN-based notification area.

- **RRC\_CONNECTED**:

- Transfer of unicast data to/from UE;

- At lower layers, the UE may be configured with a UE specific DRX;

- For UEs supporting CA, use of one or more SCells, aggregated with the PCell, for increased bandwidth;

- For UEs supporting DC, use of one SCG, aggregated with the MCG, for increased bandwidth;

- For UEs supporting (NG)EN-DC, option to configure one NR SCG in conjunction with the MCG for DRBs and SRBs, for improved performance (SRBs) and increased bandwidth (DRBs);

- For UEs supporting NE-DC, option to configure one SCG in conjunction with the NR MCG for DRBs and SRBs, for improved performance (SRBs) and increased bandwidth (DRBs);

- Network controlled mobility, i.e. handover and cell change order with optional network assistance (NACC) to GERAN (not applicable for NB-IoT);

- The UE:

- Monitors a Paging channel and/ or System Information Block Type 1 contents to detect system information change, for ETWS capable UEs, ETWS notification, and for CMAS capable UEs, CMAS notification (not applicable for BL UEs, UEs in CE and NB-IoT UEs);

- Monitors control channels associated with the shared data channel to determine if data is scheduled for it;

- For UEs in CE supporting reception of ETWS/CMAS indication in RRC\_CONNECTED mode, monitors control channels associated with the shared data channel to acquire ETWS notification and/or CMAS notification;

- Provides channel quality and feedback information (not applicable for NB-IoT);

- Performs neighbouring cell measurements and measurement reporting (not applicable for NB-IoT);

- Acquires system information (not applicable for BL UEs, UEs in CE and NB-IoT UEs, except for ETWS/CMAS, SIB31(-NB) and SIB33(-NB) reception where applicable).

NOTE: The term "UE is connected to 5GC" covers the scenarios that the UE is connected to 5GC and the UE is requesting to connect with 5GC.

Figure 4.2.1-1 not only provides an overview of the RRC states in E-UTRA/EPC, but also illustrates the mobility support between E-UTRA/EPC, UTRAN and GERAN.



Figure 4.2.1-1: E-UTRA/EPC states and inter RAT mobility procedures, 3GPP

Figure 4.2.1-2 illustrates the mobility support between E-UTRA/EPC, CDMA2000 1xRTT and CDMA2000 HRPD. The details of the CDMA2000 state models are out of the scope of this specification.



Figure 4.2.1-2: Mobility procedures between E-UTRA/EPC and CDMA2000

Figure 4.2.1-3 not only provides an overview of the RRC states in E-UTRA/5GC, but also illustrates the mobility support between E-UTRA/5GC, UTRAN and GERAN.



Figure 4.2.1-3: E-UTRA/5GC states and inter RAT mobility procedures, 3GPP

Figure 4.2.1-4 illustrates the mobility procedures supported between E-UTRA/5GC, CDMA2000 1xRTT and CDMA2000 HRPD. The details of the CDMA2000 state models are out of the scope of this specification.



Figure 4.2.1-4: Mobility procedures between E-UTRA/5GC and CDMA2000

Figure 4.2.1-5 illustrates the mobility procedures supported between E-UTRA/5GC and E-UTRA/EPC.



Figure 4.2.1-5: Mobility procedures between E-UTRA/5GC and E-UTRA/EPC

Figure 4.2.1-6 illustrates the mobility procedures supported between E-UTRA/EPC, E-UTRA/5GC and NR.



Figure 4.2.1-6: Mobility procedures between E-UTRA/EPC, E-UTRA/5GC and NR

The inter-RAT handover procedure(s) supports the case of signalling, conversational services, non-conversational services and combinations of these.

In addition to the state transitions shown in figures above, there is support for connection release with redirection information from E-UTRA RRC\_CONNECTED to GERAN, UTRAN, CDMA2000 (HRPD Idle/ 1xRTT Dormant mode) and NR. A UE in RRC\_INACTIVE enters RRC\_IDLE when it enters another RAT or switches to another CN type.

For NB-IoT, mobility between E-UTRA and UTRAN, GERAN and between E-UTRA and CDMA2000 1xRTT and CDMA2000 HRPD is not supported at AS level and hence only the E-UTRA states depicted in Figure 4.2.1-1 are applicable.

### 4.2.2 Signalling radio bearers

"Signalling Radio Bearers" (SRBs) are defined as Radio Bearers (RB) that are used only for the transmission of RRC and NAS messages. More specifically, the following SRBs are defined:

- SRB0 is for RRC messages using the CCCH logical channel;

- SRB1 is for RRC messages (which may include a piggybacked NAS message) as well as for NAS messages prior to the establishment of SRB2, all using DCCH logical channel;

- For NB-IoT, SRB1bis is for RRC messages (which may include a piggybacked NAS message) as well as for NAS messages prior to the activation of security, all using DCCH logical channel;

- SRB2 is for RRC messages which include logged measurement information as well as for NAS messages and messages which include IAB-DU specific F1-C related information, all using DCCH logical channel. SRB2 has a lower-priority than SRB1 and is always configured by E-UTRAN after security activation. SRB2 is not applicable for NB-IoT;

- SRB4 is for RRC messages which include application layer measurement reporting information, all using DCCH logical channel. SRB4 can only be configured by E-UTRAN after security activation. SRB4 is not applicable for NB-IoT.

In downlink piggybacking of NAS messages is used only for one dependant (i.e. with joint success/ failure) procedure: bearer establishment/ modification/ release. In uplink NAS message piggybacking is used only for transferring the initial NAS message during connection setup.

NOTE 1: The NAS messages transferred via SRB2 are also contained in RRC messages, which however do not include any RRC protocol control information.

Once security is activated, all RRC messages on SRB1, SRB2 and SRB4, including those containing NAS or non-3GPP messages, are integrity protected and ciphered by PDCP. NAS independently applies integrity protection and ciphering to the NAS messages.

For a UE configured with DC, all RRC messages, regardless of the SRB used and both in downlink and uplink, are transferred via the MCG. In case of EN-DC, after connection establishment NR PDCP may be configured for both SRB1 and SRB2 and if so, these SRBs may be configured as split SRB. In case of NGEN-DC and NE-DC, NR PDCP is always configured. For a split SRB, the UE receives RRC messages via both MCG and NR SCG i.e. handles out of order and duplicate PDUs as specified in TS 38.323 [83]. For a split SRB, the network configures via which cell group(s) the UE sends uplink RRC messages.

NOTE 2: In case of (NG)EN-DC, SRB3 may be configured for the transfer of some NR RRC messages between UE and SgNB via the NR radio interface, see TS 38.331 [82].

An SRB can be configured with PDCP duplication, either by two logical channels within the same CG (CA duplication) or by two logical channels each within a different CG (DC duplication).

## 4.3 Services

### 4.3.1 Services provided to upper layers

The RRC protocol offers the following services to upper layers:

- Broadcast of common control information;

- Broadcast of positioning assistance data;

- Notification of UEs in RRC\_IDLE and RRC\_INACTIVE, e.g. about a terminating call, for ETWS, for CMAS;

- Transfer of dedicated control information, i.e. information for one specific UE.

### 4.3.2 Services expected from lower layers

In brief, the following are the main services that RRC expects from lower layers:

- PDCP: integrity protection and ciphering;

- RLC: reliable and in-sequence transfer of information, without introducing duplicates and with support for segmentation and concatenation.

Further details about the services provided by Packet Data Convergence Protocol layer (e.g. integrity and ciphering) are provided in TS 36.323 [8]. The services provided by Radio Link Control layer (e.g. the RLC modes) are specified in TS 36.322 [7]. Further details about the services provided by Medium Access Control layer (e.g. the logical channels) are provided in TS 36.321 [6]. The services provided by physical layer (e.g. the transport channels) are specified in TS 36.302 [3].

## 4.4 Functions

The RRC protocol includes the following main functions:

- Broadcast of system information:

- Including NAS common information;

- Information applicable for UEs in RRC\_IDLE, e.g. cell (re-)selection parameters, neighbouring cell information and information (also) applicable for UEs in RRC\_CONNECTED, e.g. common channel configuration information;

- Including ETWS notification, CMAS notification (not applicable for NB-IoT);

- Including positioning assistance data.

- RRC connection control:

- Paging;

- Establishment/ modification/ suspension / resumption / release of RRC connection, including e.g. assignment/ modification of UE identity (C-RNTI), establishment/ modification/ suspension/ resumption/ release of SRB1, SRB1bis, SRB2 and SRB4, access class barring;

- Initial security activation, i.e. initial configuration of AS integrity protection (SRBs) and AS ciphering (SRBs, DRBs);

- For RNs, configuration of AS integrity protection for DRBs;

- RRC connection mobility including e.g. intra-frequency and inter-frequency handover, associated security handling, i.e. key/ algorithm change, specification of RRC context information transferred between network nodes;

NOTE 1: In NB-IoT, only key change (but no re-keying) at RRC Connection Resumption and RRC context information transfer are applicable.

- Establishment/ modification/ release of RBs carrying user data (DRBs);

- Radio configuration control including e.g. assignment/ modification of ARQ configuration, HARQ configuration, DRX configuration;

- For RNs, RN-specific radio configuration control for the radio interface between RN and E-UTRAN;

- In case of CA, cell management including e.g. change of PCell, addition/ modification/ release of SCell(s) and addition/modification/release of STAG(s);

- In case of DC, cell management including e.g. change of PSCell, addition/ modification/ release of SCG cell(s) and addition/modification/release of SCG TAG(s);

- In case of (NG)EN-DC, transparent transfer of NR RRC messages (e.g. DL: reconfiguration messages used to add or modify the NR SCG configuration or to (re-)configure measurements; configure conditional PSCell change; UL: measurement reports and reconfiguration complete messages) and of configurations of radio bearers using NR PDCP;

- QoS control including assignment/ modification of semi-persistent scheduling (SPS) configuration information for DL and UL, assignment/ modification of parameters for UL rate control in the UE, i.e. allocation of a priority and a prioritised bit rate (PBR) for each RB (not applicable for NB-IoT);

- Recovery from radio link failure;

- In case of LWA, RCLWI and LWIP, WLAN mobility set management including e.g. addition/ modification/ release of WLAN(s) from the WLAN mobility set;

- Inter-RAT mobility including e.g. security activation, transfer of RRC context information (not applicable for NB-IoT);

- Measurement configuration and reporting (not applicable for NB-IoT):

- Establishment/ modification/ release of measurements (e.g. intra-frequency, inter-frequency and inter- RAT measurements);

- Setup and release of measurement gaps;

- Measurement reporting;

- Other functions including e.g. transfer of dedicated NAS information and non-3GPP dedicated information, transfer of UE radio access capability information, support for E-UTRAN sharing (multiple PLMN identities);

- Generic protocol error handling;

- Support of self-configuration and self-optimisation (not applicable for NB-IoT);

- Support of measurement logging and reporting for network performance optimisation, as specified in TS 37.320 [60] (not applicable for NB-IoT).

NOTE 2: Random access is specified entirely in the MAC including initial transmission power estimation.

## 4.5 Data available for transmission for NB-IoT

For the purpose of MAC Data Volume and Power Headroom reporting, the NB-IoT UE shall consider the following as data available for transmission in the RRC layer:

- For SDUs to be submitted to lower layers:

- the SDU itself, if the SDU has not yet been processed by RRC; or

- the PDU if the SDU has been processed by RRC;

- The data available for transmission in upper layers not submitted to the RRC layer.

# 5 Procedures

## 5.1 General

### 5.1.1 Introduction

The procedural requirements are structured according to the main functional areas: system information (5.2), connection control (5.3), inter-RAT mobility (5.4) and measurements (5.5). In addition, clause 5.6 covers other aspects e.g. NAS dedicated information transfer, UE capability transfer, clause 5.7 specifies the generic error handling, clause 5.8 covers MBMS (i.e. MBMS service reception via MRB), clause 5.8a covers SC-PTM (i.e. MBMS service reception via SC-MRB), clause 5.9 covers RN-specific procedures and clause 5.10 covers sidelink.

For NB-IoT, only a subset of the above procedural requirements applies: system information (5.2), connection control (5.3), measurements (5.5), other (5.6), general error handling (5.7), and SC-PTM (5.8a). Clauses inter-RAT mobility (5.4), MBMS (5.8), RN procedures (5.9) and Sidelink (5.10) are not applicable in NB-IoT.

### 5.1.2 General requirements

The UE shall:

1> process the received messages in order of reception by RRC, i.e. the processing of a message shall be completed before starting the processing of a subsequent message;

NOTE 1: E-UTRAN may initiate a subsequent procedure prior to receiving the UE's response of a previously initiated procedure.

1> within a clause execute the steps according to the order specified in the procedural description;

1> consider the term 'radio bearer' (RB) to cover SRBs and DRBs but not MRBs or SC-MRBs unless explicitly stated otherwise;

1> set the *rrc-TransactionIdentifier* in the response message, if included, to the same value as included in the received RRC message that triggered the response message;

1> upon receiving a choice value set to *setup*:

2> apply the corresponding received configuration and start using the associated resources, unless explicitly specified otherwise;

1> upon receiving a choice value set to *release*:

2> clear the corresponding configuration and stop using the associated resources;

NOTE 1a: Following receipt of choice value set to release, the UE considers the field as if it was never configured.

1> upon handover to E-UTRA; or

1> upon receiving an *RRCConnectionReconfiguration* message including the *fullConfig*:

2> apply the Conditions in the ASN.1 for inclusion of the fields for the DRB/PDCP/RLC setup during the reconfiguration of the DRBs included in the *drb-ToAddModList*;

NOTE 2: At each point in time, the UE keeps a single value for each field except for during handover when the UE temporarily stores the previous configuration so it can revert back upon handover failure. In other words: when the UE reconfigures a field, the existing value is released except for during handover.

NOTE 3: Although not explicitly stated, the UE initially considers all functionality to be deactivated/ released until it is explicitly stated that the functionality is setup/ activated. Correspondingly, the UE initially considers lists to be empty e.g. the list of radio bearers, the list of measurements.

1> upon receiving an extension field comprising the entries in addition to the ones carried by the original field (regardless of whether E-UTRAN may signal more entries in total); apply the following generic behaviour if explicitly stated to be applicable:

2> create a combined list by concatenating the additional entries included in the extension field to the original field while maintaining the order among both the original and the additional entries;

2> for the combined list, created according to the previous, apply the same behaviour as defined for the original field;

NOTE 4: A field comprising a list of entries normally includes 'list' in the field name. The typical way to extend (the size of) such a list is to introduce a field comprising the additional entries, which should include 'listExt' in the name of the field/ IE. E.g. *field1List-RAT*, *field1ListExt-RAT*.

1> consider the term DC to cover the case of an E-UTRA MCG and SCG; Likewise, MCG covers the case of an E-UTRA MCG, SCG covers the case of an E-UTRA SCG, serving cell covers the case of an E-UTRA serving cell, PDCP covers the case of PDCP defined by E-UTRA specifications;

NOTE 5: In this specification, UE configuration refers to the parameters configured by E-UTRA RRC unless stated otherwise. Likewise, when a procedure is mentioned, this concerns the procedure defined by E-UTRA RRC unless stated otherwise.

### 5.1.3 Requirements for UE in MR-DC

In this specification, the UE considers itself to be configured with;

- EN-DC if and only if it is configured with *nr-SecondaryCellGroupConfig* and it is connected to EPC,

- NGEN-DC if and only if it is configured with *nr-SecondaryCellGroupConfig* and it is connected to 5GC,

- NE-DC if and only if it is configured with *mrdc-SecondaryCellGroup* set to *eutra-SCG* according to TS 38.331[82],

- MR-DC if and only if it is configured with (NG)EN-DC or NE-DC.

NOTE 1: The above deviates from the definition in TS 37.340 [81] (and some other specifications) i.e. according to TS 37.340 [81] a UE that is not configured with an SCG is in MR-DC when one or more bearers are terminated in the secondary node (i.e. using NR PDCP).

NOTE 2: MR-DC includes NR-DC, but that option is not relevant for this specification.

The UE configured with NE-DC only executes a subclause of clause 5 from this specification when the concerned subclause:

- is referrenced from a subclause, either in this specification or in TS 38.331 [82], that is executed by the UE; or

- covers actions upon (re-)configuration of field(s), IE(s), UE variable(s) or timer(s) applicable for NE-DC;

When executing a subclause of clause 5 in this specification, the UE also follows the related general requirements as defined in clause 5.1.2 and other subclauses of this specification e.g. message processing delay requirements.

## 5.2 System information

### 5.2.1 Introduction

#### 5.2.1.1 General

System information is divided into the *MasterInformationBlock* (MIB) and a number of *SystemInformationBlocks* (SIBs) and *SystemInformationBlockPos* (posSIBs). The MIB includes a limited number of most essential and most frequently transmitted parameters that are needed to acquire other information from the cell, and is transmitted on BCH. SIBs other than *SystemInformationBlockType1* and posSIBs are carried in *SystemInformation* (SI) messages. The mapping of SIBs and posSIBs to SI messages is flexibly configurable by *schedulingInfoList* and *posSchedulingInfoList*, respectively, included in *SystemInformationBlockType1*, with restrictions that: each SIB is contained only in a single SI message and each SIB and posSIB is contained at most once in that SI message; only SIBs and posSIBs having the same scheduling requirement (periodicity) can be mapped to the same SI message; *SystemInformationBlockType2* is always mapped to the SI message that corresponds to the first entry in the list of SI messages in *schedulingInfoList*. There may be multiple SI messages transmitted with the same periodicity. *SystemInformationBlockType1* and all SI messages are transmitted on DL-SCH.

The Bandwidth reduced Low Complexity (BL) UEs and UEs in Coverage Enhancement (CE) apply Bandwidth Reduced (BR) version of the SIB, posSIB or SI messages. A UE considers itself in enhanced coverage as specified in TS 36.304 [4]. In this and subsequent clauses, anything applicable for a particular SIB, posSIB or SI message equally applies to the corresponding BR version unless explicitly stated otherwise.

For NB-IoT, a reduced set of system information block with similar functionality but different content is defined; the UE applies the NB-IoT (NB) version of the MIB and the SIBs. These are denoted *MasterInformationBlock-NB, MasterInformationBlock-TDD-NB* *and SystemInformationBlockTypeX-NB* in this specification. All other system information blocks (without NB suffix) are not applicable to NB-IoT; this is not further stated in the corresponding text.

NOTE 1: The physical layer imposes a limit to the maximum size a SIB can take. When DCI format 1C is used the maximum allowed by the physical layer is 1736 bits (217 bytes) while for format 1A the limit is 2216 bits (277 bytes), see TS 36.212 [22] and TS 36.213 [23]. For BL UEs and UEs in CE, the maximum SIB and SI message size is 936 bits, see TS 36.213 [23]. For NB-IoT, the maximum SIB and SI message size is 680 bits, see TS 36.213 [23].

In addition to broadcasting, E-UTRAN may provide *SystemInformationBlockType1*, *SystemInformationBlockType2* and/or *SystemInformationBlockType31*, including the same parameter values, via dedicated signalling i.e., within an *RRCConnectionReconfiguration* message.

The UE applies the system information acquisition and change monitoring procedures for the PCell, except when being a BL UE or a UE in CE or a NB-IoT UE in RRC\_CONNECTED mode while T311 is not running. For an SCell, E-UTRAN provides, via dedicated signalling, all system information relevant for operation in RRC\_CONNECTED when adding the SCell. However, a UE that is configured with DC shall aquire the *MasterInformationBlock* of the PSCell but use it only to determine the SFN timing of the SCG, which may be different from the MCG. Upon change of the relevant system information of a configured SCell, E-UTRAN releases and subsequently adds the concerned SCell, which may be done with a single *RRCConnectionReconfiguration* message. If the UE is receiving or interested to receive an MBMS service in a cell, the UE shall apply the system information acquisition and change monitoring procedure to acquire parameters relevant for MBMS operation and apply the parameters acquired from system information only for MBMS operation for this cell.

NOTE 2: E-UTRAN may configure via dedicated signalling different parameter values than the ones broadcast in the concerned SCell.

In MBMS-dedicated cell, non-MBSFN subframes are used for providing *MasterInformationBlock-MBMS* (MIB-MBMS) and *SystemInformationBlockType1-MBMS*. SIBs other than *SystemInformationBlockType1-MBMS* are carried in *SystemInformation-MBMS* message which is also provided on non-MBSFN subframes.

An RN configured with an RN subframe configuration does not need to apply the system information acquisition and change monitoring procedures. Upon change of any system information relevant to an RN, E-UTRAN provides the system information blocks containing the relevant system information to an RN configured with an RN subframe configuration via dedicated signalling using the *RNReconfiguration* message. For RNs configured with an RN subframe configuration, the system information contained in this dedicated signalling replaces any corresponding stored system information and takes precedence over any corresponding system information acquired through the system information acquisition procedure. The dedicated system information remains valid until overridden.

NOTE 3: E-UTRAN may configure an RN, via dedicated signalling, with different parameter values than the ones broadcast in the concerned cell.

#### 5.2.1.2 Scheduling

The MIB uses a fixed schedule with a periodicity of 40 ms and repetitions made within 40 ms. The first transmission of the MIB is scheduled in subframe #0 of radio frames for which the SFN mod 4 = 0, and repetitions are scheduled in subframe #0 of all other radio frames. For TDD/FDD system with a bandwidth larger than 1.4 MHz that supports BL UEs or UEs in CE, MIB transmission may additionally be repeated in subframe#0 of the same radio frame, and in subframe#9 of the previous radio frame for FDD and subframe #5 of the same radio frame for TDD.

NOTE: The UE may assume the scheduling of MIB repetitions does not change. E-UTRAN may indicate in *MobilityControlInfo* whether optional MIB repetitions are enabled or not.

The MIB-MBMS uses a fixed schedule with a periodicity of 160 ms and repetitions made within 160 ms. The first transmission of the MIB-MBMS is scheduled in subframe #0 of radio frames for which the SFN mod 16 = 0, and repetitions are scheduled in subframe #0 of all other radio frames for which the SFN mod 4 = 0.

The *SystemInformationBlockType1* uses a fixed schedule with a periodicity of 80 ms and repetitions made within 80 ms. The first transmission of *SystemInformationBlockType1* is scheduled in subframe #5 of radio frames for which the SFN mod 8 = 0, and repetitions are scheduled in subframe #5 of all other radio frames for which SFN mod 2 = 0.

For BL UEs or UEs in CE, MIB is applied which may be provided with additional repetitions, while for SIB1 and further SI messages, separate messages are used which are scheduled independently and with content that may differ. The separate instance of SIB1 is named as *SystemInformationBlockType1-BR*. The *SystemInformationBlockType1-BR* uses a schedule with a periodicity of 80ms. TBS for *SystemInformationBlockType1-BR* and the repetitions made within 80ms are indicated via *schedulingInfoSIB1-BR* in MIB or optionally in the *RRCConnectionReconfiguration* message including the *MobilityControlInfo*.

The *SystemInformationBlockType1-MBMS* uses fixed schedule with a periodicity of 160 ms. The first transmission of *SystemInformationBlockType1-MBMS* is scheduled in subframe #0 of radio frames for which the SFN mod 16 = 0, and repetitions are scheduled in subframe #0 of all other radio frames for which SFN mod 8 = 0. Additionally, the *SystemInformationBlockType1-MBMS* and other system informations blocks may be scheduled in additional non-MBSFN subframes indicated in *MasterInformationBlock-MBMS*.

The SI messages are transmitted within periodically occurring time domain windows (referred to as SI-windows) using dynamic scheduling. Each SI message is associated with a SI-window and the SI-windows of different SI messages do not overlap. That is, within one SI-window only the corresponding SI is transmitted. The length of the SI-window is common for all SI messages, and is configurable. Within the SI-window, the corresponding SI message can be transmitted a number of times in any subframe other than MBSFN subframes, uplink subframes in TDD, and subframe #5 of radio frames for which SFN mod 2 = 0. The UE acquires the detailed time-domain scheduling (and other information, e.g. frequency-domain scheduling, used transport format) from decoding SI-RNTI on PDCCH (see TS 36.321 [6]). For a BL UE or a UE in CE, the detailed time/frequency domain scheduling information for the SI messages is provided in *SystemInformationBlockType1-BR*.

For UEs other than BL UE or UEs in CE SI-RNTI is used to address *SystemInformationBlockType1* as well as all SI messages. On MBMS-dedicated cell and on FeMBMS/Unicast-mixed cell, SI-RNTI with value in accordance with TS 36.321 [6] is used to address all SI messages whereas SI-RNTI with value in accordance with TS 36.321 [6] is used to address *SystemInformationBlockType1-MBMS.*

*SystemInformationBlockType1* configures the SI-window length and the transmission periodicity for the SI messages.

#### 5.2.1.2a Scheduling for NB-IoT

The *MasterInformationBlock-NB* (MIB-NB) uses a fixed schedule with a periodicity of 640 ms and repetitions made within 640 ms. The first transmission of the MIB-NB is scheduled in subframe #0 of radio frames for which the SFN mod 64 = 0 and repetitions are scheduled in subframe #0 of all other radio frames. The transmissions are arranged in 8 independently decodable blocks of 80 ms duration.

The *MasterInformationBlock-TDD-NB* (MIB-TDD-NB) uses a fixed schedule with a periodicity of 640 ms and repetitions made within 640 ms. The first transmission of the MIB-TDD-NB is scheduled in subframe #9 of radio frames for which the SFN mod 64 = 0 and repetitions are scheduled in subframe #9 of all other radio frames. The transmissions are arranged in 8 independently decodable blocks of 80 ms duration.

The *SystemInformationBlockType1-NB* (SIB1-NB) uses a fixed schedule with a periodicity of 2560 ms.

For FDD, SIB1-NB transmission occurs in subframe #4 of every other frame in 16 continuous frames. The starting frame for the first transmission of the SIB1-NB is derived from the cell PCID and the number of repetitions within the 2560 ms period and repetitions are made, equally spaced, within the 2560 ms period (see TS 36.213 [23]). TBS for *SystemInformationBlockType1-NB* and the repetitions made within the 2560 ms are indicated by *schedulingInfoSIB1* field in the MIB-NB. If *additionalTransmissionSIB1* is set to TRUE in the MIB-NB, additional SIB1-NB transmission occurs in subframe #3 of the same radio frames where SIB1-NB transmission occurs with the same number of repetitions.

For TDD, SIB1-NB transmission on the anchor carrier occurs in either subframe #0 or subframe #4 of every other frame in 16 continuous frames and SIB1-NB transmission on a non-anchor carrier occurs in subframe #0 and next in subframe #5 of every other frame in 16 continuous frames. The starting frame for the first transmission of the SIB1-NB is derived from the cell PCID and the number of repetitions within the 2560 ms period and repetitions are made, equally spaced, within the 2560 ms period (see TS 36.213 [23]). TBS for *SystemInformationBlockType1-NB,* the repetitions made within the 2560 ms, and the subframe index (#0 or #4) are indicated by *schedulingInfoSIB1* field in the MIB-TDD-NB.

The SI messages are transmitted within periodically occurring time domain windows (referred to as SI-windows) using scheduling information provided in *SystemInformationBlockType1-NB*. Each SI message is associated with a SI-window and the SI-windows of different SI messages do not overlap. That is, within one SI-window only the corresponding SI is transmitted. The length of the SI-window is common for all SI messages, and is configurable. For IoT NTN TDD mode, one or more repetitions of SI message transmission falling on the non-D subframes are postponed to the next valid D subframe within the SI-Window [RIL]:V220, IoTTDD.

Within the SI-window, the corresponding SI message can be transmitted a number of times over 2 or 8 consecutive NB-IoT downlink subframes depending on TBS.The UE acquires the detailed time/frequency domain scheduling information and other information, e.g. used transport format for the SI messages from *schedulingInfoList* field in *SystemInformationBlockType1-NB*. The UE is not required to accumulate several SI messages in parallel but may need to accumulate a SI message across multiple SI windows, depending on coverage condition.

*SystemInformationBlockType1-NB* configures the SI-window length and the transmission periodicity for all SI messages.

#### 5.2.1.3 System information validity and notification of changes

Change of system information (other than for ETWS, CMAS, EAB, UAC, and satellite assistance information parameters except for discontinuous coverage scenarios and for NB-IoT, other than for AB parameters and satellite assistance information parameters except for discontinuous coverage scenarios) only occurs at specific radio frames, i.e. the concept of a modification period is used. System information may be transmitted a number of times with the same content within a modification period, as defined by its scheduling. The modification period boundaries are defined by SFN values for which SFN mod *m*= 0, where *m* is the number of radio frames comprising the modification period. The modification periodis configured by system information. If H-SFN is provided in *SystemInformationBlockType1-BR*, modification period boundaries for BL UEs and UEs in CE are defined by SFN values for which (H-SFN \* 1024 + SFN) mod *m*=0. For NB-IoT, H-SFN is always provided and the modification period boundaries are defined by SFN values for which (H-SFN \* 1024 + SFN) mod *m*=0.

To enable system information update notification for RRC\_IDLE UEs configured to use a DRX cycle longer than the modification period, an eDRX acquisition period is defined. The boundaries of the eDRX acquisition period are determined by H-SFN values for which H-SFN mod 256 =0. For NB-IoT, the boundaries of the eDRX acquisition period are determined by H-SFN values for which H-SFN mod 1024 =0.

NOTE 1: If the UE in RRC\_IDLE is configured to use extended DRX cycle, e.g., in the order of several minutes or longer, in case the eNB is reset the UE SFN may not be synchronized to the new eNB SFN. The UE is expected to recover, e.g., acquire MIB within a reasonable time, to avoid repeated paging failures.

NOTE 1a: For the UE in RRC\_INACTIVE, the idle mode extended DRX cycle, if configured, is used to compare with the modification period.

When the network changes (some of the) system information, it first notifies the UEs about this change, i.e. this may be done throughout a modification period. In the next modification period, the network transmits the updated system information. During a modification period where ETWS or CMAS transmission is started or stopped, the SI messages carrying the SIBs scheduled in *schedulingInfoListExt* and/or SI messages carrying the posSIBs scheduled in *posSchedulingInfoList* may change, so the UE might not be able to successfully receive those SIBs and/or posSIBs in the remainder of the current modification period and next modification period according to the scheduling information received prior to the change. These general principles are illustrated in figure 5.2.1.3-1, in which different colours indicate different system information. Upon receiving a change notification, the UE not configured to use a DRX cycle that is longer than the modification period acquires the new system information immediately from the start of the next modification period. Upon receiving a change notification applicable to eDRX, a UE in RRC\_IDLE configured to use a DRX cycle that is longer than the modification period acquires the updated system information immediately from the start of the next eDRX acquisition period. The UE applies the previously acquired system information until the UE acquires the new system information. The possible boundaries of modification for *SystemInformationBlockType1-BR* are defined by SFN values for which SFN mod 512 = 0 except for notification of ETWS/CMAS for which the eNB may change *SystemInformationBlockType1-BR* content at any time. For NB-IoT, the possible boundaries of modification for *SystemInformationBlockType1-NB* are defined by SFN values for which (H-SFN \* 1024 + SFN) mod 4096 = 0.



Figure 5.2.1.3-1: Change of system Information

The *Paging* message is used to inform UEs in RRC\_IDLE and UEs in RRC\_CONNECTED about a system information change. If the UE is in RRC\_CONNECTED or is not configured to use a DRX cycle longer than the modification period in RRC\_IDLE, and receives a *Paging* message including the *systemInfoModification*, it knows that the system information will change at the next modification period boundary. A UE in RRC\_IDLE that is configured to use a DRX cycle longer than the modification period, and receives in an eDRX acquisition period at least one *Paging* message including the *systemInfoModification-eDRX*, shall acquire the updated system information at the next eDRX acquisition period boundary. Although the UE may be informed about changes in system information, no further details are provided e.g. regarding which system information will change, except if *systemInfoValueTagSI* is received by BL UEs or UEs in CE.

In RRC\_CONNECTED, BL UEs or UEs inCEor NB-IoT UEs are not required to acquire system information except when T311 is running, or upon handover where the UE is only required to acquire the *MasterInformationBlock* in the target PCell, or for UEs in CE to receive ETWS/CMAS information, or upon expiry of T317 where the UE is required to acquire the *SystemInformationBlockType31* (*SystemInformationBlockType31-NB* in NB-IoT) and may acquire the *SystemInformationBlockType33* (*SystemInformationBlockType33-NB* in NB-IoT). In RRC\_IDLE, E-UTRAN may notify BL UEs or UEs inCEorNB-IoT UEs about SI update, and except for NB-IoT, ETWS and CMAS notification, EAB modification and UAC modification, using Direct Indication information, as specified in 6.6 (or 6.7.5 in NB-IoT) and TS 36.212 [22].

NOTE 2: Upon system information change essential for BL UEs, UEs in CE, or NB-IoT UEs in RRC\_CONNECTED, E-UTRAN may initiate connection release.

NOTE 3: When acquiring SIB31(-NB) in RRC\_CONNECTED, UE may assume that the scheduling is unchanged.

*SystemInformationBlockType1* (or *MasterInformationBlock-NB/ MasterInformationBlock-TDD-NB* in NB-IoT) includes a value tag *systemInfoValueTag*, that indicates if a change has occurred in the SI messages. UEs may use *systemInfoValueTag*, e.g. upon return from out of coverage, to verify if the previously stored SI messages are still valid. *MasterInformationBlock* and RSS (if transmitted, see TS 36.211 [21]) may indicate using *systemInfoUnchanged-BR* that a change has not occurred in the SIB1-BR and SI messages of the current cell at least over the SI validity time, and the BL UEs or UEs in CE may use the *systemInfoUnchanged-BR*, e.g. upon return from out of coverage, to verify if the previously stored SIB1-BR and SI messages are still valid. Additionally, for other than BL UEs or UEs in CE or NB-IoT UEs, the UE considers stored system information to be invalid after 3 hours from the moment it was successfully confirmed as valid, unless specified otherwise. BL UE or UE in CE considers stored system information to be invalid after 24 hours from the moment it was successfully confirmed as valid, unless the UE is configured by parameter *si-ValidityTime* to consider stored system information to be invalid 3 hours after validity confirmation. NB-IoT UE considers stored system information to be invalid after 24 hours from the moment it was successfully confirmed as valid. If a BL UE, UE in CE or NB-IoT UE in RRC\_CONNECTED state considers the stored system information invalid, the UE shall continue using the stored system information while in RRC\_CONNECTED state in the serving cell.

For BL UEs or UEs in CE or NB-IoT UEs, the change of specific SI message can additionally be indicated by a SI message specific value tag *systemInfoValueTagSI.* If *systemInfoValueTag* included in the *SystemInformationBlockType1-BR* (or *MasterInformationBlock-NB/ MasterInformationBlock-TDD-NB* in NB-IoT) is different from the one of the stored system information and if *systemInfoValueTagSI* is included in the *SystemInformationBlockType1-BR* (or *SystemInformationBlockType1-NB* in NB-IoT)for a specific SI messageand is different from the stored one, the UE shall consider this specific SI message to be invalid. If only *systemInfoValueTag* is included and is different from the stored one, the BL UE or UE in CE should consider any stored system information except *SystemInformationBlockType10*, *SystemInformationBlockType11*, *SystemInformationBlockType12,* *SystemInformationBlockType14,* *SystemInformationBlockType25*, *SystemInformationBlockType31* and *SystemInformationBlockType33* to be invalid; the NB-IoT UE should consider any stored system information except *SystemInformationBlockType14-NB*, *SystemInformationBlockType31-NB* and *SystemInformationBlockType33-NB* to be invalid.

On MBMS-dedicated cell and on FeMBMS/Unicast-mixed cell, the change of system information and ETWS/CMAS notification is indicated by using Direct Indication FeMBMS defined in 6.6a. The modification periodicity follows MCCH modification periodicity as defined in 5.8.1.3.

E-UTRAN may not update *systemInfoValueTag* upon change of some system information e.g. ETWS information, CMAS information, RLOS indication (i.e., *rlos-Enabled*), regularly changing parameters like time information (*SystemInformationBlockType8*, *SystemInformationBlockType16,* *hyperSFN-MSB* in *SystemInformationBlockType1-NB*), EAB and AB parameters, UAC parameters, positioning system information blocks, or satellite assistance information. Similarly, E-UTRAN may not include the *systemInfoModification* within the *Paging* message upon change of some system information.

NOTE 4: UE connected to NTN is expected to re-acquire SIB32(-NB) based on its own decision regardless of *systemInfoValueTag* change.

The UE that is not configured to use a DRX cycle longer than the modification period verifies that stored system information remains valid by either checking *systemInfoValueTag* in *SystemInformationBlockType1* (or *MasterInformationBlock-NB/ MasterInformationBlock-TDD-NB* in NB-IoT) after the modification period boundary,or attempting to find the *systemInfoModification* indication at least *modificationPeriodCoeff* times during the modification period in case no paging is received, in every modification period*.* If no paging message is received by the UE during a modification period, the UE may assume that no change of system information will occur at the next modification period boundary. If UE in RRC\_CONNECTED, during a modification period, receives one paging message, it may deduce from the presence/ absence of *systemInfoModification* whether a change of system information other than ETWS information, CMAS information, EAB and UAC parameters will occur in the next modification period or not.

When the RRC\_IDLE UE is configured with a DRX cycle that is longer than the modification period, and at least one modification period boundary has passed since the UE last verified validity of stored system information, the UE verifies that stored system information remains valid by checking the *systemInfoValueTag* before establishing or resuming an RRC connection.

ETWS and/or CMAS capable UEs in RRC\_CONNECTED, other than BL UEs and UEs in CE, shall attempt to read paging at least once every *defaultPagingCycle* to check whether ETWS and/or CMAS notification is present or not.

#### 5.2.1.4 Indication of ETWS notification

ETWS primary notification and/ or ETWS secondary notification can occur at any point in time. The *Paging* message is used to inform ETWS capable UEs in RRC\_IDLE and UEs not in CE in RRC\_CONNECTED about presence of an ETWS primary notification and/ or ETWS secondary notification. For UEs in CE supporting reception of ETWS indication in RRC\_CONNECTED mode, control channels associated with the shared data channel are used to inform the UE about the presence of an ETWS primary notification and/or ETWS secondary notification. If the UE receives a *Paging* message or control channels associated with the shared data channel including the *etws-Indication*, it shall start receiving the ETWS primary notification and/ or ETWS secondary notification according to *schedulingInfoList* contained in *SystemInformationBlockType1*. If the UE receives *Paging* message or control channels associated with the shared data channel including the *etws-Indication* while it is acquiring ETWS notification(s), the UE shall continue acquiring ETWS notification(s) based on the previously acquired *schedulingInfoList* until it re-acquires *schedulingInfoList* in *SystemInformationBlockType1*.

NOTE: The UE is not required to periodically check *schedulingInfoList* contained in *SystemInformationBlockType1*, but *Paging* message including the *etws-Indication* triggers the UE to re-acquire *schedulingInfoList* contained in *SystemInformationBlockType1* for scheduling changes for *SystemInformationBlockType10* and *SystemInformationBlockType11*. The UE may or may not receive a *Paging* message including the *etws-Indication* and/or *systemInfoModification* when ETWS is no longer scheduled.

ETWS primary notification is contained in *SystemInformationBlockType10* and ETWS secondary notification is contained in *SystemInformationBlockType11*. Segmentation can be applied for the delivery of a secondary notification. The segmentation is fixed for transmission of a given secondary notification within a cell (i.e. the same segment size for a given segment with the same *messageIdentifier*, *serialNumber* and *warningMessageSegmentNumber*). An ETWS secondary notification corresponds to a single *CB data* IE as defined according to TS 23.041 [37].

#### 5.2.1.5 Indication of CMAS notification

CMAS notification can occur at any point in time. The *Paging* message is used to inform CMAS capable UEs in RRC\_IDLE and UEs not in CE in RRC\_CONNECTED about presence of one or more CMAS notifications. For UEs in CE supporting reception of CMAS indication in RRC\_CONNECTED mode, control channels associated with the shared data channel are used to inform the UE about the presence of one or more CMAS notifications. If the UE receives a *Paging* message including the *cmas-Indication*, it shall start receiving the CMAS notifications according to *schedulingInfoList* contained in *SystemInformationBlockType1*. If the UE receives *Paging* message or control channels associated with the shared data channel including the *cmas-Indication* while it is acquiring CMAS notification(s), the UE shall continue acquiring CMAS notification(s) based on the previously acquired *schedulingInfoList* until it re-acquires *schedulingInfoList* in *SystemInformationBlockType1*.

NOTE: The UE is not required to periodically check *schedulingInfoList* contained in *SystemInformationBlockType1*, but *Paging* message including the *cmas-Indication* triggers the UE to re-acquire *schedulingInfoList* contained in *SystemInformationBlockType1* for scheduling changes for *SystemInformationBlockType12*. The UE may or may not receive a *Paging* message including the *cmas-Indication* and/or *systemInfoModification* when *SystemInformationBlockType12* is no longer scheduled.

CMAS notification is contained in *SystemInformationBlockType12*. A CMAS notification corresponds to a single *CB data* IE as defined according to TS 23.041 [37]. A CMAS notification may optionally have associated warning area coordinates. Segmentation can be applied for the delivery of a CMAS notification and, if present, the associated warning area coordinates. The segmentation is fixed for transmission of a given CMAS notification and, if present, any associated warning area coordinates within a cell (i.e. the same segment size for a given segment with the same *messageIdentifier*, *serialNumber* and *warningMessageSegmentNumber*). E-UTRAN does not interleave transmissions of CMAS notifications, i.e. all segments of a given CMAS notification transmission are transmitted prior to those of another CMAS notification.

#### 5.2.1.6 Notification of EAB parameters change

Change of EAB parameters can occur at any point in time. The EAB parameters are contained in *SystemInformationBlockType14*. The *Paging* message is used to inform EAB capable UEs in RRC\_IDLE about a change of EAB parameters or that *SystemInformationBlockType14* is no longer scheduled. If the UE receives a *Paging* message including the *eab-ParamModification*, it shall acquire *SystemInformationBlockType14* according to *schedulingInfoList* contained in *SystemInformationBlockType1*. If the UE receives a *Paging* message including the *eab-ParamModification* while it is acquiring *SystemInformationBlockType14*, the UE shall continue acquiring *SystemInformationBlockType14* based on the previously acquired *schedulingInfoList* until it re-acquires *schedulingInfoList* in *SystemInformationBlockType1*.

NOTE: The EAB capable UE is not expected to periodically check *schedulingInfoList* contained in *SystemInformationBlockType1*.

#### 5.2.1.7 Access Barring parameters change in NB-IoT

Change of Access Barring (AB) parameters can occur at any point in time. The AB parameters are contained in *SystemInformationBlockType14-NB*. Update of the AB parameters does not impact the *systemInfoValueTag* in the *MasterInformationBlock-NB/ MasterInformationBlock-TDD-NB* or the *systemInfoValueTagSI* in *SystemInformationBlockType1-NB*.

If *SystemInformationBlockType14-NB* is scheduled, a NB-IoT UE connected to EPC is required to acquire *MasterInformationBlock-NB/ MasterInformationBlock-TDD-NB* before initiating RRC connection establishment / resume for all access causes except mobile terminating calls to check *ab-Enabled* indication. If access barring is enabled the UE shall not initiate the RRC connection establishment / resume for all access causes except mobile terminating calls until the UE has acquired the *SystemInformationBlockType14-NB*.

If *SystemInformationBlockType14-NB* is scheduled, a NB-IoT UE connected to 5GC is required to acquire *MasterInformationBlock-NB/ MasterInformationBlock-TDD-NB* before initiating RRC connection establishment / resume / re-establishment to check *ab-Enabled-5GC* indication. If access barring is enabled the UE shall not initiate the RRC connection establishment / resume / re-establishment until the UE has acquired the *SystemInformationBlockType14-NB*.

#### 5.2.1.8 Notification of UAC parameters change

Change of UAC parameters can occur at any point in time. The UAC parameters are contained in *SystemInformationBlockType25*. The *Paging* message is used to inform BL UEs or UEs in CE in RRC\_INACTIVE or RRC\_IDLE connected to 5GC about a change of UAC parameters or that *SystemInformationBlockType25* is no longer scheduled. If the UE receives a *Paging* message including the *uac-ParamModification*, it shall acquire *SystemInformationBlockType25* according to *schedulingInfoList* contained in *SystemInformationBlockType1*. If the UE receives a *Paging* message including the *uac-ParamModification* while it is acquiring *SystemInformationBlockType25*, the UE shall continue acquiring *SystemInformationBlockType25* based on the previously acquired *schedulingInfoList* until it re-acquires *schedulingInfoList* in *SystemInformationBlockType1*.

NOTE: The BL UE or UE in CE is not expected to periodically check *schedulingInfoList* contained in *SystemInformationBlockType1*.

### 5.2.2 System information acquisition

#### 5.2.2.1 General



Figure 5.2.2.1-1: System information acquisition, normal

The UE applies the system information acquisition procedure to acquire the AS- and NAS- and positioning-system information that is broadcasted by the E-UTRAN. The procedure applies to UEs in RRC\_IDLE and UEs in RRC\_CONNECTED.

For BL UE, UE in CE and NB-IoT UE, specific conditions apply, as specified below.

#### 5.2.2.2 Initiation

The UE shall apply the system information acquisition procedure upon selecting (e.g. upon power on) and upon re-selecting a cell, after handover completion, after entering E-UTRA from another RAT, upon return from out of coverage, upon receiving a notification that the system information has changed, upon receiving an indication about the presence of an ETWS notification, upon receiving an indication about the presence of a CMAS notification, upon receiving a notification that the EAB parameters have changed, upon receiving a request from CDMA2000 upper layers, upon receiving a request from positioning upper layers, upon receiving a notification that the UAC parameters have changed and upon exceeding the maximum validity duration. Unless explicitly stated otherwise in the procedural specification, the system information acquisition procedure overwrites any stored system information, i.e. delta configuration is not applicable for system information and the UE discontinues using a field if it is absent in system information unless explicitly specified otherwise.

In RRC\_CONNECTED, BL UEs and UEs in CE are required to acquire system information when T311 is running or upon handover where the UE is only required to acquire the *MasterInformationBlock* in the target PCell.

NOTE: Upon handover, E-UTRAN provides system information required by the UE in RRC\_CONNECTED except MIB with RRC signalling, i.e. *systemInformationBlockType1Dedicated* and *mobilityControlInfo*.

#### 5.2.2.3 System information required by the UE

The UE shall:

1> ensure having a valid version, as defined below, of (at least) the following system information, also referred to as the 'required' system information:

2> if in RRC\_IDLE:

3> if the UE is a NB-IoT UE:

4> the *MasterInformationBlock-NB/ MasterInformationBlock-TDD-NB* and *SystemInformationBlockType1-NB* as well as *SystemInformationBlockType2-NB* through *SystemInformationBlockType5-NB, SystemInformationBlockType22-NB*;

3> else:

4> the *MasterInformationBlock* and *SystemInformationBlockType1* (or *SystemInformationBlockType1-BR* depending on whether the UE is a BL UE or the UE in CE) as well as *SystemInformationBlockType2* through *SystemInformationBlockType8* and *SystemInformationBlockType24* (depending on support of the concerned RATs), *SystemInformationBlockType17* (depending on support of RAN-assisted WLAN interworking when the UE is connected to EPC), *SystemInformationBlockType25* (depending on support of E-UTRA/5GC), *SystemInformationBlockType29* (only for BL UE or the UE in CE depending on support of resource reservation), *SystemInformationBlockType21*, *SystemInformationBlockType26* (if UE is capable of V2X sidelink communication and is configured by upper layers to receive or transmit V2X sidelink communication),and *SystemInformationBlockType28* (if UE is capable of NR sidelink communication and is configured by upper layers to receive or transmit NR sidelink communication), *SystemInformationBlockType30* (if UE is configured by upper layers to report disaster roaming related information);

3> if initiating a RRC connection establishment/resume procedure; and

3> the UE is NTN capable:

4> *SystemInformationBlockType31* (*SystemInformationBlockType31-NB* in NB-IoT),if scheduled;

2> if in RRC\_INACTIVE:

3> the *MasterInformationBlock* and *SystemInformationBlockType1* as well as *SystemInformationBlockType2* through *SystemInformationBlockType8* (depending on support of the concerned RATs), *SystemInformationBlockType24* (depending on support of the concerned RATs), *SystemInformationBlockType25*, *SystemInformationBlockType29* (only for BL UE or the UE in CE depending on support of resource reservation), *SystemInformationBlockType21*, *SystemInformationBlockType26* (if UE is capable of V2X sidelink communication and is configured by upper layers to receive or transmit V2X sidelink communication),and *SystemInformationBlockType28* (if UE is capable of NR sidelink communication and is configured by upper layers to receive or transmit NR sidelink communication), *SystemInformationBlockType30* (if UE is configured by upper layers to report disaster roaming related information);

2> if in RRC\_CONNECTED; and

2> the UE is not a BL UE; and

2> the UE is not in CE; and

2> the UE is not a NB-IoT UE:

3> the *MasterInformationBlock*, *SystemInformationBlockType1* and *SystemInformationBlockType2* as well as *SystemInformationBlockType8* (depending on support of CDMA2000), *SystemInformationBlockType17* (depending on support of RAN-assisted WLAN interworking when the UE is connected to EPC), *SystemInformationBlockType25* (depending on support of E-UTRA/5GC);

2> if in RRC\_CONNECTED and T311 is running; and

2> the UE is a BL UE or the UE is in CE or the UE is a NB-IoT UE:

3> the *MasterInformationBlock* (or *MasterInformationBlock-NB/ MasterInformationBlock-TDD-NB* in NB-IoT), *SystemInformationBlockType1-BR* (or *SystemInformationBlockType1-NB* in NB-IoT) and *SystemInformationBlockType2* (or *SystemInformationBlockType2-NB* in NB-IoT), *SystemInformationBlockType25* (only for BL UE or the UE in CE depending on support of E-UTRA/5GC), *SystemInformationBlockType29* (only for BL UE or the UE in CE depending on support of resource reservation), *SystemInformationBlockType31* (*SystemInformationBlockType31-NB* in NB-IoT) (only for NTN capable UE) if scheduled, and for NB-IoT *SystemInformationBlockType22-NB*;

2> if in RRC\_CONNECTED and T317 is not running; and

2> the UE is NTN capable:

3> *SystemInformationBlockType31* (*SystemInformationBlockType31-NB* in NB-IoT), if scheduled;

1> delete any stored system information after 3 hours or 24 hours from the moment it was confirmed to be valid as defined in 5.2.1.3, unless specified otherwise;

1> consider any stored system information except *SystemInformationBlockType10,* *SystemInformationBlockType11,* *systemInformationBlockType12, systemInformationBlockType14* (*systemInformationBlockType14-NB* in NB-IoT), *systemInformationBlockType25* and *systemInformationBlockType31* (*systemInformationBlockType31-NB* in NB-IoT), to be invalid if *systemInfoValueTag* included in the *SystemInformationBlockType1* (*MasterInformationBlock-NB/ MasterInformationBlock-TDD-NB* in NB-IoT) is different from the one of the stored system information and in case of NB-IoT UEs, BL UEs and UEs in CE, *systemInfoValueTagSI* is not broadcasted. Otherwise consider system information validity as defined in 5.2.1.3;

#### 5.2.2.4 System information acquisition by the UE

The UE shall:

1> apply the specified BCCH configuration defined in 9.1.1.1 or BR-BCCH configuration defined in 9.1.1.8;

1> if the procedure is triggered by a system information change notification:

2> if the UE uses an idle DRX cycle longer than the modification period:

3> start acquiring the required system information, as defined in 5.2.2.3, from the next eDRX acquisition period boundary;

2> else

3> start acquiring the required system information, as defined in 5.2.2.3, from the beginning of the modification period following the one in which the change notification was received;

NOTE 1: The UE continues using the previously received system information until the new system information has been acquired.

1> if the UE is in RRC\_IDLE and enters a cell for which the UE does not have stored a valid version of the system information required in RRC\_IDLE, as defined in 5.2.2.3:

2> acquire, using the system information acquisition procedure as defined in 5.2.3, the system information required in RRC\_IDLE, as defined in 5.2.2.3;

1> following successful handover completion to a PCell for which the UE does not have stored a valid version of the system information required in RRC\_CONNECTED, as defined in 5.2.2.3:

2> acquire, using the system information acquisition procedure as defined in 5.2.3, the system information required in RRC\_CONNECTED, as defined in 5.2.2.3;

2> upon acquiring the concerned system information:

3> discard the corresponding radio resource configuration information included in the *radioResourceConfigCommon* previously received in a dedicated message, if any;

1> following a request from CDMA2000 upper layers:

2> acquire *SystemInformationBlockType8*, as defined in 5.2.3;

1> neither initiate the RRC connection establishment/resume procedure nor initiate transmission of the *RRCConnectionReestablishmentRequest* message until the UE has a valid version of the *MasterInformationBlock* (*MasterInformationBlock-NB/ MasterInformationBlock-TDD-NB* in NB-IoT) and *SystemInformationBlockType1* (*SystemInformationBlockType1-NB* in NB-IoT) messages as well as *SystemInformationBlockType2* (*SystemInformationBlockType2-NB* in NB-IoT), and for NB-IoT, *SystemInformationBlockType22-NB*;

1> not initiate the RRC connection establishment/resume procedure subject to EAB until the UE has a valid version of *SystemInformationBlockType14*, if broadcast;

1> if the UE is ETWS capable:

2> upon entering a cell during RRC\_IDLE, following successful handover or upon connection re-establishment:

3> discard any previously buffered *warningMessageSegment*;

3> clear, if any, the current values of *messageIdentifier* and *serialNumber* for *SystemInformationBlockType11*;

2> when the UE acquires *SystemInformationBlockType1* following ETWS indication, upon entering a cell during RRC\_IDLE, following successful handover or upon connection re-establishment:

3> if *schedulingInfoList* indicates that *SystemInformationBlockType10* is present:

4> if the UE is in CE:

5> start acquiring *SystemInformationBlockType10*;

4> else

5> start acquiring *SystemInformationBlockType10* immediately;

3> if *schedulingInfoList* indicates that *SystemInformationBlockType11* is present:

4> start acquiring *SystemInformationBlockType11* immediately;

NOTE 2: UEs shall start acquiring *SystemInformationBlockType10* and *SystemInformationBlockType11* as described above even when *systemInfoValueTag* in *SystemInformationBlockType1* has not changed.

1> if the UE is CMAS capable:

2> upon entering a cell during RRC\_IDLE, following successful handover or upon connection re-establishment:

3> discard any previously buffered *warningMessageSegment*;

3> clear, if any, stored values of *messageIdentifier* and *serialNumber* for *SystemInformationBlockType12* associated with the discarded *warningMessageSegment*;

2> when the UE acquires *SystemInformationBlockType1* following CMAS indication, upon entering a cell during RRC\_IDLE, following successful handover and upon connection re-establishment:

3> if *schedulingInfoList* indicates that *SystemInformationBlockType12* is present:

4> acquire *SystemInformationBlockType12*;

NOTE 3: UEs shall start acquiring *SystemInformationBlockType12* as described above even when *systemInfoValueTag* in *SystemInformationBlockType1* has not changed.

1> if the UE is interested to receive MBMS services:

2> if the UE is capable of MBMS reception as specified in 5.8:

3> if *schedulingInfoList* indicates that *SystemInformationBlockType13* is present and the UE does not have stored a valid version of this system information block:

4> acquire *SystemInformationBlockType13*;

3> else if *SystemInformationBlockType13* is present in *SystemInformationBlockType1-MBMS* and the UE does not have stored a valid version of this system information block:

4> acquire *SystemInformationBlockType13* from *SystemInformationBlockType1-MBMS*;

2> if the UE is capable of SC-PTM reception as specified in 5.8a:

3> if *schedulingInfoList* indicates that *SystemInformationBlockType20* (*SystemInformationBlockType20-NB* in NB-IoT) is present and the UE does not have stored a valid version of this system information block:

4> acquire *SystemInformationBlockType20* (*SystemInformationBlockType20-NB* in NB-IoT);

2> if the UE is capable of MBMS Service Continuity:

3> if *schedulingInfoList* indicates that *SystemInformationBlockType15* (*SystemInformationBlockType15-NB* in NB-IoT) is present and the UE does not have stored a valid version of this system information block:

4> acquire *SystemInformationBlockType15* (*SystemInformationBlockType15-NB* in NB-IoT);

1> if the UE is EAB capable:

2> when the UE does not have stored a valid version of *SystemInformationBlockType14* upon entering RRC\_IDLE, or when the UE acquires *SystemInformationBlockType1* following EAB parameters change notification, or upon entering a cell during RRC\_IDLE, or before establishing an RRC connection if using eDRX with DRX cycle longer than the modification period:

3> if *schedulingInfoList* indicates that *SystemInformationBlockType14* is present:

4> start acquiring *SystemInformationBlockType14* immediately;

3> else:

4> discard *SystemInformationBlockType14*, if previously received;

NOTE 4: EAB capable UEs start acquiring *SystemInformationBlockType14* as described above even when *systemInfoValueTag* in *SystemInformationBlockType1* has not changed.

NOTE 5: EAB capable UEs maintain an up to date *SystemInformationBlockType14* in RRC\_IDLE.

1> if the UE is capable of sidelink communication and is configured by upper layers to receive or transmit sidelink communication:

2> if the cell used for sidelink communication meets the S-criteria as defined in TS 36.304 [4]; and

2> if *schedulingInfoList* indicates that *SystemInformationBlockType18* is present and the UE does not have stored a valid version of this system information block:

3> acquire *SystemInformationBlockType18*;

1> if the UE is capable of sidelink discovery and is configured by upper layers to receive or transmit sidelink discovery announcements on the primary frequency:

2> if *schedulingInfoList* of the serving cell/ PCell indicates that *SystemInformationBlockType19* is present and the UE does not have stored a valid version of this system information block:

3> acquire *SystemInformationBlockType19*;

1> if the UE is capable of sidelink discovery and, for each of the one or more frequencies included in *discInterFreqList*, if included in *SystemInformationBlockType19* and for which the UE is configured by upper layers to receive sidelink discovery announcements on:

2> if *SystemInformationBlockType19* of the serving cell/ PCell does not provide the corresponding reception resources; and

2> if *schedulingInfoList* of the cell on the concerned frequency indicates that *SystemInformationBlockType19* is present and the UE does not have stored a valid version of this system information block:

3> acquire *SystemInformationBlockType19*;

1> if the UE is capable of sidelink discovery and, for each of the one or more frequencies included in *discInterFreqList*, if included in *SystemInformationBlockType19* and for which the UE is configured by upper layers to transmit sidelink discovery announcements on:

2> if *SystemInformationBlockType19* of the serving cell/ PCell includes *discTxResourcesInterFreq* which is set to *acquireSI-FromCarrier*; and

2> if *schedulingInfoList* of the cell on the concerned frequency indicates that *SystemInformationBlockType19* is present and the UE does not have stored a valid version of this system information block:

3> acquire *SystemInformationBlockType19*;

1> if the UE is a NB-IoT UE connected to EPC and if *ab-Enabled* included in *MasterInformationBlock-NB/ MasterInformationBlock-TDD-NB* is set to *TRUE*:

2> not initiate the RRC connection establishment/resume procedure for all access causes except mobile terminating calls until the UE has acquired the *SystemInformationBlockType14*-*NB*;

1> if the UE is capable of V2X sidelink communication and is configured by upper layers to receive or transmit V2X sidelink communication on a frequency:

2> if *schedulingInfoList* on the serving cell/PCell indicates that *SystemInformationBlockType21* is present and the UE does not have stored valid version of this system information block:

3> acquire *SystemInformationBlockType21* from serving cell/PCell;

2> if *schedulingInfoList* on the serving cell/PCell indicates that *SystemInformationBlockType26* is present and the UE does not have stored valid version of this system information block;

3> acquire *SystemInformationBlockType26* from serving cell/PCell;

1> if the UE is capable of V2X sidelink communication and is configured by upper layers to receive V2X sidelink communication on a frequency, which is not primary frequency:

2> if neither *SystemInformationBlockType21* nor *SystemInformationBlockType26* of the serving cell/ PCell provide reception resource pool for V2X sidelink communication for the concerned frequency; and

2> if the cell used for V2X sidelink communication on the concerned frequency meets the S-criteria as defined in TS 36.304 [4]:

3> if *schedulingInfoList* on the concerned frequency indicates that *SystemInformationBlockType21* is present and the UE does not have stored a valid version of this system information block:

4> acquire *SystemInformationBlockType21* from the concerned frequency;

3> if *schedulingInfoList* on the concerned frequency indicates that *SystemInformationBlockType26* is present and the UE does not have stored a valid version of this system information block:

4> acquire *SystemInformationBlockType26* from the concerned frequency;

1> if the UE is capable of V2X sidelink communication and is configured by upper layers to transmit V2X sidelink communication on a frequency, which is not primary frequency and is not included in *v2x-InterFreqInfoList* in *SystemInformationBlockType21* nor *SystemInformationBlockType26* of the serving cell/PCell:

2> if the cell used for V2X sidelink communication on the concerned frequency meets the S-criteria as defined in TS 36.304 [4]:

3> if *schedulingInfoList* on the concerned frequency indicates that *SystemInformationBlockType21* is present and the UE does not have stored a valid version of this system information block:

4> acquire *SystemInformationBlockType21* from the concerned frequency;

3> if *schedulingInfoList* on the concerned frequency indicates that *SystemInformationBlockType26* is present and the UE does not have stored a valid version of this system information block:

4> acquire *SystemInformationBlockType26* from the concerned frequency;

1> if the NB-IoT UE supports NPRACH resources using preamble format 2:

2> if *schedulingInfoList* indicates that *SystemInformationBlockType23-NB* is present and the UE does not have stored a valid version of this system information block:

3> acquire *SystemInformationBlockType23-NB*;

1> following a request from positioning upper layers:

2> acquire *SystemInformationBlockPos*, as defined in 5.2.3;

1> if the UE is capable of NR sidelink communication and is configured by upper layers to receive or transmit NR sidelink communication on a frequency:

2> if *schedulingInfoList* on the serving cell/PCell indicates that *SystemInformationBlockType28* is present and the UE does not have stored valid version of this system information block:

3> acquire *SystemInformationBlockType28* from serving cell/PCell;

1> if the UE connected to 5GC is a BL UE or a UE in CE:

2> when the UE does not have stored a valid version of *SystemInformationBlockType25* upon entering RRC\_IDLE, or when the UE acquires *SystemInformationBlockType1-BR* following UAC parameters change notification, or upon entering a cell during RRC\_IDLE, or before establishing, resuming or re-establishing an RRC connection if using an eDRX cycle longer than the modification period:

3> if *schedulingInfoList* indicates that *SystemInformationBlockType25* is present:

4> start acquiring *SystemInformationBlockType25* immediately before establishing, resuming or re-establishing an RRC connection;

3> else:

4> discard *SystemInformationBlockType25*, if previously received;

NOTE 5a: When connected to 5GC, BL UEs or a UEs in CE start acquiring *SystemInformationBlockType25* as described above even when *systemInfoValueTag* in *SystemInformationBlockType1-BR* has not changed.

NOTE 5b: When connected to 5GC, BL UEs or a UEs in CE maintain an up to date *SystemInformationBlockType25* in RRC\_IDLE.

1> if the UE is a NB-IoT UE connected to 5GC and if *ab-Enabled5GC* included in *MasterInformationBlock-NB/ MasterInformationBlock-TDD-NB* is set to *TRUE*:

2> not initiate the RRC connection establishment/ resume/ re-establishment procedure for all access causes until the UE has acquired the *SystemInformationBlockType14*-*NB*;

1> if the UE is NTN capable:

2> if *schedulingInfoList* indicates that *SystemInformationBlockType31* (*SystemInformationBlockType31-NB* in NB-IoT) is present:

3> immediately before establishing, resuming or re-establishing an RRC connection; or

3> immediately before EDT or transmission using PUR; or

3> if in RRC\_CONNECTED and T317 is not running:

4> acquire *SystemInformationBlockType31* (*SystemInformationBlockType31-NB* in NB-IoT);

2> if the UE supports discontinuous coverage; and

2> if *schedulingInfoList* indicates that *SystemInformationBlockType32* (*SystemInformationBlockType32-NB* in NB-IoT) is present and the UE does not have a valid version of this system information block:

3> acquire *SystemInformationBlockType32* (*SystemInformationBlockType32-NB* in NB-IoT);

The UE may apply the received SIBs or posSIBs immediately, i.e. the UE does not need to delay using a SIB or posSIB until all SI messages have been received. The UE may delay applying the received SIBs until completing lower layer procedures associated with a received or a UE originated RRC message, e.g. an ongoing random access procedure.

NOTE 6: While attempting to acquire a particular SIB/posSIB, if the UE detects from *schedulingInfoList*/ *posSchedulingInfoList* that it is no longer present, the UE should stop trying to acquire the particular SIB/ posSIB.

#### 5.2.2.5 Essential system information missing

The UE shall:

1> if in RRC\_IDLE, RRC\_INACTIVE or in RRC\_CONNECTED while T311 is running:

2> if the UE is unable to acquire the *MasterInformationBlock (MasterInformationBlock-NB/ MasterInformationBlock-TDD-NB* in NB-IoT); or

2> if the UE is neither a BL UE nor in CE nor in NB-IoT and the UE is unable to acquire the *SystemInformationBlockType1*; or

2> if the BL UE or UE in CE is unable to acquire *SystemInformationBlockType1-BR* or *SystemInformationBlockType1-BR* is not scheduled; or

2> if the NB-IoT UE is unable to acquire the *SystemInformationBlockType1-NB*:

3> consider the cell as barred in accordance with TS 36.304 [4]; and

3> perform barring as if *intraFreqReselection* is set to *allowed*,and as if the *csg-Indication* is set to *FALSE*;

2> else:

3> if the UE is unable to acquire the *SystemInformationBlockType2* (or *SystemInformationBlockType2-NB* in NB-IoT) and for NB-IoT, *SystemInformationBlockType22-NB* if scheduled; or

3> if *SystemInformationBlockType25* is broadcast and if the UE is connected to 5GC and is unable to acquire the *SystemInformationBlockType25*; or

3> if the UE is NTN capable, *SystemInformationBlockType31* (*SystemInformationBlockType31-NB* in NB-IoT) is broadcast and if the UE is unable to acquire the *SystemInformationBlockType31* (*SystemInformationBlockType31-NB* in NB-IoT):

4> treat the cell as barred in accordance with TS 36.304 [4];

#### 5.2.2.6 Actions upon reception of the *MasterInformationBlock* message

Upon receiving the *MasterInformationBlock* message the UE shall:

1> apply the radio resource configuration included in the *phich-Config*;

1> if the UE is in RRC\_IDLE or if the UE is in RRC\_CONNECTED while T311 is running:

2> if the UE has no valid system information stored according to 5.2.2.3 for the concerned cell:

3> apply the received value of *dl-Bandwidth* to the *ul-Bandwidth* until *SystemInformationBlockType2* is received;

Upon receiving the *MasterInformationBlock-NB* *or MasterInformationBlock-TDD-NB* message the UE shall:

1> apply the radio resource configuration included in accordance with the *operationModeInfo*.

No UE requirements related to the contents of *MasterInformationBlock-MBMS* apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/ or within the corresponding field descriptions.

#### 5.2.2.7 Actions upon reception of the *SystemInformationBlockType1* message

Upon receiving the *SystemInformationBlockType1* or *SystemInformationBlockType1-BR* either via broadcast or via dedicated signalling, the UE shall:

1> if the upper layers indicate the selected core network type as 5GC:

2> if the *cellAccessRelatedInfoList-5GC* contains an entry with the *plmn-Identity* or *plmn-Index* of the selected PLMN:

3> in the remainder of the procedures use *plmn-IdentityList*, *trackingAreaCode*, and *cellIdentity* for the cell as received in the corresponding *cellAccessRelatedInfoList-5GC* containing the selected PLMN;

1> else if the *cellAccessRelatedInfoList* contains an entry with the *PLMN-Identity* of the selected PLMN:

2> in the remainder of the procedures use *plmn-IdentityList*, *trackingAreaCode*, *trackingAreaList* and *cellIdentity* for the cell as received in the corresponding *cellAccessRelatedInfoList* containing the selected PLMN;

1> if in RRC\_IDLE or in RRC\_CONNECTED while T311 is running; and

1> if the UE is a category 0 UE according to TS 36.306 [5]; and

1> if *category0Allowed* is not included in *SystemInformationBlockType1*:

2> consider the cell as barred in accordance with TS 36.304 [4];

1> if in RRC\_CONNECTED while T311 is not running, and the UE supports multi-band cells as defined by bit 31 in *featureGroupIndicators*:

2> disregard the *freqBandIndicator* and *multiBandInfoList*, ifreceived, while in RRC\_CONNECTED;

2> forward the *cellIdentity* to upper layers;

2> forward the *trackingAreaCode* to upper layers;

2> forward the *trackingAreaList* to upper layers, if present;

1> else:

2> if UE is IAB-MT and if *iab-Support* is not provided for the selected PLMN nor the registered PLMN nor PLMN of the equivalent PLMN list:

3> consider the cell as barred for IAB-MT in accordance with TS 36.304 [4];

3> perform barring as if *intraFreqReselection* is set to allowed, and as if the *csg-Indication* is set to *FALSE*;

2> else:

3> if the frequency band indicated in the *freqBandIndicator* or *freqBandIndicatorAerial* is part of the frequency bands supported by the UE and it is not a downlink only band; or

3> if the UE supports *multiBandInfoList,* and if one or more of the frequency bands indicated in the *multiBandInfoList* or *multiBandInfoListAerial* are part of the frequency bands supported by the UE and they are not downlink only bands:

4> forward the *cellIdentity* to upper layers;

4> forward the *trackingAreaCode* to upper layers;

4> forward the *trackingAreaList* to upper layers, if present;

4> forward the PLMN identity to upper layers;

4> if in RRC\_INACTIVE and the forwarded information does not trigger message transmission by upper layers:

5> if the serving cell does not belong to the configured *ran-NotificationAreaInfo*:

6> initiate an RNA update as specified in 5.3.17.2;

4> forward the *ims-EmergencySupport* to upper layers, if present;

4> forward the *eCallOverIMS-Support* to upper layers, if present;

4> if the UE is capable of 5G NAS:

5> forward the *ims-EmergencySupport5GC* to upper layers, if present;

5> forward the *eCallOverIMS-Support5GC* to upper layers, if present;

5> forward *cp-CIoT-5GS-Optimisation* to upper layers, if present for the selected PLMN;

5> forward *up-CIoT-5GS-Optimisation* to upper layers, if present for the selected PLMN;

4> if the UE is aerial UE and for the frequency band selected by the UE (from *freqBandIndicatorAerial* or *multiBandInfoListAerial*), the *freqBandInfoAerial* or the *multiBandInfoListAerial* is present and the UE capable of *multiNS-Pmax* does not support any of the *additionalSpectrumEmission* in the *NS-PmaxListAerial* within the *freqBandInfoAerial* or *multiBandInfoListAerial*:

5> consider the cell as barred in accordance with TS 36.304 [4];

5> perform barring as if *intraFreqReselection* is set to *notAllowed*,and as if the *csg-Indication* is set to *FALSE*, upon which the procedure ends;

4> else if the UE is aerial UE and for the frequency band selected by the UE (from *freqBandIndicatorAerial* or *multiBandInfoListAerial*), the *freqBandInfoAerial* or the *multiBandInfoListAerial* is present and the UE capable of *multiNS-Pmax* supports at least one *additionalSpectrumEmission* in the *NS-PmaxListAerial* within the *freqBandInfoAerial* or *multiBandInfoListAerial*:

5> apply the first listed *additionalSpectrumEmission* which it supports among the values included in *NS-PmaxListAerial* within *freqBandInfoAerial* or *multiBandInfoListAerial*;

5> if the *additionalPmax* is present in the same entry of the selected *additionalSpectrumEmission* within *NS-PmaxListAerial*:

6> apply the *additionalPmax*;

5> else:

6> apply the *p-Max*;

4> else if, for the frequency band selected by the UE (from *freqBandIndicator* or *multiBandInfoList*), the *freqBandInfo* or the *multiBandInfoList-v10j0* is present and the UE capable of *multiNS-Pmax* supports at least one *additionalSpectrumEmission* in the *NS-PmaxList* within the *freqBandInfo* or *multiBandInfoList-v10j0*:

5> apply the first listed *additionalSpectrumEmission* which it supports among the values included in *NS-PmaxList* within *freqBandInfo* or *multiBandInfolist-v10j0*;

5> if the *additionalPmax* is present in the same entry of the selected *additionalSpectrumEmission* within *NS-PmaxList*:

6> apply the *additionalPmax*;

5> else:

6> apply the *p-Max*;

4> else:

5> apply the *additionalSpectrumEmission* in *SystemInformationBlockType2* and the *p-Max*;

3> else:

4> consider the cell as barred in accordance with TS 36.304 [4]; and

4> perform barring as if *intraFreqReselection* is set to *notAllowed*,and as if the *csg-Indication* is set to *FALSE*;

Upon receiving the *SystemInformationBlockType1-NB*, the UE shall:

1> if the upper layers indicate the selected core network type as 5GC:

2> in the remainder of the procedures use *plmn-IdentityList*, *trackingAreaCode*, and *cellIdentity* for the cell as received in the *cellAccessRelatedInfo-5GC*;

1> else:

2> in the remainder of the procedures use *plmn-IdentityList*, *trackingAreaCode*, *trackingAreaList* and *cellIdentity* for the cell as received in the *cellAccessRelatedInfo*;

1> if the frequency band indicated in the *freqBandIndicator* is part of the frequency bands supported by the UE; or

1> if one or more of the frequency bands indicated in the *multiBandInfoList* are part of the frequency bands supported by the UE:

2> forward the *cellIdentity* to upper layers;

2> forward the *trackingAreaCode* to upper layers;

2> forward the *trackingAreaList* to upper layers, if present;

2> if *attachWithoutPDN-Connectivity* is received for the selected PLMN:

3> forward the a*ttachWithoutPDN-Connectivity* to upper layers;

2> else:

3> indicate to upper layers that *attachWithoutPDN-Connectivity* is not present;

2> if the UE is capable of 5G NAS:

3> forward *ng-U-DataTransfer* to upper layers, if present for the selected PLMN;

3> forward *up-CIoT-5GS-Optimisation* to upper layers, if present for the selected PLMN;

2> if, for the frequency band selected by the UE (from *freqBandIndicator* or *multiBandInfoList*), the *freqBandInfo* is present and the UE capable of *multiNS-Pmax* supports at least one *additionalSpectrumEmission* in the *NS-PmaxList* within the *freqBandInfo*:

3> apply the first listed *additionalSpectrumEmission* which it supports among the values included in *NS-PmaxList* within *freqBandInfo*;

3> if the *additionalPmax* is present in the same entry of the selected *additionalSpectrumEmission* within *NS-PmaxList*:

4> apply the *additionalPmax*;

3> else:

4> apply the *p-Max*;

2> else:

3> apply the *additionalSpectrumEmission* in *SystemInformationBlockType2-NB* and the *p-Max*;

1> else:

2> consider the cell as barred in accordance with TS 36.304 [4]; and

2> perform barring as if *intraFreqReselection* is set to *notAllowed*.

No UE requirements related to the contents of *SystemInformationBlockType1-MBMS* apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/ or within the corresponding field descriptions.

#### 5.2.2.8 Actions upon reception of *SystemInformation* messages

No UE requirements related to the contents of the *SystemInformation* messages apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/ or within the corresponding field descriptions.

#### 5.2.2.9 Actions upon reception of *SystemInformationBlockType2*

Upon receiving *SystemInformationBlockType2*, the UE shall:

1> apply the configuration included in the *radioResourceConfigCommon*;

1> derive the DRX cycle as specified in TS 36.304 [4], clause 7.1;

1> if the *mbsfn-SubframeConfigList* is included:

2> consider that DL assignments may occur in the MBSFN subframes indicated in the *mbsfn-SubframeConfigList* under the conditions specified in TS 36.213 [23], clause 7.1;

1> apply the specified PCCH configuration defined in 9.1.1.3;

1> not apply the *timeAlignmentTimerCommon*;

1> if in RRC\_CONNECTED and UE is configured with RLF timers and constants values received within *rlf-TimersAndConstants*:

2> not update its values of the timers and constants in *ue-TimersAndConstants* except for the value of timer T300;

1> if in RRC\_CONNECTED while T311 is not running; and the UE supports multi-band cells as defined by bit 31 in *featureGroupIndicators* or *multipleNS-Pmax*:

2> disregard the *additionalSpectrumEmission* and *ul-CarrierFreq*, ifreceived, while in RRC\_CONNECTED;

1> if *attachWithoutPDN-Connectivity* is received for the selected PLMN:

2> forward a*ttachWithoutPDN-Connectivity* to upper layers;

1> else:

2> indicate to upper layers that *attachWithoutPDN-Connectivity* is not present;

1> if *cp-CIoT-EPS-Optimisation* is received for the selected PLMN:

2> forward *cp-CIoT-EPS-Optimisation* to upper layers;

1> else:

2> indicate to upper layers that *cp-CIoT-EPS-Optimisation* is not present;

1> if *up-CIoT-EPS-Optimisation* is received for the selected PLMN:

2> forward *up-CIoT-EPS-Optimisation* to upper layers;

1> else:

2> indicate to upper layers that *up-CIoT-EPS-Optimisation* is not present;

1> if *SystemInformationBlockType26a* is not present:

2> to upper layers either forward *upperLayerIndication*, if present for the selected PLMN, or otherwise indicate absence of this field;

NOTE: *upperLayerIndication* is an indication to upper layers that the UE has entered a coverage area that offers 5G capabilities.

1> to upper layers either forward *rlos-Enabled*, if present, or otherwise indicate absence of this field;

Upon receiving *SystemInformationBlockType2-NB*, the UE shall:

1> apply the configuration included in the *radioResourceConfigCommon*;

1> derive the DRX cycle as specified in TS 36.304 [4], clause 7.1;

1> if *SystemInformationBlockType22-NB* is scheduled:

2> read and act on information sent in *SystemInformationBlockType22-NB*;

1> apply the specified PCCH configuration defined in 9.1.1.3.

1> if in RRC\_CONNECTED and UE is configured with RLF timers and constants values received within *rlf-TimersAndConstants*:

2> not update its values of the timers and constants in *ue-TimersAndConstants* except for the value of timer T300;

Upon receiving *SystemInformationBlockType2* (*SystemInformationBlockType2-NB* in NB-IoT), the UE shall:

1> if *up-PUR-5GC* is not included and the UE connected to 5GC in RRC\_IDLE with a suspended RRC connection is configured with *pur-Config*; or

1> if *up-PUR-EPC* is not included and the UE connected to EPC in RRC\_IDLE with a suspended RRC connection is configured with *pur-Config*; or

1> if *cp-PUR-5GC* is not included and the UE connected to 5GC in RRC\_IDLE without a suspended RRC connection is configured with *pur-Config*; or

1> if *cp-PUR-EPC* is not included and the UE connected to EPC in RRC\_IDLE without a suspended RRC connection is configured with *pur-Config*:

2> if *pur-TimeAlignmentTimer* is configured, indicate to lower layers that *pur-TimeAlignmentTimer* is released;

2> release *pur-Config*;

2> discard previously stored *pur-Config*.

#### 5.2.2.10 Actions upon reception of *SystemInformationBlockType3*

Upon receiving *SystemInformationBlockType3*, the UE shall:

1> if in RRC\_IDLE, the *redistributionServingInfo* is included and the UE is redistribution capable:

2> perform E-UTRAN inter-frequency redistribution procedure as specified in TS 36.304 [4], clause 5.2.4.10;

1> if in RRC\_IDLE, or in RRC\_CONNECTED while T311 is running:

2> if, for the frequency band selected by the UE (from the procedure in clause 5.2.2.7) to represent the serving cell's carrier frequency, the *freqBandInfo* or the *multiBandInfoList-v10j0* (for aerial UE the *freqBandInfoAerial* or the *multiBandInfoListAerial*) is present in *SystemInformationBlockType3* and the UE capable of *multiNS-Pmax* supports at least one *additionalSpectrumEmission* in the *NS-PmaxList* within the *freqBandInfo* or *multiBandInfoList-v10j0* (for aerial UE the *NS-PmaxListAerial* within the *freqBandInfoAerial* or the *multiBandInfoListAerial*):

3> if the UE is aerial UE:

4> apply the first listed *additionalSpectrumEmission* which it supports among the values included in *NS-PmaxListAerial* within *freqBandInfoAerial* or *multiBandInfoListAerial*;

3> else:

4> apply the first listed *additionalSpectrumEmission* which it supports among the values included in *NS-PmaxList* within *freqBandInfo* or *multiBandInfoList-v10j0*;

3> if the *additionalPmax* is present in the same entry of the selected *additionalSpectrumEmission* within *NS-PmaxList* (for aerial UE the *NS-PmaxListAerial*):

4> apply the *additionalPmax*;

3> else:

4> apply the *p-Max*;

2> else:

3> apply the *p-Max*;

Upon receiving *SystemInformationBlockType3-NB*, the UE shall:

1> if in RRC\_IDLE, or in RRC\_CONNECTED while T311 is running:

2> if, for the frequency band selected by the UE (from the procedure in clause 5.2.2.7) to represent the serving cell's carrier frequency, the *freqBandInfo* or the *multiBandInfoList* is present in *SystemInformationBlockType3-NB* and the UE capable of *multiNS-Pmax* supports at least one *additionalSpectrumEmission* in the *NS-PmaxList* within the *freqBandInfo* or the *multiBandInfoList*:

3> apply the first listed *additionalSpectrumEmission* which it supports among the values included in *NS-PmaxList* within *freqBandInfo* or *multiBandInfoList*;

3> if the *additionalPmax* is present in the same entry of the selected *additionalSpectrumEmission* within *NS-PmaxList*:

4> apply the *additionalPmax*;

3> else:

4> apply the *p-Max*;

2> else:

3> apply the *p-Max*;

#### 5.2.2.11 Actions upon reception of *SystemInformationBlockType4*

No UE requirements related to the contents of this *SystemInformationBlock (SystemInformationBlockType4* or *SystemInformationBlockType4-NB)* apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/ or within the corresponding field descriptions.

#### 5.2.2.12 Actions upon reception of *SystemInformationBlockType5*

Upon receiving *SystemInformationBlockType5*, the UE shall:

1> if in RRC\_IDLE, the *redistributionInterFreqInfo* is included and the UE is redistribution capable:

2> perform E-UTRAN inter-frequency redistribution procedure as specified in TS 36.304 [4], clause 5.2.4.10;

1> if in RRC\_IDLE, or in RRC\_CONNECTED while T311 is running:

2> if the frequency band selected by the UE to represent a non-serving E UTRA carrier frequency is not a downlink only band:

3> if, for the selected frequency band, the *freqBandInfo* or the *multiBandInfoList-v10j0* (for aerial UE the *freqBandInfoAerial* or the *multiBandInfoListAerial*) is present and the UE capable of *multiNS-Pmax* supports at least one *additionalSpectrumEmission* in the *NS-PmaxList* within *freqBandInfo* or *multiBandInfoList-v10j0* (for aerial UE the *NS-PmaxListAerial* within the *freqBandInfoAerial* or the *multiBandInfoListAerial*):

4> if the UE is aerial UE:

5> apply the first listed *additionalSpectrumEmission* which it supports among the values included in *NS-PmaxListAerial* within *freqBandInfoAerial* or *multiBandInfoListAerial*;

4> else:

5> apply the first listed *additionalSpectrumEmission* which it supports among the values included in *NS-PmaxList* within *freqBandInfo* or *multiBandInfoList-v10j0*;

4> if the *additionalPmax* is present in the same entry of the selected *additionalSpectrumEmission* within *NS-PmaxList* (for aerial UE the *NS-PmaxListAerial*):

5> apply the *additionalPmax*;

4> else:

5> apply the *p-Max*;

3> else:

4> apply the *p-Max*;

1> if in RRC\_IDLE or RRC\_INACTIVE, and T331 is running:

2> perform the actions as specified in 5.6.20.1a;

Upon receiving *SystemInformationBlockType5-NB*, the UE shall:

1> if in RRC\_IDLE, or in RRC\_CONNECTED while T311 is running:

2> if, for the frequency band selected by the UE (from *multiBandInfoList*) to represent a non-serving NB-IoT carrier frequency, the *freqBandInfo* is present and the UE capable of *multiNS-Pmax* supports at least one *additionalSpectrumEmission* in the *NS-PmaxList* within the *freqBandInfo*:

3> apply the first listed *additionalSpectrumEmission* which it supports among the values included in *NS-PmaxList* within *freqBandInfo*;

3> if the *additionalPmax* is present in the same entry of the selected *additionalSpectrumEmission* within *NS-PmaxList*:

4> apply the *additionalPmax*;

3> else:

4> apply the *p-Max*;

2> else:

3> apply the *p-Max*;

#### 5.2.2.13 Actions upon reception of *SystemInformationBlockType6*

No UE requirements related to the contents of this *SystemInformationBlock* apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/ or within the corresponding field descriptions.

#### 5.2.2.14 Actions upon reception of *SystemInformationBlockType7*

No UE requirements related to the contents of this *SystemInformationBlock* apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/ or within the corresponding field descriptions.

#### 5.2.2.15 Actions upon reception of *SystemInformationBlockType8*

Upon receiving *SystemInformationBlockType8*, the UE shall:

1> if *sib8-PerPLMN-List* is included and the UE is capable of network sharing for CDMA2000:

2> apply the CDMA2000 parameters below corresponding to the RPLMN;

1> if the *systemTimeInfo* is included:

2> forward the *systemTimeInfo* to CDMA2000 upper layers;

1> if the UE is in RRC\_IDLE and if *searchWindowSize* is included:

2> forward the *searchWindowSize* to CDMA2000 upper layers;

1> if *parametersHRPD* is included:

2> forward the *preRegistrationInfoHRPD* to CDMA2000 upper layers only if the UE has not received the *preRegistrationInfoHRPD* within an *RRCConnectionReconfiguration* message after entering this cell;

2> if the *cellReselectionParametersHRPD* is included:

3> forward the *neighCellList* to the CDMA2000 upper layers;

1> if the *parameters1XRTT* is included:

2> if the *csfb-RegistrationParam1XRTT* is included:

3> forward the *csfb-RegistrationParam1XRTT* to the CDMA2000 upper layers which will use this information to determine if a CS registration/re-registration towards CDMA2000 1xRTT in the EUTRA cell is required;

2> else:

3> indicate to CDMA2000 upper layers that CSFB Registration to CDMA2000 1xRTT is not allowed;

2> if the *longCodeState1XRTT* is included:

3> forward the *longCodeState1XRTT* to CDMA2000 upper layers;

2> if the *cellReselectionParameters1XRTT* is included:

3> forward the *neighCellList* to the CDMA2000 upper layers;

2> if the *csfb-SupportForDualRxUEs* is included:

3> forward *csfb-SupportForDualRxUEs* to the CDMA2000 upper layers;

2> else:

3> forward *csfb-SupportForDualRxUEs*, with its value set to *FALSE*, to the CDMA2000 upper layers;

2> if *ac-BarringConfig1XRTT* is included:

3> forward *ac-BarringConfig1XRTT* to the CDMA2000 upper layers;

2> if the *csfb-DualRxTxSupport* is included:

3> forward *csfb-DualRxTxSupport* to the CDMA2000 upper layers;

2> else:

3> forward *csfb-DualRxTxSupport*, with its value set to *FALSE*, to the CDMA2000 upper layers;

#### 5.2.2.16 Actions upon reception of *SystemInformationBlockType9*

Upon receiving *SystemInformationBlockType9*, the UE shall:

1> if *hnb-Name* is included, forward the *hnb-Name* to upper layers;

#### 5.2.2.17 Actions upon reception of *SystemInformationBlockType10*

Upon receiving *SystemInformationBlockType10*, the UE shall:

1> forward the received *warningType*, *messageIdentifier* and *serialNumber* to upper layers;

#### 5.2.2.18 Actions upon reception of *SystemInformationBlockType11*

Upon receiving *SystemInformationBlockType11*, the UE shall:

1> if there is no current value for *messageIdentifier* and *serialNumber* for *SystemInformationBlockType11*; or

1> if either the received value of *messageIdentifier* or of s*erialNumber* or of both are different from the current values of *messageIdentifier* and *serialNumber* for *SystemInformationBlockType11*:

2> use the received values of *messageIdentifier* and *serialNumber* for *SystemInformationBlockType11* as the current values of *messageIdentifier* and *serialNumber* for *SystemInformationBlockType11*;

2> discard any previously buffered *warningMessageSegment*;

2> if all segments of a warning message have been received:

3> assemble the warning message from the received *warningMessageSegment*;

3> forward the received warning message, *messageIdentifier*, *serialNumber* and *dataCodingScheme* to upper layers;

3> stop reception of *SystemInformationBlockType11*;

3> discard the current values of *messageIdentifier* and *serialNumber* for *SystemInformationBlockType11*;

2> else:

3> store the received *warningMessageSegment*;

3> continue reception of *SystemInformationBlockType11*;

1> else if all segments of a warning message have been received:

2> assemble the warning message from the received *warningMessageSegment*;

2> forward the received complete warning message, *messageIdentifier*, *serialNumber* and *dataCodingScheme* to upper layers;

2> stop reception of *SystemInformationBlockType11*;

2> discard the current values of *messageIdentifier* and *serialNumber* for *SystemInformationBlockType11*;

1> else:

2> store the received *warningMessageSegment*;

2> continue reception of *SystemInformationBlockType11*;

The UE should discard any stored *warningMessageSegment* and the current value of *messageIdentifier* and *serialNumber* for *SystemInformationBlockType11* if the complete warning message has not been assembled within a period of 3 hours.

#### 5.2.2.19 Actions upon reception of *SystemInformationBlockType12*

Upon receiving *SystemInformationBlockType12*, the UE shall:

1> if the *SystemInformationBlockType12* contains a complete warning message and the complete geographical area coordinates (if any):

2> forward the received warning message, *messageIdentifier*, *serialNumber*, *dataCodingScheme* and the geographical area coordinates (if any) to upper layers;

2> continue reception of *SystemInformationBlockType12*;

1> else:

2> if the received values of *messageIdentifier* and *serialNumber* are the same (each value is the same) as a pair for which a warning message and the geographical area coordinates (if any) are currently being assembled:

3> store the received *warningMessageSegment*;

3> store the received *warningAreaCoordinatesSegment* (if any);

3> if all segments of a warning message and geographical area coordinates (if any) have been received:

4> assemble the warning message from the received *warningMessageSegment*;

4> assemble the geographical area coordinates from the received *warningAreaCoordinatesSegment* (if any);

4> forward the received warning message, *messageIdentifier*, *serialNumber*, *dataCodingScheme* and geographical area coordinates (if any) to upper layers;

4> stop assembling a warning message and warning area coordinates (if any) for this *messageIdentifier* and *serialNumber* and delete all stored information held for it;

3> continue reception of *SystemInformationBlockType12*;

2> else if the received values of *messageIdentifier* and/or *serialNumber* are not the same as any of the pairs for which a warning message is currently being assembled:

3> start assembling a warning message for this *messageIdentifier* and *serialNumber* pair;

3> start assembling the geographical area coordinates (if any) for this *messageIdentifier* and *serialNumber* pair;

3> store the received *warningMessageSegment*;

3> store the received *warningAreaCoordinatesSegment* (if any);

3> continue reception of *SystemInformationBlockType12*;

The UE should discard *warningMessageSegment* and *warningAreaCoordinatesSegment* (if any) and the associated values of *messageIdentifier* and *serialNumber* for *SystemInformationBlockType12* if the complete warning message and the warning area coordinates (if any) have not been assembled within a period of 3 hours.

NOTE: The number of warning messages that a UE can re-assemble simultaneously is a function of UE implementation.

#### 5.2.2.20 Actions upon reception of *SystemInformationBlockType13*

No UE requirements related to the contents of this *SystemInformationBlock* apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/ or within the corresponding field descriptions.

#### 5.2.2.21 Actions upon reception of *SystemInformationBlockType14*

No UE requirements related to the contents of this *SystemInformationBlock* (*SystemInformationBlockType14* or *SystemInformationBlockType14-NB*)apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/ or within the corresponding field descriptions.

#### 5.2.2.22 Actions upon reception of *SystemInformationBlockType15*

No UE requirements related to the contents of this *SystemInformationBlock* (*SystemInformationBlockType15* or *SystemInformationBlockType15-NB*)apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/ or within the corresponding field descriptions.

#### 5.2.2.23 Actions upon reception of *SystemInformationBlockType16*

Upon receiving *SystemInformationBlockType16* with *timeReferenceInfo*, the UE may perform the related actions as specified in clause 5.6.1.3.

#### 5.2.2.24 Actions upon reception of *SystemInformationBlockType17*

Upon receiving *SystemInformationBlockType17*, the UE shall:

1> if *wlan-OffloadConfigCommon* corresponding to the RPLMN is included:

2> if the UE is not configured with *rclwi-Configuration* with *command* set to *steerToWLAN*:

3> apply the *wlan-Id-List* corresponding to the RPLMN;

2> if not configured with the *wlan-OffloadConfigDedicated*:

3> apply the *wlan-OffloadConfigCommon* corresponding to the RPLMN;

#### 5.2.2.25 Actions upon reception of *SystemInformationBlockType18*

Upon receiving *SystemInformationBlockType18*, the UE shall:

1> if *SystemInformationBlockType18* message includes the *commConfig*:

2> if configured to receive sidelink communication:

3> from the next SC period, as defined by *sc-Period*, use the resource pool indicated by *commRxPool* for sidelink communication monitoring, as specified in 5.10.3;

2> if configured to transmit sidelink communication:

3> from the next SC period, as defined by *sc-Period*, use the resource pool indicated by *commTxPoolNormalCommon*, *commTxPoolNormalCommonExt* or by *commTxPoolExceptional* for sidelink communication transmission, as specified in 5.10.4;

#### 5.2.2.26 Actions upon reception of *SystemInformationBlockType19*

Upon receiving *SystemInformationBlockType19*, the UE shall:

1> if *SystemInformationBlockType19* message includes the *discConfig* or *discConfigPS*:

2> from the next discovery period, as defined by *discPeriod*, use the resources indicated by *discRxPool*, *discRxResourcesInterFreq* or *discRxPoolPS* for sidelink discovery monitoring, as specified in 5.10.5;

2> if *SystemInformationBlockType19* message includes the *discTxPoolCommon* or *discTxPoolPS-Common*; and the UE is in RRC\_IDLE:

3> from the next discovery period, as defined by *discPeriod*, use the resources indicated by *discTxPoolCommon* or *discTxPoolPS-Common* for sidelink discovery announcement, as specified in 5.10.6;

2> if the *SystemInformationBlockType19* message includes the *discTxPowerInfo*:

3> use the power information included in *discTxPowerInfo* for sidelink discovery transmission on the serving frequency, as specified in TS 36.213 [23];

1> if *SystemInformationBlockType19* message includes the *discConfigRelay*:

2> if the *SystemInformationBlockType19* message includes the *txPowerInfo*:

3> use the power information included in *txPowerInfo* for sidelink discovery transmission on the corresponding non-serving frequency, as specified in TS 36.213 [23];

#### 5.2.2.27 Actions upon reception of *SystemInformationBlockType20*

No UE requirements related to the contents of this *SystemInformationBlock* (*SystemInformationBlockType20* or *SystemInformationBlockType20-NB*)apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/ or within the corresponding field descriptions.

#### 5.2.2.28 Actions upon reception of *SystemInformationBlockType21*

Upon receiving *SystemInformationBlockType21*, the UE shall:

1> if *SystemInformationBlockType21* message includes *sl-A2X-ConfigCommon*:

2> if configured to receive A2X sidelink communication:

3> in the remainder of the procedures, consider *sl-V2X-ConfigCommon* as included and use the resource pool indicated by *a2x-CommRxPool* and *a2x-CommTxPool* in *sl-A2X-ConfigCommon* for sidelink communication for A2X instead of *v2x-CommRxPool* and *v2x-CommTxPoolNormalCommon* in *sl-V2XConfigCommon*;

1> if *SystemInformationBlockType21* message includes *sl-V2X-ConfigCommon*:

2> if configured to receive V2X sidelink communication:

3> use the resource pool indicated by *v2x-CommRxPool* in *sl-V2X-ConfigCommon* for V2X sidelink communication monitoring, as specified in 5.10.12;

2> if configured to transmit V2X sidelink communication:

3> use the resource pool indicated by *v2x-CommTxPoolNormalCommon*, *p2x-CommTxPoolNormalCommon, v2x-CommTxPoolNormal, p2x-CommTxPoolNormal* or by *v2x-CommTxPoolExceptional* for V2X sidelink communication transmission, as specified in 5.10.13;

3> perform CBR measurement on the transmission resource pool(s) indicated by *v2x-CommTxPoolNormalCommon, v2x-CommTxPoolNormal* and *v2x-CommTxPoolExceptional* for V2X sidelink communication transmission, as specified in 5.5.3;

#### 5.2.2.29 Actions upon reception of *SystemInformationBlockType22-NB*

No UE requirements related to the contents of this *SystemInformationBlock* apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/ or within the corresponding field descriptions.

#### 5.2.2.30 Actions upon reception of *SystemInformationBlockType23-NB*

No UE requirements related to the contents of this *SystemInformationBlock* apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/ or within the corresponding field descriptions.

#### 5.2.2.31 Actions upon reception of *SystemInformationBlockType24*

Upon receiving *SystemInformationBlockType24*, the UE shall:

1> if in RRC\_IDLE or RRC\_INACTIVE, and T331 is running:

2> perform the actions as specified in 5.6.20.1a;

#### 5.2.2.32 Actions upon reception of *SystemInformationBlockType25*

No UE requirements related to the contents of this *SystemInformationBlock* apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/ or within the corresponding field descriptions.

#### 5.2.2.33 Actions upon reception of *SystemInformationBlockType26*

Upon receiving *SystemInformationBlockType26*, the UE shall:

1> if configured to receive V2X sidelink communication:

2> use the resource pool indicated by *v2x-CommRxPool* for V2X sidelink communication monitoring, as specified in 5.10.12;

1> if configured to transmit V2X sidelink communication:

2> use the resource pool indicated by *v2x-CommTxPoolNormal, p2x-CommTxPoolNormal* or by *v2x-CommTxPoolExceptional* for V2X sidelink communication transmission, as specified in 5.10.13;

2> perform CBR measurement on the transmission resource pool(s) indicated by *v2x-CommTxPoolNormal* and *v2x-CommTxPoolExceptional* for V2X sidelink communication transmission, as specified in 5.5.3;

#### 5.2.2.33a Actions upon reception of *SystemInformationBlockType26a*

Upon receiving *SystemInformationBlockType26a* the UE shall:

1> if *nrBandList* is included for the selected PLMN and the UE supports to operate in EN-DC using the serving cell and at least one of NR bands in *nrBandList:*

2> forward *upperLayerIndication*, as if the UE receives this field from SIB2, to upper layers;

1> else:

2> indicate upper layers absence of *upperLayerIndication*;

#### 5.2.2.34 Actions upon reception of *SystemInformationBlockPos*

No UE requirements related to the contents of the *SystemInformationBlockPos* apply other than those specified elsewhere e.g. within TS 36.355 [54], and/or within the corresponding field descriptions.

#### 5.2.2.35 Actions upon reception of *SystemInformationBlockType27*

No UE requirements related to the contents of this *SystemInformationBlock (SystemInformationBlockType27* or *SystemInformationBlockType27-NB)* apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/ or within the corresponding field descriptions.

#### 5.2.2.36 Actions upon reception of *SystemInformationBlockType28*

1> if the UE has stored at least one segment of *SIB28* and the value tag of *SIB28* has changed since a previous segment was stored:

2> discard all stored segments;

1> store the segment;

1> if all segments have been received:

2> assemble *SIB12-IEs* from the received segments;

2> perform actions as specified in 5.2.2.4.13 in TS 38.331 [82].

The UE should discard any stored segments for *SIB28* if the complete *SIB28* has not been assembled within a period of 3 hours. The UE shall discard any stored segments for *SIB 28* upon cell (re-)selection.

#### 5.2.2.37 Actions upon reception of *SystemInformationBlockType29*

No UE requirements related to the contents of this *SystemInformationBlock* apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/ or within the corresponding field descriptions.

#### 5.2.2.38 Actions upon reception of *SystemInformationBlockType30*

Upon receiving *SystemInformationBlockType30*, the UE shall:

1> forward the applicable disaster roaming information for each PLMN sharing the cell to upper layers.

#### 5.2.2.39 Actions upon reception of *SystemInformationBlockType31*

Upon receiving *SystemInformationBlockType31* (*SystemInformationBlockType31-NB*), the UE shall:

1> start or restart timer T317 with the duration *ul-SyncValidityDuration* from the subframe indicated by *epochTime*.

#### 5.2.2.40 Actions upon reception of *SystemInformationBlockType32*

No UE requirements related to the contents of this *SystemInformationBlock* (*SystemInformationBlockType32* or *SystemInformationBlockType32-NB*)apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/ or within the corresponding field descriptions.

#### 5.2.2.41 Actions upon reception of *SystemInformationBlockType33*

No UE requirements related to the contents of this *SystemInformationBlock* (*SystemInformationBlockType33* or *SystemInformationBlockType33-NB*)apply other than those specified elsewhere e.g. within procedures using the concerned system information, or within the corresponding field descriptions.

### 5.2.3 Acquisition of an SI message

When acquiring an SI message, the UE shall:

1> determine the start of the SI-window for the concerned SI message as follows:

2> if the concerned SI message is configured in the *schedulingInfoList*, *schedulingInfoListExt* (if present) or if the concerned SI message is configured in the *posSchedulingInfoList* and *si-posOffset* is not configured;

3> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the concatenated list of SI messages configured by *schedulingInfoList*, *schedulingInfoListExt* (if present) and *posSchedulingInfoList* in *SystemInformationBlockType1*;

3> determine the integer value *x* = (*n* – 1)\**w*, where *w* is the *si-WindowLength*;

3> the SI-window starts at the subframe #*a*, where *a* = *x* mod 10, in the radio frame for which SFN mod *T* = FLOOR(*x*/10), where *T* is the *si-Periodicity* or the *posSI-Periodicity* of the concerned SI message;

2> else if the concerned SI message is configured by the *posSchedulingInfoList* and *si-posOffset* is configured determine the start of the SI-window for the concerned SI message as follows:

3> determine the number *m* which corresponds to the number of SI messages with an associated *si-Periodicity* of 8 radio frames (80 ms), configured by *schedulingInfoList* and *schedulingInfoListExt* (if present) in *SystemInformationBlockType1*;

3> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the list of SI messages configured by *posSchedulingInfoList* in *SystemInformationBlockType1*;

3> determine the integer value *x* = *m*\**w +* (*n* – 1)\**w*, where *w* is the *si-WindowLength*

3> the SI-window starts at the subframe #*a*, where *a* = *x* mod 10, in the radio frame for which SFN mod *T* = FLOOR(*x*/10) + 8, where *T* is the *posSI-Periodicity* of the concerned SI message;

NOTE: E-UTRAN should configure an SI-window of 1 ms only if all SIs are scheduled before subframe #5 in radio frames for which SFN mod 2 = 0.

1> receive DL-SCH using the SI-RNTI from the start of the SI-window and continue until the end of the SI-window whose absolute length in time is given by *si-WindowLength*, or until the SI message was received, excluding the following subframes:

2> subframe #5 in radio frames for which SFN mod 2 = 0;

2> any MBSFN subframes;

2> any uplink subframes in TDD;

1> if the SI message was not received by the end of the SI-window, repeat reception at the next SI-window occasion for the concerned SI message;

### 5.2.3a Acquisition of an SI message by BL UE or UE in CE or a NB-IoT UE

When acquiring an SI message, the BL UE or UE in CE or NB-IoT UE shall:

1> determine the start of the SI-window for the concerned SI message as follows:

2> if the concerned SI message is configured in the *schedulingInfoList*, *schedulingInfoListExt* (if present) or if the concerned SI message is configured in the *posSchedulingInfoList* and *si-posOffset* is not configured;

3> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the concatenated list of SI messages configured by *schedulingInfoList*, *schedulingInfoListExt* (if present) in *SystemInformationBlockType1-BR* (or *SystemInformationBlockType1-NB* in NB-IoT) and *posSchedulingInfoList* in *SystemInformationBlockType1-BR*;

3> determine the integer value *x* = (*n* – 1)\**w*, where *w* is the *si-WindowLength-BR* (or *si-WindowLength* in NB-IoT);

3> if the UE is a NB-IoT UE:

4> the SI-window starts at the subframe #0 in the radio frame for which (H-SFN \* 1024 + SFN) mod *T* = FLOOR(*x*/10) + Offset, where *T* is the *si-Periodicity* of the concerned SI message and, Offset is the offset of the start of the SI-Window (*si-RadioFrameOffset*);

3> else:

4> the SI-window starts at the subframe #0 in the radio frame for which SFN mod *T* = FLOOR(*x*/10), where *T* is the *si-Periodicity* or the *posSI-Periodicity* of the concerned SI message;

2> else if the concerned SI message is configured by the *posSchedulingInfoList* and *si-posOffset* is configured determine the start of the SI-window for the concerned SI message as follows:

3> determine the number *m* which corresponds to the number of SI messages with an associated *si-Periodicity* of 8 radio frames (80 ms), configured by *schedulingInfoList* and *schedulingInfoListExt* (if present) in *SystemInformationBlockType1-BR*;

3> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the list of SI messages configured by *posSchedulingInfoList* in *SystemInformationBlockType1-BR*;

3> determine the integer value *x* = *m*\**w +* (*n* – 1)\**w*, where *w* is the *si-WindowLength-BR*;

3> the SI-window starts at the subframe #0 in the radio frame for which SFN mod *T* = FLOOR(*x*/10) + 8, where *T* is the *posSI-Periodicity* of the concerned SI message;

1> if the UE is a NB-IoT UE:

2> receive and accumulate SI message transmissions on DL-SCH from the start of the SI-window and continue until the end of the SI-window whose absolute length in time is given by *si-WindowLength,* starting from the radio frames as provided in *si-RepetitionPattern* and in subframes as provided in *downlinkBitmap* if present, or until successful decoding of the accumulated SI message transmissions, excluding the subframes used for transmission of NPSS, NSSS, *MasterInformationBlock-NB/ MasterInformationBlock-TDD-NB* and *SystemInformationBlockType1-NB*, and in IoT NTN TDD mode, the non-D subframes. If there are not enough subframes for one SI message transmission in the radio frames as provided in *si-RepetitionPattern*, the UE shall continue to receive the SI message transmission in the radio frames following the radio frame indicated in *si-RepetitionPattern*;

1> else:

2> receive and accumulate SI message transmissions on DL-SCH on narrowband provided by *si-Narrowband*, from the start of the SI-window and continue until the end of the SI-window whose absolute length in time is given by *si-WindowLength-BR,* only in radio frames as provided in *si-RepetitionPattern* and subframes as provided in *fdd-DownlinkOrTddSubframeBitmapBR* in *bandwidthReducedAccessRelatedInfo*, or until successful decoding of the accumulated SI message transmissions;

1> if the SI message was not possible to decode from the accumulated SI message transmissions by the end of the SI-window, continue reception and accumulation of SI message transmissions on DL-SCH in the next SI-window occasion for the concerned SI message;

### 5.2.3b Acquisition of an SI message from MBMS-dedicated cell

When acquiring an SI message, the UE shall:

1> determine the start of the SI-window for the concerned SI message as follows:

2> for the concerned SI message, determine the number *n* which corresponds to the order of entry in the list of SI messages configured by *schedulingInfoList* in *SystemInformationBlockType1-MBMS*;

2> determine the integer value *x* = (*n* – 1)\**w*, where *w* is the *si-WindowLength*;

2> the SI-window starts always at the subframe #*a*, where *a* = *x* mod 10, in the radio frame for which SFN mod *T* = FLOOR(*x*/10), where *T* is the *si-Periodicity* of the concerned SI message;

1> receive DL-SCH using SI-RNTI with value in accordance with 36.321 [6] from the start of the SI-window and continue until the end of the SI-window whose absolute length in time is given by *si-WindowLength*, or until the SI message was received, excluding the following subframes:

2> any MBSFN subframes;

1> if the SI message was not received by the end of the SI-window, repeat reception at the next SI-window occasion for the concerned SI message;

## 5.3 Connection control

### 5.3.1 Introduction

#### 5.3.1.1 RRC connection control

RRC connection establishment involves the establishment of SRB1. Except for EDT and transmission using PUR, E-UTRAN completes RRC connection establishment prior to completing the establishment of the S1 connection, i.e. prior to receiving the UE context information from the EPC. Consequently, AS security is not activated during the initial phase of the RRC connection. During this initial phase of the RRC connection, the E-UTRAN may configure the UE to perform measurement reporting, but the UE only sends the corresponding measurement reports after successful security activation. However, the UE only accepts a handover message when security has been activated.

NOTE 1: In case the serving frequency broadcasts multiple overlapping bands, E-UTRAN can only configure measurements after having obtained the UE capabilities, as the measurement configuration needs to be set according to the band selected by the UE.

Upon receiving the UE context from the EPC, E-UTRAN activates security (both ciphering and integrity protection) using the initial security activation procedure. The RRC messages to activate security (command and successful response) are integrity protected, while ciphering is started only after completion of the procedure. That is, the response to the message used to activate security is not ciphered, while the subsequent messages (e.g. used to establish SRB2 and DRBs) are both integrity protected and ciphered.

After having initiated the initial security activation procedure, E-UTRAN initiates the establishment of SRB2 and DRBs, i.e. E-UTRAN may do this prior to receiving the confirmation of the initial security activation from the UE. In any case, E-UTRAN will apply both ciphering and integrity protection for the RRC connection reconfiguration messages used to establish SRB2 and DRBs. E-UTRAN should release the RRC connection if the initial security activation and/ or the radio bearer establishment fails (i.e. security activation and DRB establishment are triggered by a joint S1-procedure, which does not support partial success).

For SRB2 and DRBs, security is always activated from the start, i.e. the E-UTRAN does not establish these bearers prior to activating security.

For some radio configuration fields, a critical extension has been defined. A switch from the original version of the field to the critically extended version is allowed using any connection reconfiguration. The UE reverts to the original version of some critically extended fields upon handover and re-establishment as specified elsewhere in this specification. Otherwise, switching a field from the critically extended version to the original version is only possible using the handover or re-establishment procedure with the full configuration option. This also applies for fields that are critically extended within a release (i.e. original and extended version defined in same release).

After having initiated the initial security activation procedure, E-UTRAN may configure a UE that supports CA, with one or more SCells in addition to the PCell that was initially configured during connection establishment. The PCell is used to provide the security inputs and upper layer system information (i.e. the NAS mobility information e.g. TAI). SCells are used to provide additional downlink and optionally uplink radio resources. When not configured with any kind of DC, all SCells the UE is configured with, if any, are part of the MCG.

When configured with DC, some of the SCells are part of a SCG. In this case, user data carried by a DRB may either be transferred via MCG (i.e. MCG-DRB), via SCG (SCG-DRB) or via both MCG and SCG in DL while E-UTRAN configures the CG used in UL (split DRB). An RRC connection reconfiguration message may be used to change the DRB type from MCG-DRB to SCG-DRB or to split DRB, as well as from SCG-DRB or split DRB to MCG-DRB.

DC employs SCG change, which is a synchronous SCG reconfiguration procedure (i.e. involving RA to the PSCell) including reset/ re-establishment of layer 2 and, if SCG DRBs are configured, refresh of security. The procedure is used in a number of different scenarios e.g. SCG establishment, PSCell change, Key refresh, change of DRB type. The UE performs the SCG change related actions upon receiving an *RRCConnectionReconfiguration* message including *mobilityControlInfoSCG*, see 5.3.10.10.

In case of MR-DC, the cells of one CG use another RAT, namely NR. The configuration of an NR CG is specified in TS 38.331 [82]. When configured with MR-DC, user data carried by a DRB may either be transferred via MCG, via NR SCG or via both MCG and NR SCG. Also RRC signalling carried by a SRB may either be transferred via MCG or via both MCG and NR SCG. When DRBs and SRBs are configured with transmission via both MCG and SCG, duplication may be used in both DL and UL.

When connected to EPC, change to NR PDCP or vice versa can be done for both SRBs and DRBs as follows. For DRBs, it can be performed using an *RRCConnectionReconfiguration* message either with or without the *mobilityControlInfo* (handover) by release and addition of the concerned RB. For SRBs, it can be performed using an *RRCConnectionReconfiguration* message with the *mobilityControlInfo* (handover) by release and addition of the concerned PDCP entity. For SRBs and DRBs, it can also be performed using the full configuration option. The same *RRCConnectionReconfiguration* message may be used to make changes regarding the CG(s) used for transmission. For SRB1, change from E-UTRA PDCP to NR PDCP type may, before initial security activation, also be performed using an *RRCConnectionReconfiguration* message not including the *mobilityControlInfo*.

In case of (NG)EN-DC, there are three types of NR SCG reconfigurations:

- Reconfiguration with sync and key change i.e. a procedure involving RA to the PSCell, including NR MAC reset, re-establishment of NR RLC and NR PDCP and refresh of NR SCG security; and

- Reconfiguration with sync but without key change i.e. a procedure involving RA to the PSCell, including NR MAC reset and NR RLC re-establishment and PDCP data recovery (for AM DRB); and

- Regular NR SCG reconfiguration neither involving refresh of NR SCG security, nor RA to the PSCell, NR MAC reset or NR RLC re-establishment;

The network is only required to use the NR SCG reconfiguration with sync and key change in case the NR SCG security key changes (i.e. handover, change of SNs, S-KgNB refresh). Further details are specified in NR RRC TS 38.331 [82].

NOTE 2: In case of MR-DC, E-UTRA RRC configuration parameters should only affect E-UTRA operation. E.g., *s-Measure* only affects measurements configured by parameters defined in this specification. Should an E-UTRA RRC configuration change require a change of NR RRC configuration, the network should indicate such NR change by NR RRC signalling. E.g. a specific indication is used to trigger RLC re-establishment upon reconfigurations changing the CG(s) used for transmission (in DL or UL) that otherwise would only involve NR RRC signalling.

In this release of the specification, change between DC and MR-DC as well as change between DC and E-UTRA configured with SN terminated DRB without SCG are not supported (i.e. neither the direct reconfiguration nor specific measurement events). Likewise, the direct transition between (NG)EN-DC and NR DC or NE-DC is not supported in this release of the specification.

The release of the RRC connection normally is initiated by E-UTRAN. The procedure may be used to re-direct the UE to an E-UTRA frequency or an inter-RAT carrier frequency. Only in exceptional cases, as specified within this specification, TS 36.300 [9], TS 36.304 [4] or TS 24.301 [35], may the UE abort the RRC connection, i.e. move to RRC\_IDLE without notifying E-UTRAN.

The suspension of the RRC connection is initiated by E-UTRA/EPC or E-UTRA/5GC. When the RRC connection is suspended, the UE stores the UE AS context and the *resumeIdentity* (EPC) or I-RNTI (5GC), and transitions to RRC\_IDLE state. The RRC message to suspend the RRC connection is integrity protected and ciphered. Suspension can only be performed when at least 1 DRB is successfully established.

The resumption of a suspended RRC connection is initiated by upper layers when the UE has a stored UE AS context, RRC connection resume is permitted by E-UTRA/EPC or E-UTRA/5GC and the UE needs to transit from RRC\_IDLE state to RRC\_CONNECTED state. When the RRC connection is resumed, RRC configures the UE according to the RRC connection resume procedure based on the stored UE AS context and any RRC configuration received from E-UTRA/EPC or E-UTRA/5GC. The RRC connection resume procedure re-activates security and re-establishes SRB(s) and DRB(s). The request to resume the RRC connection includes the *resumeIdentity* (EPC) or I-RNTI (5GC). The request is not ciphered, but protected with a message authentication code.

In response to a request to resume the RRC connection, E-UTRA/EPC or E-UTRA/5GC may resume the suspended RRC connection, reject the request to resume and instruct the UE to either keep or discard the stored context, or setup a new RRC connection.

In case of CP-EDT or CP transmission using PUR, the data are appended in the *RRCEarlyDataRequest* and *RRCEarlyDataComplete* messages, if available, and sent over SRB0. In case of UP-EDT or UP transmission using PUR, security is re-activated prior to transmission of RRC message using the *nextHopChainingCount* provided in the *RRCConnectionRelease* message with suspend indication during the preceding suspend procedure and the radio bearers are re-established. The uplink data are transmitted ciphered on DTCH multiplexed with the *RRCConnectionResumeRequest* message on CCCH. In the downlink, the data, if available, are transmitted on DTCH multiplexed with the *RRCConnectionRelease* message on DCCH. In response to a request for EDT or transmission using PUR, E-UTRA/EPC or E-UTRA/5GC may also choose to establish or resume the RRC connection.

A UE in RRC\_CONNECTED enters RRC\_INACTIVE when the network indicates RRC connection suspension in *RRCConnectionRelease* message. When entering RRC\_INACTIVE, the UE stores the UE Inactive AS context and any RRC configuration received from the network.

The resumption of an RRC connection from RRC\_INACTIVE is initiated by upper layers when the UE needs to transit from RRC\_INACTIVE state to RRC\_CONNECTED state or by RRC layer for, e.g. RNAU or reception of RAN paging. When the RRC connection is resumed, network configures the UE according to the RRC connection resume procedure based on the stored UE Inactive AS context and any RRC configuration received from the network. The RRC connection resume procedure re-activates security and re-establishes SRB(s) and DRB(s).

In response to a request to resume the RRC connection from RRC\_INACTIVE, the network may resume the suspended RRC connection and UE enters to RRC\_CONNECTED, or reject the request to resume using RRC message without security protection and send UE to RRC\_INACTIVE with wait time, or directly re-suspend the RRC connection and send UE to RRC\_INACTIVE, or directly release the RRC connection and send UE to RRC\_IDLE, or instruct the UE to initiate NAS level recovery.

NOTE 3: In case the configurations for V2X sidelink communication are acquired from NR, the configurations for V2X sidelink communication in *SystemInformationBlockType21,* *SystemInformationBlockType26, SL-V2X-ConfigDedicated* within *RRCConnectionReconfiguration* used in this clause can be provided by *SIB13*, *SIB14,* *sl-ConfigDedicatedEUTRA* within *RRCReconfiguration* as specified in TS 38.331 [82], respectively.

#### 5.3.1.2 Security

AS security comprises of the integrity protection of RRC signalling (SRBs) as well as the ciphering of RRC signalling (SRBs) and user data (DRBs). Integrity protection is optionally supported for DRBs when using NR PDCP configured with *nr-RadioBearerConfig1* or *nr-RadioBearerConfig2.*

RRC handles the configuration of the security parameters which are part of the AS configuration: the integrity protection algorithm, the ciphering algorithm and two parameters, namely the *keyChangeIndicator* and the *nextHopChainingCount,* which are used by the UE to determine the AS security keys upon handover, connection re-establishment, connection resume, UP-EDT and/ or UP transmission using PUR.

The integrity protection algorithm is common for signalling radio bearers SRB1, SRB2 and SRB4. The integrity protection algorithm signalled in *nr-RadioBearerConfig1*/ *nr-RadioBearerConfig2* for the DRBs configured to apply integrity protection of user data and *keyToUse* set to *master* as defined in TS 38.331 [82] is the same as the one signalled in *securityAlgorithmConfig*. When configured with MCG only, the ciphering algorithm is common for all radio bearers (i.e. SRB1, SRB2, SRB4 and DRBs). Neither integrity protection nor ciphering applies for SRB0.

RRC integrity and ciphering are always activated together, i.e. in one message/ procedure. RRC integrity and ciphering are never de-activated. However, it is possible to switch to a 'NULL' ciphering algorithm (eea0).

The 'NULL' integrity protection algorithm (eia0) is used only for the UE in limited service mode, as specified in TS 33.401 [32]. In case the 'NULL' integrity protection algorithm is used, 'NULL' ciphering algorithm is also used.

NOTE 1: Lower layers discard RRC messages for which the integrity check has failed and indicate the integrity verification check failure to RRC.

The AS applies different security keys: one for the integrity protection of RRC signalling (KRRCint), one for the ciphering of RRC signalling (KRRCenc) and one for the ciphering of user data (KUPenc). For the UE capable of user plane integrity protection when it is connected to E-UTRA/EPC (TS 33.401 [32]), the AS applies a security key for integrity protection of user data (KUPint) for the DRBs that are configured to apply integrity protection of user data. All AS keys are derived from the KeNB key. The KeNB is based on the KASME key for E-UTRA/EPC, or KAMF for E-UTRA/5GC, which is handled by upper layers.

Upon connection establishment new AS keys are derived. No AS-parameters are exchanged to serve as inputs for the derivation of the new AS keys at connection establishment.

The integrity and ciphering of the RRC message used to perform handover is based on the security configuration used prior to the handover and is performed by the source eNB.

The integrity and ciphering algorithms can only be changed upon handover. The AS keys (KeNB, KRRCint, KRRCenc, KUPenc and KUPint) change upon every handover, connection re-establishment, connection resume, UP-EDT and UP transmission using PUR. The *keyChangeIndicator* is used upon handover and indicates whether the UE should use the keys associated with the KASME key for E-UTRA/EPC, or KAMF for E-UTRA/5GC, taken into use with the latest successful NAS SMC procedure. The *nextHopChainingCount* parameter is used upon handover, connection re-establishment, connection resume, UP-EDT and UP transmission using PUR by the UE when deriving the new KeNB that is used to generate KRRCint, KRRCenc and KUPenc (see TS 33.401 [32]). An intra cell handover procedure may be used to change the keys in RRC\_CONNECTED.

For each radio bearer an independent counter (COUNT, as specified in TS 36.323 [8] for E-UTRA/EPC, and TS 38.323 [83] for E-UTRA/5GC) is maintained for each direction. For each DRB, the COUNT is used as input for ciphering. For each SRB, the COUNT is used as input for both ciphering and integrity protection. It is not allowed to use the same COUNT value more than once for a given security key. At connection resume the COUNT is reset. As specified in TS 33.401 clause 7.2.9.1 [32], the eNB is responsible for avoiding reuse of the COUNT with the same RB identity and with the same KeNB, e.g. due to the transfer of large volumes of data, release and establishment of new RBs, and multiple termination point changes for RLC-UM bearers, multiple termination point changes for RLC-AM bearer with SN terminated PDCP re-establishment (COUNT reset) due to SN only full configuration whilst the key stream inputs (i.e. bearer ID, security key) at MN have not been updated. In order to avoid such re-use, the eNB may e.g. use different RB identities for successive RB establishments, trigger an intra cell handover or by triggering a transition from RRC\_CONNECTED to RRC\_IDLE or RRC\_INACTIVE and then back to RRC\_CONNECTED.

In order to limit the signalling overhead, individual messages/ packets include a short sequence number (PDCP SN, as specified in TS 36.323 [8] for E-UTRA/EPC, and TS 38.323 [83] for E-UTRA/5GC). In addition, an overflow counter mechanism is used: the hyper frame number (TX\_HFN and RX\_HFN, as specified in TS 36.323 [8] for E-UTRA/EPC, and *HFN* as specified in TS 38.323 [83] for E-UTRA/5GC). The HFN needs to be synchronized between the UE and the eNB.

For each SRB, the value provided by RRC to lower layers to derive the 5-bit BEARER parameter used as input for ciphering and for integrity protection is the value of the corresponding *srb-Identity* with the MSBs padded with zeroes.

With E-UTRA/5GC for a UE not capable of NGEN-DC, the same ciphering algorithm signalled at SMC or handover is used for all radio bearers. Likewise, the same integrity algorithm signalled at SMC or handover is used for all SRBs.

In case of DC, a separate KeNB is used for SCG-DRBs (S-KeNB). This key is derived from the key used for the MCG (KeNB) and an SCG counter that is used to ensure freshness. To refresh the S-KeNB e.g. when the COUNT will wrap around, E-UTRAN employs an SCG change, i.e. an *RRCConnectionReconfiguration* message including *mobilityControlInfoSCG*. When performing handover, while at least one SCG-DRB remains configured, both KeNB and S-KeNB are refreshed. In such case E-UTRAN performs handover with SCG change i.e. an *RRCConnectionReconfiguration* message including both *mobilityControlInfo* and *mobilityControlInfoSCG*. The ciphering algorithm is common for all radio bearers within a CG but may be different between MCG and SCG. The ciphering algorithm for SCG DRBs can only be changed upon SCG change.

In case of (NG)EN-DC or of SN terminated RB without SCG, the network indicates whether the UE shall use either KeNB or S-KgNB for a particular DRB. In case of NE-DC, the network indicates whether the UE shall use either KgNB or S-KeNB for a particular DRB. S-KgNB/S-KeNB is derived from KeNB/KgNB as defined in TS 33.501 [86], uses a different counter (*sk-Counter*) and is used only for DRBs using NR PDCP. Whenever there is a need to refresh S-KgNB/S-KeNB, e.g. upon change of MN or SN, the NR SCG reconfiguration with sync and key change is used for S-KgNB refresh (see 5.3.1.1) and the *RRCConnectionReconfiguration* message including *mobilityControlInfoSCG* is used for S-KeNB refresh (see 5.3.10.10). E-UTRAN provides a UE configured with (NG)EN-DC with an *sk-Counter* even when no DRB is setup using S-KgNB i.e. to facilitate configuration of SRB3. The same ciphering algorithm as signalled by *nr-RadioBearerConfig1* and *nr-RadioBearerConfig2* as defined in TS 38.331 [82] is used for all radio bearers using the same key (i.e. KeNB or S-KgNB). Likewise, the same integrity algorithm as signalled by *nr-RadioBearerConfig1* and *nr-RadioBearerConfig2* as defined in TS 38.331 [82] is used for all SRBs, and DRBs configured to apply integrity protection of user data, using the same key. Although NR RRC uses different values for the security algorithms than E-UTRA, the actual algorithms are the same in case of (NG)EN-DC and NE-DC in this version of the specification. Hence, for such algorithms, the security capabilities supported by a UE are consistent across these RATs. For MR-DC with 5GC, integrity protection is not enabled for DRBs terminated on ng-eNB or when the master node is an ng-eNB.

NOTE 2: The network ensures that different values are used for the SCG counter and for the *sk-Counter* when deriving S-KgNB and/or S-KeNB from the same master key.

#### 5.3.1.2a RN security

For RNs, AS security follows the procedures in 5.3.1.2. Furthermore, E-UTRAN may configure per DRB whether or not integrity protection is used. The use of integrity protection may be configured only upon DRB establishment and reconfigured only upon handover or upon the first reconfiguration following RRC connection re-establishment.

To provide integrity protection on DRBs between the RN and the E-UTRAN, the KUPint key is derived from the KeNB key as described in TS 33.401 [32]. The same integrity protection algorithm used for SRBs also applies to the DRBs. The KUPint changes at every handover and RRC connection re-establishment and is based on an updated KeNB which is derived by taking into account the *nextHopChainingCount.* The COUNT value maintained for DRB ciphering is also used for integrity protection, if the integrity protection is configured for the DRB.

#### 5.3.1.3 Connected mode mobility

In RRC\_CONNECTED, the network controls UE mobility, i.e. the network decides when the UE shall connect to which E-UTRA cell(s), or inter-RAT cell. For network controlled mobility in RRC\_CONNECTED, the PCell can be changed using an *RRCConnectionReconfiguration* message including the *mobilityControlInfo* (handover), whereas the SCell(s) can be changed using the *RRCConnectionReconfiguration* message either with or without the *mobilityControlInfo*.

In DC, an SCG can be established, reconfigured or released by using an *RRCConnectionReconfiguration* message with or without the *mobilityControlInfo*. In case Random Access to the PSCell or initial PUSCH transmission to the PSCell if *rach-SkipSCG* is configured is required upon SCG reconfiguration, E-UTRAN employs the SCG change procedure (i.e. an *RRCConnectionReconfiguration* message including the *mobilityControlInfoSCG*). The PSCell can only be changed using the SCG change procedure and by release and addition of the PSCell.

In (NG)EN-DC, an NR SCG can be established or reconfigured by using an *RRCConnectionReconfiguration* message containing *nr-secondaryCellGroupConfig* and *nr-RadioBearerConfig*. The contents of *nr-secondaryCellGroupConfig* and *nr-RadioBearerConfig*, of other (NG)EN-DC fields as well as the associated procedures are specified in TS 38.331 [82]. In (NG)EN-DC, the PSCell can only be changed using the Reconfiguration with sync procedure, with or without MR-DC release and addition.

The network triggers the handover procedure e.g. based on radio conditions, load. To facilitate this, the network may configure the UE to perform measurement reporting (possibly including the configuration of measurement gaps). The network may also initiate handover blindly, i.e. without having received measurement reports from the UE.

Before sending the handover message to the UE, the source eNB prepares one or more target cells. The source eNB selects the target PCell. The source eNB may also provide the target eNB with a list of best cells on each frequency for which measurement information is available, in order of decreasing RSRP. The source eNB may also include available measurement information for the cells provided in the list. The target eNB decides which SCells are configured for use after handover, which may include cells other than the ones indicated by the source eNB. If an SCG is configured, handover involves either SCG release or either SCG change (in case of DC) or an NR SCG reconfiguration with sync and key change (in case of EN-DC and NGEN-DC). In case the UE was configured with (EN-) DC or NGEN-DC, the target eNB indicates in the handover message whether the UE shall release the entire (NR) SCG configuration. Upon connection re-establishment, the UE releases the entire SCG configuration except for the DRB configuration, while E-UTRAN in the first reconfiguration message following the re-establishment either releases the DRB(s) or reconfigures the DRB(s) to MCG DRB(s).

The target eNB generates the message used to perform the handover, i.e. the message including the AS-configuration to be used in the target cell(s). The source eNB transparently (i.e. does not alter values/ content) forwards the handover message/ information received from the target to the UE. When appropriate, the source eNB may initiate data forwarding for (a subset of) the DRBs.

After receiving the handover message, the UE attempts to access the target PCell at the first available RACH occasion according to Random Access resource selection defined in TS 36.321 [6], i.e. the handover is asynchronous, or at the first available PUSCH occasion if *rach-Skip* is configured. Consequently, when allocating a dedicated preamble for the random access in the target PCell, E-UTRA shall ensure it is available from the first RACH occasion the UE may use. The first available PUSCH occasion is provided by *ul-ConfigInfo*, if configured, otherwise UE shall monitor the PDCCH of target eNB. Upon successful completion of the handover, the UE sends a message used to confirm the handover.

If the target eNB does not support the release of RRC protocol which the source eNB used to configure the UE, the target eNB may be unable to comprehend the UE configuration provided by the source eNB. In this case, the target eNB should use the full configuration option to reconfigure the UE for Handover and Re-establishment. Full configuration option includes an initialization of the radio configuration, which makes the procedure independent of the configuration used in the source cell(s) with the exception that the security algorithms are continued for the RRC re-establishment.

The same behavior applies in (NG)EN-DC, if upon handover the target eNB is unable to comprehend the MCG part of the UE configuration i.e. the target eNB uses the full configuration option which involves release and configuration of (most of the) MCG and NR SCG configuration. In case of (NG)EN-DC, the target SgNB may be unable to comprehend the NR SCG configuration provided by the source SgNB. In such a case, release and addition may be applied for the NR SCG part of the configuration.

NOTE 1: When using release and addition for the NR SCG configuration during handover or SN change, E-UTRAN includes *drb-ToReleaseList* for the SN terminated RBs. For SN modification case, see TS 37.340 [81].

After the successful completion of handover, PDCP SDUs may be re-transmitted in the target cell(s). This only applies for DRBs using RLC-AM mode and for handovers not involving full configuration option. The further details are specified in TS 36.323 [8]. After the successful completion of handover not involving full configuration option, the SN and the HFN are reset except for the DRBs using RLC-AM mode (for which both SN and HFN continue). For reconfigurations involving the full configuration option, the PDCP entities are newly established (SN and HFN do not continue) for all DRBs irrespective of the RLC mode. The further details are specified in TS 36.323 [8].

One UE behaviour to be performed upon handover is specified, i.e. this is regardless of the handover procedures used within the network (e.g. whether the handover includes X2 or S1 signalling procedures).

The source eNB should, for some time, maintain a context to enable the UE to return in case of handover failure. After having detected handover failure, the UE attempts to resume the RRC connection either in the source PCell or in another cell using the RRC re-establishment procedure. This connection resumption succeeds only if the accessed cell is prepared, i.e. concerns a cell of the source eNB or of another eNB towards which handover preparation has been performed. The cell in which the re-establishment procedure succeeds becomes the PCell while SCells and STAGs, if configured, are released.

Normal measurement and mobility procedures are used to support handover to cells broadcasting a CSG identity. In addition, E-UTRAN may configure the UE to report that it is entering or leaving the proximity of cell(s) included in its Permitted CSG list. Furthermore, E-UTRAN may request the UE to provide additional information broadcast by the handover candidate cell e.g. global cell identity, CSG identity, CSG membership status.

NOTE 2: E-UTRAN may use the 'proximity report' to configure measurements as well as to decide whether or not to request additional information broadcast by the handover candidate cell. The additional information is used to verify whether or not the UE is authorised to access the target PCell and may also be needed to identify handover candidate cell (*PCI confusion* i.e. when the physical layer identity that is included in the measurement report does not uniquely identify the cell).

#### 5.3.1.4 Connection control in NB-IoT

In NB-IoT, during the RRC connection establishment procedure, SRB1bis is established implicitly with SRB1. SRB1bis uses the logical channel identity defined in 9.1.2a, with the same configuration as SRB1 but no PDCP entity. SRB1bis is used until security is activated. The RRC messages to activate security (command and successful response) are sent over SRB1 being integrity protected and ciphering is started after completion of the procedure. In case of unsuccessful security activation, the failure message is sent over SRB1 and subsequent messages are sent over SRB1bis. Once security is activated, new RRC messages shall be transmitted using SRB1. A NB-IoT UE that only supports the Control Plane CIoT EPS optimisation (see TS 24.301 [35]) or the Control Plane CIoT 5GS optimisation (see TS 24.501 [95]) only establishes SRB1bis.

A NB-IoT UE only supports 0, 1 or 2 DRBs, depending on its capability. A NB-IoT UE that only supports the Control Plane CIoT EPS optimisation (see TS 24.301 [35]) or the Control Plane CIoT 5GS optimisation (see TS 24.501 [95]) does not need to support any DRBs and associated procedures.

Table 5.3.1.4-1 lists the procedures that are applicable for NB-IoT. All other procedures are not applicable; this is not further stated in the corresponding procedures.

Table 5.3.1.4-1: Connection control procedures applicable to a NB-IoT UE

|  |  |
| --- | --- |
| Clause | Procedures |
| 5.3.2 | Paging |
| 5.3.3 | RRC connection establishment |
| RRC connection resume (see NOTE) |
| CP-EDT |
| UP-EDT (see NOTE) |
| CP transmission using PUR |
| UP transmission using PUR (see NOTE) |
| 5.3.4 | Initial security activation (see NOTE) |
| 5.3.5 | RRC connection reconfiguration (see NOTE) |
| 5.3.7 | RRC connection re-establishment |
| 5.3.8 | RRC connection release |
| 5.3.9 | RRC connection release requested by upper layers |
| 5.3.10 | Radio resource configuration |
| 5.3.11 | Radio link failure related actions |
| 5.3.12 | UE actions upon leaving RRC\_CONNECTED |
| 5.3.13b | Action upon receiving PUR release request |
| 5.3.16 | Unified Access Control |

NOTE: Not applicable for a UE that only supports the Control Plane CIoT EPS optimisation (see TS 24.301 [35]) or the Control Plane CIoT 5GS optimisation (see TS 24.501 [95]).

### 5.3.2 Paging

#### 5.3.2.1 General



Figure 5.3.2.1-1: Paging

The purpose of this procedure is:

- to transmit CN initiated paging information to a UE in RRC\_IDLE or RRC\_INACTIVE and/ or;

- to transmit RAN initiated paging information to a UE in RRC\_INACTIVE and/or;

- to inform UEs in RRC\_IDLE, UEs in RRC\_INACTIVE and UEs in RRC\_CONNECTED other than NB-IoT UEs, BL UEs and UEs in CE, about a system information change and/ or;

- to inform UEs in RRC\_IDLE other than NB-IoT UEs, UEs in RRC\_INACTIVE and UEs in RRC\_CONNECTED other than NB-IoT UEs, BL UEs and UEs in CE, about an ETWS primary notification and/ or ETWS secondary notification and/ or;

- to inform UEs in RRC\_IDLE other than NB-IoT UEs, UEs in RRC\_INACTIVE and UEs in RRC\_CONNECTED other than NB-IoT UEs, BL UEs and UEs in CE, about a CMAS notification and/ or;

- to inform UEs other than NB-IoT UEs in RRC\_IDLE, and other than UEs connected to 5GC about an EAB parameters modification and/ or;

- to inform UEs other than NB-IoT UEs in RRC\_IDLE, and UEs in RRC\_INACTIVE to perform E-UTRAN inter-frequency redistribution procedure.

The paging information of CN initiated paging is provided to upper layers, which in response may initiate RRC connection establishment, e.g. to receive an incoming call.

#### 5.3.2.2 Initiation

E-UTRAN initiates the paging procedure by transmitting the *Paging* message at the UE's paging occasion as specified in TS 36.304 [4]. E-UTRAN may address multiple UEs within a *Paging* message by including one *PagingRecord* for each UE. E-UTRAN may also indicate a change of system information, and/ or provide an ETWS notification or a CMAS notification in the *Paging* message.

#### 5.3.2.3 Reception of the *Paging* message by the UE

Upon receiving the *Paging* message, the UE shall:

1> if in RRC\_IDLE, for each of the *PagingRecord*, if any, included in the *Paging* message:

2> if the *ue-Identity* included in the *PagingRecord* matches one of the UE identities allocated by upper layers:

3> except for NB-IoT, if upper layers indicate the support of paging cause:

4> forward the *ue-Identity, accessType* (if present), paging cause (if determined) and the *cn-Domain* to the upper layers;

3> else:

4> forward the *ue-Identity,* *accessType* (if present) and, except for NB-IoT, the *cn-Domain* to the upper layers;

3> store *mt-EDT*, if present;

1> if in RRC\_INACTIVE, for each of the *PagingRecord*, if any, included in the *Paging* message:

2> if the *ue-Identity* included in the *PagingRecord* matches the stored *fullI-RNTI*:

3> if UE is configured with one or more access identities equal to 1, 2 or 11-15 applicable in the selected PLMN:

4> initiate RRC connection resume procedure in 5.3.3.2 with cause value set to 'highProrityAccess';

3> else:

4> initiate the RRC connection resumption procedure according to 5.3.3.2 with cause value set to 'mt-access';

NOTE 1: A MUSIM UE may not initiate the RRC connection resumption procedure, e.g. when it decides not to respond to the *Paging* message due to UE implementation constraints as specified in TS 24.501 [95].

2> else if the *ue-Identity* included in the *PagingRecord* matches one of the UE identities allocated by upper layers:

3> if upper layers indicate the support of paging cause:

4> forward the *ue-Identity, accessType* (if present), paging cause (if determined) and the *cn-Domain* to the upper layers;

3> else:

4> forward the *ue-Identity*, *accessType* (if present) and the *cn-Domain* to the upper layers;

3> perform the actions upon leaving RRC\_INACTIVE as specified in 5.3.12, with release cause 'other';

1> if the UE is not configured with a DRX cycle longer than the modification period and the *systemInfoModification* is included; or

1> if the UE is configured with a DRX cycle longer than the modification period and the *systemInfoModification-eDRX* is included:

2> re-acquire the required system information using the system information acquisition procedure as specified in 5.2.2;

1> if the *etws-Indication* is included and the UE is ETWS capable:

2> re-acquire *SystemInformationBlockType1* immediately, i.e., without waiting until the next system information modification period boundary;

2> if the *schedulingInfoList* indicates that *SystemInformationBlockType10* is present:

3> acquire *SystemInformationBlockType10*;

NOTE 2: If the UE is in CE, it is up to UE implementation when to start acquiring *SystemInformationBlockType10*.

2> if the *schedulingInfoList* indicates that *SystemInformationBlockType11* is present:

3> acquire *SystemInformationBlockType11*;

1> if the *cmas-Indication* is included and the UE is CMAS capable:

2> re-acquire *SystemInformationBlockType1* immediately, i.e., without waiting until the next system information modification period boundary as specified in 5.2.1.5;

2> if the *schedulingInfoList* indicates that *SystemInformationBlockType12* is present:

3> acquire *SystemInformationBlockType12*;

1> if in RRC\_IDLE, the *eab-ParamModification* is included and the UE is EAB capable:

2> consider previously stored *SystemInformationBlockType14* as invalid;

2> re-acquire *SystemInformationBlockType1* immediately, i.e., without waiting until the next system information modification period boundary as specified in 5.2.1.6;

2> re-acquire *SystemInformationBlockType14* using the system information acquisition procedure as specified in 5.2.2.4;

1> if in RRC\_IDLE, the *uac-ParamModification* is included and the UE connected to 5GC is a BL UE or UE in CE:

2> consider previously stored *SystemInformationBlockType25* as invalid;

2> re-acquire *SystemInformationBlockType1* immediately, i.e., without waiting until the next system information modification period boundary as specified in 5.2.1.6;

2> re-acquire *SystemInformationBlockType25* using the system information acquisition procedure as specified in 5.2.2.4;

1> if in RRC\_IDLE, the *redistributionIndication* is included and the UE is redistribution capable:

2> perform E-UTRAN inter-frequency redistribution procedure as specified in TS 36.304 [4], clause 5.2.4.10;

### 5.3.3 RRC connection establishment

#### 5.3.3.1 General



Figure 5.3.3.1-1: RRC connection establishment, successful



Figure 5.3.3.1-2: RRC connection establishment, network reject



Figure 5.3.3.1-3: RRC connection resume (suspended RRC connection or RRC\_INACTIVE), or UP-EDT fallback or fallback from UP transmission using PUR to RRC connection resume, successful



Figure 5.3.3.1-4: RRC connection resume (suspended RRC connection or RRC\_INACTIVE) or UP-EDT fallback or fallback from UP transmission using PUR to RRC connection establishment, successful



Figure 5.3.3.1-5: RRC connection resume or UP-EDT or UP transmission using PUR, network reject (suspended RRC connection or RRC\_INACTIVE) or release (suspended RRC connection)



Figure 5.3.3.1-6: RRC connection resume (RRC\_INACTIVE), network release or suspend or UP-EDT or UP transmission using PUR, successful



Figure 5.3.3.1-7: CP-EDT or CP transmission using PUR, successful



Figure 5.3.3.1-7a: CP transmission using PUR, successful



Figure 5.3.3.1-8: CP-EDT fallback or fallback from CP transmission using PUR to RRC connection establishment, successful



Figure 5.3.3.1-9: CP-EDT or CP transmission using PUR, network reject

The purpose of this procedure is to establish an RRC connection, to resume a suspended RRC connection, to move the UE from RRC\_INACTIVE to RRC\_CONNECTED, to perform EDT or to perform transmission using PUR. RRC connection establishment involves SRB1 (and SRB1bis for NB-IoT) establishment. The procedure is also used to transfer the initial NAS dedicated information/ message from the UE to E-UTRAN.

E-UTRAN applies the procedure as follows:

- When establishing an RRC connection:

- to establish SRB1 and, for NB-IoT, SRB1bis;

- When resuming an RRC connection from a suspended RRC connection or from RRC\_INACTIVE:

- to restore the AS configuration from a stored context including resuming SRB(s) and DRB(s);

- When performing EDT;

- When performing transmission using PUR.

#### 5.3.3.1a Conditions for establishing RRC Connection for sidelink communication/ discovery/ V2X sidelink communication/ NR sidelink communication

For sidelink communication an RRC connection is initiated only in the following case:

1> if configured by upper layers to transmit non-relay related sidelink communication and related data is available for transmission:

2> if *SystemInformationBlockType18* is broadcast by the cell on which the UE camps; and if the valid version of *SystemInformationBlockType18* does not include *commTxPoolNormalCommon*;

1> if configured by upper layers to transmit relay related sidelink communication:

2> if the UE is acting as sidelink relay UE; and if *SystemInformationBlockType18* is broadcast by the cell on which the UE camps; or

2> if the UE has a selected sidelink relay UE; and if the sidelink remote UE threshold conditions as specified in 5.10.11.5 are met and if *SystemInformationBlockType18* is broadcast by the cell on which the UE camps; and if the valid version of *SystemInformationBlockType18* does not include *commTxPoolNormalCommon* or *commTxAllowRelayCommon*;

For V2X sidelink communication an RRC connection is initiated only in the following case:

1> if configured by upper layers to transmit non-P2X related V2X sidelink communication and related data is available for transmission:

2> if the frequency on which the UE is configured to transmit non-P2X related V2X sidelink communication concerns the camped frequency; and if *SystemInformationBlockType21* is broadcast by the cell on which the UE camps; and if the valid version of *SystemInformationBlockType21* includes *sl-V2X-ConfigCommon*; and *sl-V2X-ConfigCommon* does not include *v2x-CommTxPoolNormalCommon*; or

2> if the frequency on which the UE is configured to transmit non-P2X related V2X sidelink communication is included in *v2x-InterFreqInfoList* within *SystemInformationBlockType21* or *SystemInformationBlockType26* broadcast by the cell on which the UE camps; and if neither the valid version of *SystemInformationBlockType21* nor that of *SystemInformationBlockType26* includes *v2x-CommTxPoolNormal* for the concerned frequency;

1> if configured by upper layers to transmit P2X related V2X sidelink communication and related data is available for transmission:

2> if the frequency on which the UE is configured to transmit P2X related V2X sidelink communication concerns the camped frequency; and if *SystemInformationBlockType21* is broadcast by the cell on which the UE camps; and if the valid version of *SystemInformationBlockType21* includes *sl-V2X-ConfigCommon*; and *sl-V2X-ConfigCommon* does not include *p2x-CommTxPoolNormalCommon*; or

2> if the frequency on which the UE is configured to transmit P2X related V2X sidelink communication is included in *v2x-InterFreqInfoList* within *SystemInformationBlockType21* or *SystemInformationBlockType26* broadcast by the cell on which the UE camps; and if neither the valid version of *SystemInformationBlockType21* nor that of *SystemInformationBlockType26* includes *p2x-CommTxPoolNormal* for the concerned frequency;

For NR sidelink communication an RRC connection is initiated only when the conditions for NR sidelink communication specified in clause 5.3.3.1a of TS 38.331 [82] are met;

NOTE 1: *SIB12* specified in clause 5.3.3.1a of TS 38.331 is provided in *SystemInformationBlockType28.*

For sidelink discovery an RRC connection is initiated only in the following case:

1> if configured by upper layers to transmit non-PS related sidelink discovery announcements:

2> if the frequency on which the UE is configured to transmit non-PS related sidelink discovery announcements concerns the camped frequency; and *SystemInformationBlockType19* of the cell on which the UE camps does not include *discTxPoolCommon-r12*; or

2> if the frequency on which the UE is configured to transmit non-PS related sidelink discovery announcements is included in *discInterFreqList* in *SystemInformationBlockType19* broadcast by the cell on which the UE camps, with *discTxResourcesInterFreq* included within *discResourcesNonPS* and set to *requestDedicated*;

1> if configured by upper layers to transmit non-relay PS related sidelink discovery announcements:

2> if the frequency on which the UE is configured to transmit non-relay PS related sidelink discovery announcements concerns the camped frequency; and *SystemInformationBlockType19* of the cell on which the UE camps includes *discConfigPS* but does not include *discTxPoolPS-Common*; or

2> if the frequency on which the UE is configured to transmit non-relay PS related sidelink discovery announcements (e.g. group member discovery) is included in *discInterFreqList* in *SystemInformationBlockType19* broadcast by the cell on which the UE camps, with *discTxResourcesInterFreq* within *discResourcesPS* included and set to *requestDedicated*;

1> if configured by upper layers to transmit relay PS related sidelink discovery announcements:

2> if the UE is acting as sidelink relay UE; and if the sidelink relay UE threshold conditions as specified in 5.10.10.4 are met; or

2> if the UE is selecting a sidelink relay UE / has a selected sidelink relay UE; and if the sidelink remote UE threshold conditions as specified in 5.10.11.5 are met:

3> if the frequency on which the UE is configured to transmit relay PS related sidelink discovery announcements concerns the camped frequency; and *SystemInformationBlockType19* of the cell on which the UE camps includes *discConfigRelay* and *discConfigPS* but does not include *discTxPoolPS-Common*;

NOTE: Upper layers initiate an RRC connection. The interaction with NAS is left to UE implementation.

#### 5.3.3.1b Conditions for initiating EDT

A BL UE, UE in CE or NB-IoT UE can initiate EDT when all of the following conditions are fulfilled:

1> if the UE is connected to EPC:

2> for CP-EDT, the upper layers request establishment of an RRC connection, the UE supports CP-EDT, and *SystemInformationBlockType2 (SystemInformationBlockType2-NB* in NB-IoT) includes *cp-EDT*; or

2> for UP-EDT, the upper layers request resumption of an RRC connection, the UE supports UP-EDT, *SystemInformationBlockType2 (SystemInformationBlockType2-NB* in NB-IoT) includes *up-EDT*, and the UE has a stored value of the *nextHopChainingCount* provided in the *RRCConnectionRelease* message with suspend indication during the preceding suspend procedure;

1> else if the UE is connected to 5GC:

2> for CP-EDT, the upper layers request establishment of an RRC connection, the UE connected to 5GC supports CP-EDT, and *SystemInformationBlockType2 (SystemInformationBlockType2-NB* in NB-IoT) includes *cp-EDT-5GC*; or

2> for UP-EDT, the upper layers request resumption of an RRC connection, the UE connected to 5GC supports UP-EDT, *SystemInformationBlockType2 (SystemInformationBlockType2-NB* in NB-IoT) includes *up-EDT-5GC*, and the UE has a stored value of the *nextHopChainingCount* provided in the *RRCConnectionRelease* message with suspend indication during the preceding suspend procedure;

1> the establishment or resumption request is for mobile originating calls and the establishment cause is *mo-Data* or *mo-ExceptionData* or *delayTolerantAccess*; or

1> the establishment or resumption request is for mobile terminating calls, the UE has a stored *mt-EDT* indication and the establishment cause is *mt-Access*;

1> the establishment or resumption request is suitable for EDT as specified in TS 36.300 [9], clause 7.3b.1;

1> *SystemInformationBlockType2 (SystemInformationBlockType2-NB* in NB-IoT) includes *edt-Parameters*;

1> for mobile originating calls, the size of the resulting MAC PDU including the total UL data is expected to be smaller than or equal to the TBS signalled in *edt-TBS* as specified in TS 36.321 [6], clause 5.1.1;

1> EDT fallback indication has not been received from lower layers for this establishment or resumption procedure;

NOTE 1: Upper layers request or resume an RRC connection. The interaction with NAS is up to UE implementation.

NOTE 2: It is up to UE implementation how the UE determines whether the size of UL data is suitable for EDT.

#### 5.3.3.1c Conditions for initiating transmission using PUR

A BL UE, UE in CE or NB-IoT UE can initiate transmission using PUR when all of the following conditions are fulfilled:

1> the UE has a valid PUR configuration for the serving cell as specified in 5.3.3.20;

1> the UE has a valid timing alignment value as specified in 5.3.3.19;

1> the upper layers request establishment of an RRC connection; or the upper layers request resumption of an RRC connection and the UE has a stored value of the *nextHopChainingCount* provided in the *RRCConnectionRelease* message with suspend indication during the preceding suspend procedure;

1> the establishment or resumption request is for mobile originating calls and the establishment cause is *mo-Data* or *mo-ExceptionData* or *delayTolerantAccess*;

1> for CP transmission using PUR, the size of the resulting MAC PDU including the total UL data is expected to be smaller than or equal to the TBS configured for PUR.

NOTE 1: Upper layers request or resume an RRC connection. The interaction with NAS is up to UE implementation.

NOTE 2: It is up to UE implementation how the UE determines whether the establishment or resumption request is suitable for transmission using PUR.

#### 5.3.3.1d Condition for establishing RRC Connection in NTN

If s*ystemInformationBlockType31* (*systemInformationBlockType31-NB* in NB-IoT) is broadcast, a RRC connection is initiated only if the UE has a valid GNSS position.

NOTE: The UE may need to re-acquire the GNSS position before establishing the connection to avoid interruption during the connection.

#### 5.3.3.2 Initiation

The UE initiates the procedure when upper layers request establishment or resume of an RRC connection while the UE is in RRC\_IDLE or when upper layers request resume of an RRC connection or RRC layer requests resume of an RRC connection for, e.g. RNAU or reception of RAN paging while the UE is in RRC\_INACTIVE.

Except for NB-IoT, upon initiation of the procedure, if the UE is connected to EPC, the UE shall:

1> if *SystemInformationBlockType2* includes *ac-BarringPerPLMN-List* and the *ac-BarringPerPLMN-List* contains an *AC-BarringPerPLMN* entry with the *plmn-IdentityIndex* corresponding to the PLMN selected by upper layers (see TS 23.122 [11], TS 24.301 [35]):

2> select the *AC-BarringPerPLMN* entry with the *plmn-IdentityIndex* corresponding to the PLMN selected by upper layers;

2> in the remainder of this procedure, use the selected *AC-BarringPerPLMN* entry (i.e. presence or absence of access barring parameters in this entry) irrespective of the common access barring parameters included in *SystemInformationBlockType2;*

1> else

2> in the remainder of this procedure use the common access barring parameters (i.e. presence or absence of these parameters) included in *SystemInformationBlockType2;*

1> if *SystemInformationBlockType2* contains *acdc-BarringPerPLMN-List* and the *acdc-BarringPerPLMN-List* contains an *ACDC-BarringPerPLMN* entry with the *plmn-IdentityIndex* corresponding to the PLMN selected by upper layers (see TS 23.122 [11], TS 24.301 [35]):

2> select the *ACDC-BarringPerPLMN* entry with the *plmn-IdentityIndex* corresponding to the PLMN selected by upper layers;

2> in the remainder of this procedure, use the selected *ACDC-BarringPerPLMN* entry for ACDC barring check (i.e. presence or absence of access barring parameters in this entry) irrespective ofthe *acdc-BarringForCommon* parameters included in *SystemInformationBlockType2*;

1> else:

2> in the remainder of this procedure use the *acdc-BarringForCommon* (i.e. presence or absence of these parameters) included in *SystemInformationBlockType2* for ACDC barring check;

1> if upper layers indicate that the RRC connection is subject to EAB (see TS 24.301 [35]):

2> if the result of the EAB check, as specified in 5.3.3.12, is that access to the cell is barred:

3> inform upper layers about the failure to establish the RRC connection or failure to resume the RRC connection with suspend indication and that EAB is applicable, upon which the procedure ends;

1> if upper layers indicate that the RRC connection is subject to ACDC (see TS 24.301 [35]), *SystemInformationBlockType2* contains *BarringPerACDC-CategoryList*, and *acdc-HPLMNonly* indicates that ACDC is applicable for the UE:

2> if the *BarringPerACDC-CategoryList* contains a *BarringPerACDC-Category* entry corresponding to the ACDC category selected by upper layers:

3> select the *BarringPerACDC-Category* entry corresponding to the ACDC category selected by upper layers;

2> else:

3> select the last *BarringPerACDC-Category* entry in the *BarringPerACDC-CategoryList*;

2> stop timer T308, if running;

2> perform access barring check as specified in 5.3.3.13, using T308 as "Tbarring" and *acdc-BarringConfig* in the *BarringPerACDC-Category* as "ACDC barring parameter";

2> if access to the cell is barred:

3> inform upper layers about the failure to establish the RRC connection or failure to resume the RRC connection with suspend indication and that access barring is applicable due to ACDC, upon which the procedure ends;

1> else if the UE is establishing the RRC connection for mobile terminating calls:

2> if timer T302 is running:

3> inform upper layers about the failure to establish the RRC connection or failure to resume the RRC connection with suspend indication and that access barring for mobile terminating calls is applicable, upon which the procedure ends;

1> else if the UE is establishing the RRC connection for emergency calls:

2> if *SystemInformationBlockType2* includes the *ac-BarringInfo*:

3> if the *ac-BarringForEmergency* is set to *TRUE*:

4> if the UE has one or more Access Classes, as stored on the USIM, with a value in the range 11..15, which is valid for the UE to use according to TS 22.011 [10] and TS 23.122 [11]:

NOTE 1: ACs 12, 13, 14 are only valid for use in the home country and ACs 11, 15 are only valid for use in the HPLMN/ EHPLMN.

5> if the *ac-BarringInfo* includes *ac-BarringForMO-Data*, and for all of these valid Access Classes for the UE, the corresponding bit in the *ac-BarringForSpecialAC* contained in *ac-BarringForMO-Data* is set to *one*:

6> consider access to the cell as barred;

4> else:

5> consider access to the cell as barred;

2> if access to the cell is barred:

3> inform upper layers about the failure to establish the RRC connection or failure to resume the RRC connection with suspend indication, upon which the procedure ends;

1> else if the UE is establishing the RRC connection for mobile originating calls:

2> perform access barring check as specified in 5.3.3.11, using T303 as "Tbarring" and *ac-BarringForMO-Data* as "AC barring parameter";

2> if access to the cell is barred:

3> if *SystemInformationBlockType2* includes *ac-BarringForCSFB* or the UE does not support CS fallback:

4> inform upper layers about the failure to establish the RRC connection or failure to resume the RRC connection with suspend indication and that access barring for mobile originating calls is applicable, upon which the procedure ends;

3> else (*SystemInformationBlockType2* does not include *ac-BarringForCSFB* and the UE supports CS fallback):

4> if timer T306 is not running, start T306 with the timer value of T303;

4> inform upper layers about the failure to establish the RRC connection or failure to resume the RRC connection with suspend indication and that access barring for mobile originating calls and mobile originating CS fallback is applicable, upon which the procedure ends;

1> else if the UE is establishing the RRC connection for mobile originating signalling:

2> perform access barring check as specified in 5.3.3.11, using T305 as "Tbarring" and *ac-BarringForMO-Signalling* as "AC barring parameter";

2> if access to the cell is barred:

3> inform upper layers about the failure to establish the RRC connection or failure to resume the RRC connection with suspend indication and that access barring for mobile originating signalling is applicable, upon which the procedure ends;

1> else if the UE is establishing the RRC connection for mobile originating CS fallback:

2> if *SystemInformationBlockType2* includes *ac-BarringForCSFB*:

3> perform access barring check as specified in 5.3.3.11, using T306 as "Tbarring" and *ac-BarringForCSFB* as "AC barring parameter";

3> if access to the cell is barred:

4> inform upper layers about the failure to establish the RRC connection or failure to resume the RRC connection with suspend indication and that access barring for mobile originating CS fallback is applicable, due to *ac-BarringForCSFB*, upon which the procedure ends;

2> else:

3> perform access barring check as specified in 5.3.3.11, using T306 as "Tbarring" and *ac-BarringForMO-Data* as "AC barring parameter";

3> if access to the cell is barred:

4> if timer T303 is not running, start T303 with the timer value of T306;

4> inform upper layers about the failure to establish the RRC connection or failure to resume the RRC connection with suspend indication and that access barring for mobile originating CS fallback and mobile originating calls is applicable, due to *ac-BarringForMO-Data*, upon which the procedure ends;

1> else if the UE is establishing the RRC connection for mobile originating MMTEL voice, mobile originating MMTEL video, mobile originating SMSoIP or mobile originating SMS; or

1> if the UE is establishing the RRC connection after EPS fallback for IMS voice (see TS 23.502 [102]) was triggered in NR via *RRCRelease* with *voiceFallbackIndication* (see TS 38.331 [82]):

2> if the UE is establishing the RRC connection for mobile originating MMTEL voice and *SystemInformationBlockType2* includes *ac-BarringSkipForMMTELVoice*; or

2> if the UE is establishing the RRC connection for mobile originating MMTEL video and *SystemInformationBlockType2* includes *ac-BarringSkipForMMTELVideo*; or

2> if the UE is establishing the RRC connection for mobile originating SMSoIP or SMS and *SystemInformationBlockType2* includes *ac-BarringSkipForSMS*:

3> consider access to the cell as not barred;

2> else:

3> if *establishmentCause* received from higher layers is set to *mo-Signalling* (including the case that *mo-Signalling* is replaced by *highPriorityAccess* according to TS 24.301 [35] or by *mo-VoiceCall* according to the clause 5.3.3.3)*:*

4> perform access barring check as specified in 5.3.3.11, using T305 as "Tbarring" and *ac-BarringForMO-Signalling* as "AC barring parameter";

4> if access to the cell is barred:

5> inform upper layers about the failure to establish the RRC connection or failure to resume the RRC connection with suspend indication and that access barring for mobile originating signalling is applicable, upon which the procedure ends;

3> if *establishmentCause* received from higher layers is set to *mo-Data* (including the case that *mo-Data* is replaced by *highPriorityAccess* according to TS 24.301 [35] or by *mo-VoiceCall* according to the clause 5.3.3.3):

4> perform access barring check as specified in 5.3.3.11, using T303 as "Tbarring" and *ac-BarringForMO-Data* as "AC barring parameter";

4> if access to the cell is barred:

5> if *SystemInformationBlockType2* includes *ac-BarringForCSFB* or the UE does not support CS fallback:

6> inform upper layers about the failure to establish the RRC connection or failure to resume the RRC connection with suspend indication and that access barring for mobile originating calls is applicable, upon which the procedure ends;

5> else (*SystemInformationBlockType2* does not include *ac-BarringForCSFB* and the UE supports CS fallback):

6> if timer T306 is not running, start T306 with the timer value of T303;

6> inform upper layers about the failure to establish the RRC connection or failure to resume the RRC connection with suspend indication and that access barring for mobile originating calls and mobile originating CS fallback is applicable, upon which the procedure ends;

Upon initiation of the procedure, if the UE is connected to 5GC, the UE shall:

1> if the upper layers provide an Access Category and one or more Access Identities upon requesting establishment of an RRC connection:

2> perform the unified access control procedure as specified in 5.3.16 using the Access Category and Access Identities provided by upper layers;

3> if the access attempt is barred, the procedure ends;

1> if the resumption of the RRC connection is triggered by response to NG-RAN paging:

2> select '0' as the Access Category;

2> perform the unified access control procedure as specified in 5.3.16 using the selected Access Category and one or more Access Identities provided by upper layers;

3> if the access attempt is barred, the procedure ends;

1> else if the resumption of the RRC connection is triggered by upper layers:

2> if the upper layers provide an Access Category and one or more Access Identities:

3> perform the unified access control procedure as specified in 5.3.16 using the Access Category and Access Identities provided by upper layers;

4> if the access attempt is barred, the procedure ends;

2> set the *resumeCause* in accordance with the information received from upper layers;

1> else if the resumption of the RRC connection is triggered due to an RNAU:

2> if an emergency service is ongoing:

3> select '2' as the Access Category;

3> set the *resumeCause* to *emergency*;

2> else:

3> select '8' as the Access Category;

2> perform the unified access control procedure as specified in 5.3.16 using the selected Access Category and one or more Access Identities to be applied as specified in TS 24.501 [95];

3> if the access attempt is barred:

4> set the variable *pendingRnaUpdate* to 'TRUE';

4> the procedure ends;

Except for NB-IoT, upon initiating the procedure, if connected to EPC or 5GC, the UE shall:

1> if the UE is resuming an RRC connection from a suspended RRC connection or from RRC\_INACTIVE:

2> if the UE was configured with (NG)EN-DC:

3> if the UE does not support maintaining SCG configuration upon connection resumption:

4> perform MR-DC release, as specified in TS 38.331 [82], clause 5.3.5.10;

4> release *p-MaxEUTRA*, if configured;

4> release *p-MaxUE-FR1*, if configured;

4> release *tdm-PatternConfig* or *tdm-PatternConfig2*, if configured;

3> release *otherConfig* associated with the SCG, if configured;

3> stop timers T346a, T346b, T346c, T346d and T346e associated with the SCG (see TS 38.331 [82], clause 7.1.1), if running;

2> if the UE does not support maintaining the MCG SCell configurations upon connection resumption:

3> release the MCG SCell(s), if configured, in accordance with 5.3.10.3a;

2> release *powerPrefIndicationConfig*, if configured and stop timer T340, if running;

2> release *reportProximityConfig* and clear any associated proximity status reporting timer;

2> release *obtainLocationConfig*, if configured;

2> release *bt-NameListConfig*, if configured;

2> release *wlan-NameListConfig*, if configured;

2> release *measUncomBarPre*, if configured;

2> release *idc-Config*, if configured;

2> release *sps-AssistanceInfoReport*, if configured;

2> release *scg-DeactivationPreferenceConfig*, if configured and stop timer T346, if running;

2> release *measSubframePatternPCell*, if configured;

2> if the UE was configured with DC:

3> release the entire SCG configuration, if configured, except for the DRB configuration (as configured by *drb-ToAddModListSCG*);

2> release *naics-Info* for the PCell, if configured;

2> release the LWA configuration, if configured, as described in 5.6.14.3;

2> release the LWIP configuration, if configured, as described in 5.6.17.3;

2> release *bw-PreferenceIndicationTimer*, if configured and stop timer T341, if running;

2> release *delayBudgetReportingConfig*, if configured and stop timer T342, if running;

2> release *ailc-BitConfig*, if configured;

2> release *uplinkDataCompression*, if configured;

2> release *overheatingAssistanceConfig* and *overheatingAssistanceConfigForSCG*, if configured and stop timer T345, if running;

NOTE 1a: The parameters and configurations are released from the UE Inactive AS context if the UE is resuming an RRC connection from RRC\_INACTIVE.

1> if the UE is establishing or resuming an RRC connection from a suspended RRC connection:

2> if the UE has a stored *pur-Config* and the cell is different from the cell where *pur-Config* was provided:

3> if *pur-TimeAlignmentTimer* is configured, indicate to lower layers that *pur-TimeAlignmentTimer* is released;

3> release *pur-Config*;

3> discard previously stored *pur-Config*;

1> apply the default physical channel configuration as specified in 9.2.4;

1> apply the default semi-persistent scheduling configuration as specified in 9.2.3;

1> apply the default MAC main configuration as specified in 9.2.2;

1> apply the CCCH configuration as specified in 9.1.1.2;

1> apply the *timeAlignmentTimerCommon* included in *SystemInformationBlockType2*;

1> if UE supports timing advance reporting and *ta-Report* is included in *SystemInformationBlockType2*:

2> instruct the associated MAC entity to trigger Timing Advance reporting;

1> start timer T300;

1> if the UE is resuming an RRC connection from a suspended RRC connection:

2> initiate transmission of the *RRCConnectionResumeRequest* message in accordance with 5.3.3.3a;

1> else if the UE is resuming an RRC connection from RRC\_INACTIVE:

2> set the variable *pendingRnaUpdate* to 'FALSE';

2> initiate transmission of the *RRCConnectionResumeRequest* message in accordance with 5.3.3.3a;

1> else:

2> if stored, discard the UE AS context, UE Inactive AS context and *resumeIdentity*;

2> release *rrc-InactiveConfig*, if configured;

2> if the UE is initiating CP-EDT in accordance with conditions in 5.3.3.1b; or

2> if the UE is initiating CP transmission using PUR in accordance with conditions in 5.3.3.1c:

3> initiate transmission of the *RRCEarlyDataRequest* message in accordance with 5.3.3.3b;

2> else:

3> initiate transmission of the *RRCConnectionRequest* message in accordance with 5.3.3.3;

1> if stored, discard *mt-EDT*;

NOTE 2: Upon initiating the connection establishment procedure, the UE is not required to ensure it maintains up to date system information applicable only for UEs in RRC\_IDLE state or UEs in RRC\_INACTIVE. However, the UE needs to perform system information acquisition upon cell re-selection.

For NB-IoT, upon initiation of the procedure, the UE shall:

1> if theUEis connected to EPC:

2> if theUEis establishing or resuming the RRC connection for mobile originating exception data;or

2> if theUEis establishing or resuming the RRC connection for mobile originating data;or

2> if theUEis establishing or resuming the RRC connection for delay tolerant access;or

2> if theUEis establishing or resuming the RRC connection for mobile originating signalling;

3> perform access barring check as specified in 5.3.3.14;

3> if access to the cell is barred:

4> inform upper layers about the failure to establish the RRC connection or failure to resume the RRC connection with suspend indication and that access barring is applicable, upon which the procedure ends;

1> if the UE is connected to 5GC:

2> if the Access Category provided by the upper layers is different from '0':

3> perform access barring check for per-NRSRP barring as specified in 5.3.3.14;

3> if access to the cell is barred:

4> inform upper layers about the failure to establish the RRC connection or failure to resume the RRC connection with suspend indication, upon which the procedure ends;

3> else:

4> perform the unified access control procedure as specified in 5.3.16 using the Access Category and Access Identities provided by upper layers;

4> if the access attempt is barred, the procedure ends;

1> if the UE is establishing or resuming an RRC connection:

2> if the UE has a stored *pur-Config* and the cell is different from the cell where *pur-Config* was provided:

3> if *pur-TimeAlignmentTimer* is configured, indicate to lower layers that *pur-TimeAlignmentTimer* is released;

3> release *pur-Config*;

3> discard previously stored *pur-Config*;

2> release *obtainLocationNB*, if configured;

1> apply the default physical channel configuration as specified in 9.2.4;

1> apply the default MAC main configuration as specified in 9.2.2;

1> apply the CCCH configuration as specified in 9.1.1.2;

1> if UE supports timing advance reporting and *ta-Report* is included in *SystemInformationBlockType2-NB*:

2> instruct the associated MAC entity to trigger Timing Advance reporting;

1> start timer T300;

1> if the UE is establishing an RRC connection:

2> if stored, discard the UE AS context and *resumeIdentity*;

2> if the UE is initiating CP-EDT in accordance with conditions in 5.3.3.1b; or

2> if the UE is initiating CP transmission using PUR in accordance with conditions in 5.3.3.1c:

3> initiate transmission of the *RRCEarlyDataRequest* message in accordance with 5.3.3.3b;

2> else:

3> initiate transmission of the *RRCConnectionRequest* message in accordance with 5.3.3.3;

1> else if the UE is resuming an RRC connection:

2> release *schedulingRequestConfig*, if configured;

2> initiate transmission of the *RRCConnectionResumeRequest* message in accordance with 5.3.3.3a;

1> if stored, discard *mt-EDT*;

NOTE 3: Upon initiating the connection establishment or resumption procedure, the UE is not required to ensure it maintains up to date system information applicable only for UEs in RRC\_IDLE state. However, the UE needs to perform system information acquisition upon cell re-selection.

NOTE 4: For EDT and transmission using PUR, upon initiating the connection establishment or resumption procedure, it is up to UE implementation whether to continue cell re-selection related measurements as well as cell re-selection evaluation and, if the conditions for cell re-selection are fulfilled, whether to perform cell re-selection as specified in 5.3.3.5.

#### 5.3.3.3 Actions related to transmission of *RRCConnectionRequest* message

The UE shall set the contents of *RRCConnectionRequest* message as follows:

1> if the UE is connected to EPC:

2> set the *ue-Identity* as follows:

3> if upper layers provide an S-TMSI:

4> set the *ue-Identity* to the value received from upper layers;

3> else:

4> draw a random value in the range 0 .. 240-1 and set the *ue-Identity* tothis value;

NOTE 1: Upper layers provide the S-TMSI if the UE is registered in the TA of the current cell.

2> if the establishment of the RRC connection is the result of release with redirect with *mpsPriorityIndication* (either in NR or E-UTRAN):

3> set the establishmentCause to *highPriorityAccess*;

2> else:

3> if the UE supports *mo-VoiceCall* establishment cause and UE is establishing the RRC connection for mobile originating MMTEL voice and *SystemInformationBlockType2* includes *voiceServiceCauseIndication* and the establishment cause received from upper layers is not set to *highPriorityAccess*; or

3> if the UE supports *mo-VoiceCall* establishment cause and EPS fallback for IMS voice (see TS 23.502 [102]) was triggered in NR via *RRCRelease* with *voiceFallbackIndication* (see TS 38.331 [82]) and *SystemInformationBlockType2* includes *voiceServiceCauseIndication* and the establishment cause received from upper layers is not set to *highPriorityAccess* or *emergency*:

4> set the *establishmentCause* to mo-VoiceCall;

3> else if the UE supports *mo-VoiceCall* establishment cause for mobile originating MMTEL video and UE is establishing the RRC connection for mobile originating MMTEL video and *SystemInformationBlockType2* includes *videoServiceCauseIndication* and the establishment cause received from upper layers is not set to *highPriorityAccess*:

4> set the *establishmentCause* to mo-VoiceCall;

3> else:

4> set the *establishmentCause* in accordance with the information received from upper layers;

1> if the UE is connected to 5GC:

2> set the *ue-Identity* as follows:

3> if upper layers provide a 5G-S-TMSI:

4> except for NB-IoT, set the ue-Identity to ng-5G-S-TMSI-Part1;

4> for NB-IoT, set the *ue-Identity* to ng-5G-S-TMSI;

3> else:

4> draw a random value in the range 0 .. 240-1 and set the *ue-Identity* to this value;

2> if the establishment of the RRC connection is the result of release with redirect with *mpsPriorityIndication* (either in NR or E-UTRAN);

3> set the establishmentCause to *highPriorityAccess*;

2> else:

3> set the *establishmentCause* in accordance with the information received from upper layers;

2> except for NB-IoT, apply the default NR PDCP configuration as specified in TS 38.331 [82], clause 9.2.1.1 for SRB1;

2> except for NB-IoT, use NR PDCP for all subsequent messages received and sent by the UE via SRB1;

1> if the UE is a NB-IoT UE:

2> if the UE is connected to EPC:

3> if the UE supports multi-tone transmission, include *multiToneSupport*;

3> if the UE supports multi-carrier operation, include *multiCarrierSupport*;

3> set *earlyContentionResolution* to TRUE;

2> if the UE supports DL channel quality reporting in MSG3 and *cqi-Reporting* is present in *SystemInformationBlockType2-NB*:

3> set the *cqi-NPDCCH* to include the latest results of the downlink channel quality measurements of the carrier where the random access response is received as specified in TS 36.133 [16];

NOTE 2: The downlink channel quality measurements use measurement period T1 or T2, as defined in TS 36.133 [16].

1> if the UE is initiating transmission using PUR in accordance with conditions in 5.3.3.1c:

2> configure, except *pur-TimeAlignmentTimer*, the lower layers to use transmission using PUR;

2> deliver the UL grant for transmission using PUR to the MAC entity;

The UE shall submit the *RRCConnectionRequest* message to lower layers for transmission.

The UE shall continue cell re-selection related measurements as well as cell re-selection evaluation. If the conditions for cell re-selection are fulfilled, the UE shall perform cell re-selection as specified in 5.3.3.5.

#### 5.3.3.3a Actions related to transmission of *RRCConnectionResumeRequest* message

If the UE is resuming the RRC connection from a suspended RRC connection, the UE shall set the contents of *RRCConnectionResumeRequest* message as follows:

1> if the UE is a NB-IoT UE; or

1> if the UE is initiating UP-EDT for mobile originating calls in accordance with conditions in 5.3.3.1b; or

1> if the UE is initiating UP transmission using PUR in accordance with conditions in 5.3.3.1c; or

1> if field *useFullResumeID* is signalled in *SystemInformationBlockType2*:

2> if the UE connected to 5GC is a BL UE or UE in CE:

3> set the *fullI-RNTI* to the stored *fullI-RNTI*;

2> else:

3> set the *resumeID* to the stored *resumeIdentity*;

1> else:

2> if the UE connected to 5GC is a BL UE or UE in CE:

3> set the *shortI-RNTI* to the stored *shortI-RNTI*;

2> else:

3> set the *truncatedResumeID* to include bits in bit position 9 to 20 and 29 to 40 from the left in the stored *resumeIdentity*.

1> if the UE is resuming the RRC connection after release with redirect with *mpsPriorityIndication*:

2> set the *resumeCause* to *highPriorityAccess*;

1> else if the UE supports *mo-VoiceCall* establishment cause and UE is resuming the RRC connection for mobile originating MMTEL voice and *SystemInformationBlockType2* includes *voiceServiceCauseIndication* and the establishment cause received from upper layers is not set to *highPriorityAccess*:

2> set the *resumeCause* to *mo-VoiceCall*;

1> else if the UE supports *mo-VoiceCall* establishment cause for mobile originating MMTEL video and UE is resuming the RRC connection for mobile originating MMTEL video and *SystemInformationBlockType2* includes *videoServiceCauseIndication* and the establishment cause received from upper layers is not set to *highPriorityAccess*:

2> set the *resumeCause* to *mo-VoiceCall*;

1> else if the UE is initiating UP-EDT for mobile terminating calls in accordance with conditions in 5.3.3.1b:

2> set the *resumeCause* to *mt-EDT*;

1> else:

2> set the *resumeCause* in accordance with the information received from upper layers;

1> set the *shortResumeMAC-I* to the 16 least significant bits of the MAC-I calculated:

2> over the ASN.1 encoded as per clause 8 (i.e., a multiple of 8 bits) *VarShortResumeMAC-Input* (or *VarShortResumeMAC-Input-NB* in NB-IoT);

2> with the KRRCint key and the previously configured integrity protection algorithm; and

2> with all input bits for COUNT, BEARER and DIRECTION set to binary ones;

1> if the UE is a NB-IoT UE:

2> if the UE supports DL channel quality reporting in MSG3 and *cqi-Reporting* is present in *SystemInformationBlockType2-NB*:

3> set the *cqi-NPDCCH* to include the latest results of the downlink channel quality measurements of the carrier where the random access response is received as specified in TS 36.133 [16];

NOTE 0: The downlink channel quality measurements use measurement period T1 or T2, as defined in TS 36.133 [16].

2> if the UE is connected to EPC, set *earlyContentionResolution* to TRUE;

1> restore the RRC configuration and security context from the stored UE AS context, except for the following:

- MCG SCell(s) configuration, if stored,

- *nr-SecondaryCellGroupConfig*, if stored;

1> if the UE is initiating UP-EDT for mobile originating calls in accordance with conditions in 5.3.3.1b:

2> if the UE is a NB-IoT UE connected to EPC:

3> if the UE has ANR measurements information available in *VarANR-MeasReport-NB* and if the RPLMN is included in *plmn-IdentityList* stored in *VarANR-MeasReport-NB*:

4> set *anr-InfoAvailable* to TRUE;

1> if the UE is resuming an RRC connection after early security reactivation in accordance with conditions in 5.3.3.18:

2> if the UE is initiating UP-EDT in accordance with conditions in 5.3.3.1b; or

2> if the UE is initiating UP transmission using PUR in accordance with conditions in 5.3.3.1c:

3> restore the PDCP state and re-establish PDCP entities for all SRBs and all DRBs;

3> if *drb-ContinueROHC* has been provided in immediately preceding RRC connection release message, and the UE is requesting to resume RRC connection in the same cell:

4> indicate to lower layers that stored UE AS context is used and that *drb-ContinueROHC* is configured;

4> continue the header compression protocol context for the DRBs configured with the header compression protocol;

3> else:

4> indicate to lower layers that stored UE AS context is used;

4> reset the header compression protocol context for the DRBs configured with the header compression protocol;

3> resume all SRBs and all DRBs;

2> else:

3> if the UE is a NB-IoT UE or the UE is connected to EPC, restore the PDCP state and re-establish the PDCP entity for SRB1;

3> if the UE is connected to 5GC:

4> apply the default configuration for SRB1 as specified in 9.2.1.1;

4> except for NB-IoT, apply the default NR PDCP configuration as specified in TS 38.331 [82], clause 9.2.1 for SRB1;

3> resume SRB1;

2> derive the KeNB key based on the KASME key to which the current KeNB is associated, using the stored value of *nextHopChainingCount* received in the *RRCConnectionRelease* message in the preceding connection, as specified in TS 33.401 [32] for EPC and TS 33.501 [86] for 5GC;

2> derive the KRRCint key associated with the previously configured integrity algorithm, as specified in TS 33.401 [32] for EPC and TS 33.501 [86] for 5GC;

2> derive the KRRCenc key and the KUPenc key associated with the previously configured ciphering algorithm, as specified in TS 33.401 [32] for EPC and TS 33.501 [86] for 5GC;

2> configure lower layers to resume integrity protection using the previously configured algorithm and the KRRCint key derived in this clause to all subsequent messages received and sent by the UE;

2> configure lower layers to resume ciphering and to apply the ciphering algorithm and the KRRCenc key derived in this clause to all subsequent messages received and sent by the UE;

2> configure lower layers to resume ciphering and to apply the ciphering algorithm and the KUPenc key derived in this clause immediately to the user data sent and received by the UE;

2> if the UE is initiating UP-EDT for mobile originated calls in accordance with conditions in 5.3.3.1b:

3> configure the lower layers to use EDT;

2> else if the UE is initiating UP transmission using PUR in accordance with conditions in 5.3.3.1c:

3> configure, except *pur-TimeAlignmentTimer*, the lower layers to use transmission using PUR;

3> deliver the UL grant for transmission using PUR to the MAC entity;

1> else:

2> if SRB1 was configured with NR PDCP:

3> for SRB1, release the NR PDCP entity and establish an E-UTRA PDCP entity with the current (MCG) security configuration;

NOTE 1: The UE applies the LTE ciphering and integrity protection algorithms that are equivalent to the previously configured NR security algorithms.

2> else:

3> for SRB1, restore the PDCP state and re-establish the PDCP entity;

If the UE is resuming the RRC connection from RRC\_INACTIVE, the UE shall set the contents of *RRCConnectionResumeRequest* message as follows:

2> if field *useFullResumeID* is signalled in *SystemInformationBlockType2*:

3> set the *fullI-RNTI* to the stored *fullI-RNTI* value provided in suspend;

2> else:

3> set the *shortI-RNTI* to the stored *shortI-RNTI* value provided in suspend;

2> restore the RRC configuration, RoHC state, the stored QoS flow to DRB mapping rules and the KeNB and KRRCint keys from the UE Inactive AS context except for the following:

- MCG physical layer,

- MCG MAC configuration,

- NR *pdcp-Config*,

- MCG SCell configurations, if stored,

- *nr*-*SecondaryCellGroupConfig*, if stored;

2> set the *shortResumeMAC-I* to the 16 least significant bits of the MAC-I calculated:

3> over the ASN.1 encoded as per clause 8 (i.e., a multiple of 8 bits) *VarShortINACTIVE-MAC-Input*;

3> with the KRRCint key in the UE Inactive AS Context and the previously configured integrity protection algorithm; and

3> with all input bits for COUNT, BEARER and DIRECTION set to binary ones;

2> derive the KeNB key based on the current KeNB or the NH, using the stored *nextHopChainingCount* value, as specified in TS 33.501 [86];

2> derive the KRRCenc key, the KRRCint and the KUPenc key, as specified in TS 33.401 [32];

2> apply the default configuration for SRB1 as specified in 9.2.1.1;

2> apply the default NR PDCP configuration as specified in TS 38.331 [82], clause 9.2.1 for SRB1;

2> configure lower layers to resume integrity protection for all SRBs except SRB0 using the configured algorithm and the KRRCint key derived in this clause immediately, i.e., integrity protection shall be applied to all subsequent messages received and sent by the UE;

2> configure lower layers to resume ciphering for all radio bearers except SRB0 and to apply the configured ciphering algorithm, the KRRCenc key and the KUPenc key derived in this clause, i.e. the ciphering configuration shall be applied to all subsequent messages received and sent by the UE;

Following procedures are applied for both suspended RRC connection and RRC\_INACTIVE:

2> resume SRB1;

NOTE 2: Until successful connection resumption, the default physical layer configuration and the default MAC Main configuration are applied for the transmission of SRB0 and SRB1, and SRB1 is used only for the transfer of *RRCConnectionResume* message, and *RRCConnectionRelease* message if security has been re-activated.

The UE shall submit the *RRCConnectionResumeRequest* message to lower layers for transmission.

The UE shall continue cell re-selection related measurements as well as cell re-selection evaluation.

If the UE is resuming the RRC connection from RRC\_INACTIVE and if lower layers indicate an integrity check failure while T300 is running, the UE shall perform actions specified in 5.3.3.16.

#### 5.3.3.3b Actions related to transmission of *RRCEarlyDataRequest* message

The UE shall set the contents of *RRCEarlyDataRequest* message as follows:

1> if upper layers provide an S-TMSI:

2> set the *s-TMSI* to the value received from upper layers;

1> else if upper layers provide a 5G-S-TMSI:

2> set the *ng-5G-S-TMSI* to the value received from upper layers;

1> set the *establishmentCause* in accordance with the information received from upper layers;

1> if the UE is a NB-IoT UE:

2> if the UE supports DL channel quality reporting and *cqi-Reporting* is present in *SystemInformationBlockType2-NB*:

3> set the *cqi-NPDCCH* to include the latest results of the downlink channel quality measurements of the carrier where the random access response is received as specified in TS 36.133 [16];

NOTE: The downlink channel quality measurements may use measurement period T1 or T2, as defined in TS 36.133 [16]. In case period T2 is used the RRC-MAC interactions are left to UE implementation.

1> set the *dedicatedInfoNAS* to include the information received from upper layers;

The UE shall:

1> if the UE is initiating CP-EDT in accordance with conditions in 5.3.3.1b:

2> configure the lower layers to use EDT;

1> else if the UE is initiating CP transmission using PUR in accordance with conditions in 5.3.3.1c:

2> configure, except *pur-TimeAlignmentTimer*, the lower layers to use transmission using PUR;

2> deliver the UL grant for transmission using PUR to the MAC entity;

1> submit the *RRCEarlyDataRequest* message to the lower layers for transmission.

#### 5.3.3.3c UE actions upon receiving EDT fallback indication from lower layers

Upon indication from lower layers that EDT is cancelled, the UE shall:

1> start or restart timer T300;

1> if the fallback is indicated by lower layers in response to the *RRCEarlyDataRequest*:

2> initiate transmission of *RRCConnectionRequest* message in accordance with 5.3.3.3;

1> else if the fallback is indicated by lower layers in response to the *RRCConnectionResumeRequest* for EDT when connected to EPC and the fallback is not due to the UL grant provided in Random Access Response not being for EDT:

2> perform the actions as specified in 5.3.3.9a;

2> initiate transmission of the *RRCConnectionResumeRequest* message in accordance with 5.3.3.3a;

NOTE: It is up to UE implementation to avoid data loss due to EDT fallback.

5.3.3.3d UE actions upon receiving PUR indications from lower layers

The UE shall:

1> if repetition adjustment is indicated by lower layers:

2> update *numRepetitions* (*npusch-NumRepetitionsIndex* in NB-IoT) in previously stored *pur-Config* in accordance with the received indication;

1> if *pur-RSRP-ChangeThreshold* (*pur-NRSRP-ChangeThreshold* in NB-IoT) is configured and timing advance adjustment is indicated by lower layers:

2> replace the serving cell reference (N)RSRP value with the current serving cell (N)RSRP value (see 5.3.3.19);

For CP transmission using PUR, upon indication from lower layers that transmission using PUR is successfully completed, the UE shall perform the actions as specified in 5.3.3.4b as if an empty *RRCEarlyDataComplete* message was received.

Upon reception of PUR fallback or PUR failure indication from lower layers, the procedure ends.

NOTE: For transmission using PUR, further UE actions upon reception of PUR fallback or PUR failure indication from lower layers (see TS 36.321 [6]) is left up to implementation.

#### 5.3.3.4 Reception of the *RRCConnectionSetup* by the UE

NOTE 1: Prior to this, lower layer signalling is used to allocate a C-RNTI. For further details see TS 36.321 [6];

The UE shall:

1> except when the UE connected to 5GC is a BL UE or UE in CE, if the *RRCConnectionSetup* is received in response to an *RRCConnectionResumeRequest* from a suspended RRC connection:

2> if the UE is resuming an RRC connection after early security reactivation in accordance with conditions in 5.3.3.18:

3> discard any current AS security context including the KRRCenc key, the KRRCint key, the KUPint key and the KUPenc key;

2> release all radio resources, including release of the RLC entity, the MAC configuration and the associated PDCP entity for all established or suspended RBs, except for SRB0;

2> discard the stored UE AS context and *resumeIdentity*;

2> if stored, discard the stored *nextHopChainingCount*;

2> if stored, discard the stored *drb-ContinueROHC*;

2> indicate to upper layers fallback of the RRC connection;

1> if the *RRCConnectionSetup* is received in response to an *RRCConnectionResumeRequest* from RRC\_INACTIVE:

2> stop T380 if running;

2> discard the stored UE Inactive AS context;

2> release *rrc-InactiveConfig*, if configured;

1> if the UE connected to 5GC is a BL UE or UE in CE, and the *RRCConnectionSetup* is received in response to an *RRCConnectionResumeRequest* from a suspended RRC connection:

2> discard the stored UE AS context and *resumeIdentity*;

2> if stored, discard the stored *nextHopChainingCount*;

2> if stored, discard the stored *drb-ContinueROHC*;

1> if the *RRCConnectionSetup* is received in response to an *RRCConnectionResumeRequest* from RRC\_INACTIVE; or

1> if the UE connected to 5GC is a BL UE or UE in CE, and the *RRCConnectionSetup* is received in response to an *RRCConnectionResumeRequest* from a suspended RRC connection:

2> discard any current AS security context including the KRRCenc key, the KRRCint key, the KUPint key and the KUPenc key;

2> release radio resources for all established RBs except SRB0, including release of the RLC entities, of the associated PDCP entities and of SDAP entities;

2> release the RRC configuration except for the default L1 parameter values, default MAC main configuration and CCCH;

2> apply the default NR PDCP configuration as specified in TS 38.331 [82], clause 9.2.1.1 for SRB1;

2> use NR PDCP for all subsequent messages received and sent by the UE via SRB1;

2> indicate to upper layers fallback of the RRC connection;

1> if the *RRCConnectionSetup* is received in response to an *RRCEarlyDataRequest* or *RRCConnectionResumeRequest* for transmission using PUR:

2> instruct the associated MAC entity to start *timeAlignmentTimer*;

1> perform the radio resource configuration procedure in accordance with the received *radioResourceConfigDedicated* and as specified in 5.3.10.0;

1> if stored, discard the cell reselection priority information provided by the *idleModeMobilityControlInfo* or inherited from another RAT;

1> if stored, discard the *altFreqPriorities* provided by the *RRCConnectionRelease*;

1> if stored, discard the dedicated offset provided by the *redirectedCarrierOffsetDedicated*;

1> stop timer T300;

1> if T302 is running:

2> stop timer T302;

2> if the UE is connected to 5GC:

3> perform the actions as specified in 5.3.16.4;

1> stop timer T303, if running;

1> stop timer T305, if running;

1> stop timer T306, if running;

1> stop timer T308, if running;

1> perform the actions as specified in 5.3.3.7;

1> stop timer T320, if running;

1> stop timer T350, if running;

1> perform the actions as specified in 5.6.12.4;

1> release *rclwi-Configuration*, if configured, as specified in 5.6.16.2;

1> stop timer T360, if running;

1> stop timer T322, if running;

1> if timer T331 is running:

2> stop timer T331;

2> perform the actions as specified in 5.6.20.3;

1> stop timer T323, if running;

1> forward the *dedicatedInfoNAS,* if received, to the upper layers;

1> if T309 is running:

2> stop timer T309 for all access categories;

2> perform the actions as specified in 5.3.16.4.

1> enter RRC\_CONNECTED;

1> stop the cell re-selection procedure;

1> consider the current cell to be the PCell;

1> except for NB-IoT:

2> if the UE supports RLF report for inter-RAT MRO EUTRA as defined in TS 38.306 [87], and if the UE has radio link failure or handover failure information available in *VarRLF-Report* of TS 38.331 [82] and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report* of TS 38.331 [82]:

3> if *reconnectCellId* in *VarRLF-Report* of TS 38.331 [82] is not set after failing to perform reestablishment and if this is the first *RRCConnectionSetup* received by the UE after declaring the failure; or

3> if *reconnectCellId* in *VarRLF-Report* of TS 38.331 [82] is not set, and if the UE selected the current PCell immediately after failure in performing *MobilityFromNRCommand*:

4> if the selected PCell is an acceptable cell as defined in TS 36.304 [4]:

5> set *timeUntilReconnection* in *VarRLF-Report* of TS 38.331 [82] to the time that elapsed since the *MobilityFromNRCommand* failure;

4> if the selected PCell is a suitable cell as defined in TS 36.304 [4]:

5> if the UE supports RLF-Report for conditional handover as defined in TS 38.306 [87] and if *choCellId* in *VarRLF-Report* of TS 38.331 [82] is set:

6> set *timeUntilReconnection* in *VarRLF-Report* of TS 38.331 [82] to the time that elapsed since the radio link failure or handover failure experienced in the *failedPCellID* stored in *VarRLF-Report* of TS 38.331 [82];

5> else:

6> set *timeUntilReconnection* in *VarRLF-Report* of TS 38.331 [82] to the time that elapsed since the last radio link failure or handover failure;

5> set *eutraReconnectCellId* in *reconnectCellId* in *VarRLF-Report* of TS 38.331 [82] to the global cell identity and the tracking area code of the PCell;

2> if the UE radio link failure or handover failure information available in *VarRLF-Report* and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report*:

3> if *reconnectCellId* in *VarRLF-Report* is not set, and if the UE failed to perform reestablishment:

4> set *timeUntilReconnection* in *VarRLF-Report* to the time that elapsed since the last radio link failure or handover failure;

4> set *eutraReconnectCellId* in *reconnectCellId* in *VarRLF-Report* to the global cell identity and the tracking area code of the PCell;

1> set the content of *RRCConnectionSetup**Complete* message as follows:

2> if the *RRCConnectionSetup* is received in response to an *RRCConnectionResumeRequest*:

3> if upper layers provide an S-TMSI:

4> set the *s-TMSI* to the value received from upper layers;

3> else if upper layers provide a 5G-S-TMSI:

4> if the UE is a NB-IoT UE:

5> set the *ng-5G-S-TMSI* to the value received from upper layers;

4> else:

5> set the *ng-5G-S-TMSI-Bits* to *ng-5G-S-TMSI* with the value received from upper layers;

2> else if upper layers provide a 5G-S-TMSI:

3> except for NB-IoT, set the *ng-5G-S-TMSI-Bits* to *ng-5G-S-TMSI-Part2* to the leftmost 8 bits of 5G-S-TMSI received from upper layers;

2> set the *selectedPLMN-Identity* to the PLMN selected by upper layers (see TS 23.122 [11], TS 24.301 [35] for E-UTRA/EPC and TS 24.501 [95] for E-UTRA/5GC) from the PLMN(s) included in the *plmn-IdentityList* in *SystemInformationBlockType1* (or *SystemInformationBlockType1-NB* in NB-IoT);

2> if upper layers provide the 'Registered MME', include and set the *registeredMME* as follows:

3> if the PLMN identity of the 'Registered MME' is different from the PLMN selected by the upper layers:

4> include the *plmnIdentity* in the *registeredMME* and set it to the value of the PLMN identity in the 'Registered MME' received from upper layers;

3> set the *mmegi* andthe *mmec* to the value received from upper layers;

2> if upper layers provided the 'Registered MME':

3> include and set the *gummei-Type* to the value provided by the upper layers;

2> if upper layers provide the 'Registered AMF', include and set the *registeredAMF* as follows:

3> if the PLMN identity of the 'Registered AMF' is different from the PLMN selected by the upper layers:

4> include the *plmnIdentity* in the *registeredAMF* and set it to the value of the PLMN identity in the 'Registered AMF' received from upper layers;

3> set the *amf-Identifier* to AMF Identifier of the 'Registered AMF' received from upper layers;

2> if upper layers provided the 'Registered AMF':

3> include and set the *guami-Type* to the value provided by the upper layers;

2> if upper layers provide one or more S-NSSAI (see TS 23.003 [27]):

3> include the *s-NSSAI-list* and set the content to the values provided by the upper layers;

2> if the UE supports CIoT EPS optimisation(s):

3> include a*ttachWithoutPDN-Connectivity* if received from upper layers;

3> include *up-CIoT-EPS-Optimisation* if received from upper layers;

3> except for NB-IoT, include *cp-CIoT-EPS-Optimisation* if received from upper layers;

2> if the UE supports CIoT 5GS optimisation(s):

3> for NB-IoT, include *ng-U-DataTransfer* if received from upper layers;

3> except for NB-IoT, include *cp-CIoT-5GS-Optimisatoin* if received from upper layers;

2> if connecting as an RN:

3> include the *rn-SubframeConfigReq*;

2> if the *RRCConnectionSetup* is received in response to *RRCEarlyDataRequest*:

3> set the *dedicatedInfoNAS* to a zero-length octet string;

2> else:

3> set the *dedicatedInfoNAS* to include the information received from upper layers;

2> if the *RRCConnectionSetup* is not in response to transmission using PUR and the UE has a stored *pur-Config* including *pur-ConfigID*:

3> include the stored *pur-ConfigID*;

2> if the UE is connected to EPC:

3> except for NB-IoT:

4> include the *mobilityState* and set it to the mobility state (as specified in TS 36.304 [4]) of the UE just prior to entering RRC\_CONNECTED state;

3> for NB-IoT:

4> if the UE has radio link failure information available in *VarRLF-Report-NB* and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report-NB*:

5> include *rlf-InfoAvailable*;

4> if the UE has ANR measurements information available in *VarANR-MeasReport-NB* and if the RPLMN is included in *plmn-IdentityList* stored in *VarANR-MeasReport-NB*:

5> include *anr-InfoAvailable*;

3> include *dcn-ID* if a DCN-ID value (see TS 23.401 [41]) is received from upper layers;

2> else (i.e. the UE is connected to 5GC):

3> if the UE is a BL UE:

4> include *lte-M*;

2> except for NB-IoT:

3> if the UE has radio link failure or handover failure information available in *VarRLF-Report* and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report*:

4> include *rlf-InfoAvailable*;

3> if the UE has MBSFN logged measurements available for E-UTRA and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:

4> include *logMeasAvailableMBSFN*;

3> if the UE has logged measurements available for E-UTRA and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:

4> include *logMeasAvailable*;

4> if Bluetooth measurement results are included in the logged measurements the UE has available:

5> include *logMeasAvailableBT*;

4> if WLAN measurement results are included in the logged measurements the UE has available:

5> include *logMeasAvailableWLAN*;

3> if the UE has connection establishment failure information available in *VarConnEstFailReport* and if the RPLMN is equal to *plmn-Identity* stored in *VarConnEstFailReport*:

4> include *connEstFailInfoAvailable*;

3> if the UE has flight path information available:

4> include *flightPathInfoAvailable*;

3> if the UE supports storage of mobility history information and the UE has mobility history information available in *VarMobilityHistoryReport*:

4> include the *mobilityHistoryAvail*;

3> if the SIB2 contains *idleModeMeasurements* and the UE has E-UTRA idle/inactive measurement information concerning cells other than the PCell available in *VarMeasIdleReport*; or

3> if the SIB2 contains *idleModeMeasurementsNR* and the UE has NR idle/inactive measurement information available in *VarMeasIdleReport*:

4> include the *idleMeasAvailable*;

3> if upper layers indicate that access to RLOS is initiated (see TS 23.401 [41] clause 4.3.8.3):

4> set *rlos-Request* to *true*;

2> if UE needs UL gaps during continuous uplink transmission:

3> include *ue-CE-NeedULGaps*;

2> for NB-IoT:

3> if the UE supports serving cell idle mode measurements reporting and *servingCellMeasInfo* is present in *SystemInformationBlockType2-NB*:

4> set the *measResultServCell* to include the measurements of the serving cell;

NOTE 2: The UE includes the latest results of the serving cell measurements as used for cell selection/ reselection evaluation, which are performed in accordance with the performance requirements as specified in TS 36.133 [16].

2> if connecting as an IAB-node:

3> include *iab-NodeIndication;*

2> if the UE is connected to NTN:

3> include *gnss-validityDuration* in accordance with the remaining time of the GNSS validity duration;

3> if UE supports GNSS position fix in RRC\_CONNECTED and *gnss-PositionFixDurationReporting* is present in *SystemInformationBlockType2(-NB)*:

4> include *gnss-PositionFixDuration* in accordance with the time duration required for the UE to acquire a GNSS position;

2> if UE supports uplink RRC Segmentation of *UECapabilityInformation* according to the network indication *rrc-SegAllowed*:

3> except for NB-IoT, may include *ul-RRC-Segmentation* if upper layers indicate that they are performing an Attach or TA Update;

2> if the UE supports uplink RRC Segmentation of *UECapabilityInformation* according to the network indication *rrc-MaxCapaSegAllowed*:

3> except for NB-IoT, include the *ul-RRC-MaxCapaSegments* if upper layers indicate that they are performing an Attach or TA Update;

1> submit the *RRCConnectionSetupComplete* message to lower layers for transmission;

1> for NB-IoT:

2> if the UE supports connected mode measurements and *connMeasConfig* is present in *SystemInformationBlockType3-NB*:

3> perform measurements as specified in 5.5.8.

1> the procedure ends.

#### 5.3.3.4a Reception of the *RRCConnectionResume* by the UE

The UE shall:

1> stop timer T300;

1> if T309 is running:

2> stop timer T309 for all access categories;

2> perform the actions as specified in 5.3.16.4.

1> stop T380 if running;

1> if the *RRCConnectionResume* is received in response to an *RRCConnectionResumeRequest* for EDT or for transmission using PUR:

2> discard the stored UE AS context and *resumeIdentity*;

2> if the *RRCConnectionResume* is received in response to an *RRCConnectionResumeRequest* for transmission using PUR:

3> instruct the associated MAC entity to start *timeAlignmentTimer*;

1> else:

2> if resuming an RRC connection from a suspended RRC connection in EPC; or

2> for NB-IoT, if resuming an RRC connection from a suspended RRC connection in 5GC and *fullConfig* is not present in the *RRCConnectionResume* message:

3> restore the PDCP state and re-establish PDCP entities for SRB2, if configured withE-UTRA PDCP, and for all DRBs that are configured with E-UTRA PDCP;

3> if *drb-ContinueROHC* is included:

4> indicate to lower layers that stored UE AS context is used and that *drb-ContinueROHC* is configured;

4> continue the header compression protocol context for the DRBs configured with the header compression protocol;

3> else:

4> indicate to lower layers that stored UE AS context is used;

4> reset the header compression protocol context for the DRBs configured with the header compression protocol;

3> if *restoreMCG-SCells* is included:

4> restore the MCG SCell(s) configuration, if stored;

3> else:

4> release the MCG SCell(s) from the UE AS context, if stored;

3> if *restoreSCG* is included:

4> restore *nr-SecondaryCellGroupConfig*, if stored;

3> else if the UE was configured with EN-DC:

4> perform MR-DC release, as specified in TS 38.331 [82], clause 5.3.5.10;

4> release *tdm-PatternConfig* or *tdm-PatternConfig2*, if configured;

3> discard the stored UE AS context and *resumeIdentity*;

3> configure lower layers to consider the restored MCG and SCG SCell(s) (if any) to be in deactivated state;

2> else if the *RRCConnectionResume* message includes the *fullConfig* (i.e., for resuming an RRC connection from RRC\_INACTIVE or for resuming a suspended RRC connection in 5GC):

3> perform the radio configuration procedure as specified in 5.3.5.8;

2> else if resuming an RRC connection from RRC\_INACTIVE:

3> restore the following from the stored UE Inactive AS context:

- MCG physical layer configuration,

- MCG MAC configuration,

- MCG RLC configuration,

- PDCP configuration;

3> if *restoreMCG-SCells* is included:

4> restore the MCG SCell(s) configuration, if stored;

3> else:

4> release the MCG SCell(s) from the UE Inactive AS context, if stored;

3> if *restoreSCG* is included:

4> restore *nr-SecondaryCellGroupConfig*, if stored;

3> else if the UE was configured with NGEN-DC:

4> perform MR-DC release, as specified in TS 38.331 [82], clause 5.3.5.10;

4> release *tdm-PatternConfig* or *tdm-PatternConfig2*, if configured;

3> discard the stored UE Inactive AS context;

3> configure lower layers to consider the restored MCG and SCG SCell(s) (if any) to be in deactivated state;

3> release the *rrc-InactiveConfig*, except *ran-NotificationAreaInfo*;

2> else (i.e., except for NB-IoT for resuming a suspended RRC connection in 5GC):

3> restore the physical layer configuration, the MAC configuration, the RLC configuration and the PDCP configuration from the stored UE AS context;

3> discard the stored UE AS context and *resumeIdentity*;

1> perform the radio resource configuration procedure in accordance with the received *radioResourceConfigDedicated* and as specified in 5.3.10.0;

NOTE 1: When performing the radio resource configuration procedure, for the physical layer configuration and the MAC Main configuration, the restored RRC configuration from the stored UE AS context is used as basis for the reconfiguration.

1> if the received *RRCConnectionResume* includes the *sCellToReleaseList*:

2> perform SCell release as specified in 5.3.10.3a;

1> if the received *RRCConnectionResume* includes the *sCellToAddModList*:

2> perform SCell addition or modification as specified in 5.3.10.3b;

1> if the received *RRCConnectionResume* includes the *sCellGroupToReleaseList*:

2> perform SCell group release as specified in 5.3.10.3d;

1> if the received *RRCConnectionResume* includes the *sCellGroupToAddModList*:

2> perform SCell group addition or modification as specified in 5.3.10.3e;

1> if the received *RRCConnectionResume* message includes the *nr-SecondaryCellGroupConfig*:

2> perform NR RRC Reconfiguration as specified in TS 38.331 [82], clause 5.3.5.3;

1> if the received *RRCConnectionResume* message includes the *sk-Counter*:

2> perform key update procedure as specified in TS 38.331 [82], clause 5.3.5.8;

1> if the received *RRCConnectionResume* message includes the *nr-RadioBearerConfig1*:

2> perform radio bearer configuration as specified in TS 38.331 [82], clause 5.3.5.6;

1> if the received *RRCConnectionResume* message includes the *nr-RadioBearerConfig2*:

2> perform radio bearer configuration as specified in TS 38.331 [82], clause 5.3.5.6;

1> except if the *RRCConnectionResume* is received in response to an *RRCConnectionResumeRequest* for EDT or for transmission using PUR:

2> resume SRB2, SRB3 (if configured), and all DRBs, if any, including RBs configured with NR PDCP;

NOTE 1a: If the NR SCG is deactivated, resuming SRB3 and all DRBs does not imply that PDCP or RRC PDUs can be transmitted or received on SCG RLC bearers.

1> if stored, discard the cell reselection priority information provided by the *idleModeMobilityControlInfo* or inherited from another RAT;

1> if stored, discard the *altFreqPriorities* provided by the *RRCConnectionRelease*;

1> if stored, discard the dedicated offset provided by the *redirectedCarrierOffsetDedicated*;

1> if the *RRCConnectionResume* message includes the *measConfig*:

2> perform the measurement configuration procedure as specified in 5.5.2;

1> if the *RRCConnectionResume* message includes the *otherConfig*:

2> perform the other configuration procedure as specified in 5.3.10.9;

1> if T302 is running:

2> stop timer T302;

2> if the UE is connected to 5GC:

3> perform the actions as specified in 5.3.16.4;

1> stop timer T303, if running;

1> stop timer T305, if running;

1> stop timer T306, if running;

1> stop timer T308, if running;

1> perform the actions as specified in 5.3.3.7;

1> stop timer T320, if running;

1> stop timer T350, if running;

1> perform the actions as specified in 5.6.12.4;

1> stop timer T360, if running;

1> stop timer T322, if running;

1> stop timer T323, if running;

1> if timer T331 is running:

2> stop timer T331;

2> perform the actions as specified in 5.6.20.3;

1> if the UE is resuming an RRC connection after early security reactivation in accordance with conditions in 5.3.3.18 or *RRCConnectionResume* is received in response to an *RRCConnectionResumeRequest* from RRC\_INACTIVE:

2> ignore the *nextHopChainingCount* value indicated in the *RRCConnectionResume* message;

1> else:

2> if resuming an RRC connection from a suspended RRC connection in EPC:

3> update the KeNB key based on the KASME key to which the current KeNB is associated, using the *nextHopChainingCount* value indicated in the *RRCConnectionResume* message, as specified in TS 33.401 [32];

3> store the *nextHopChainingCount* value;

3> derive the KRRCint key associated with the previously configured integrity algorithm, as specified in TS 33.401 [32];

3> request lower layers to verify the integrity protection of the *RRCConnectionResume* message, using the previously configured algorithm and the KRRCint key;

3> if the integrity protection check of the *RRCConnectionResume* message fails:

4> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'other', upon which the procedure ends;

3> derive the KRRCenc key and the KUPenc key associated with the previously configured ciphering algorithm, as specified in TS 33.401 [32];

3> configure lower layers to resume integrity protection using the previously configured algorithm and the KRRCint key immediately, i.e., integrity protection shall be applied to all subsequent messages received and sent by the UE;

3> configure lower layers to resume ciphering and to apply the ciphering algorithm, the KRRCenc key and the KUPenc key, i.e. the ciphering configuration shall be applied to all subsequent messages received and sent by the UE;

1> enter RRC\_CONNECTED;

1> indicate to upper layers that the suspended RRC connection has been resumed;

1> stop the cell re-selection procedure;

1> consider the current cell to be the PCell;

1> set the content of *RRCConnectionResumeComplete* message as follows:

2> set the *selectedPLMN-Identity* to the PLMN selected by upper layers (see TS 23.122 [11], TS 24.301 [35] for E-UTRA/EPC and TS 24.501 [95] for E-UTRA/5GC) from the PLMN(s) included in the *plmn-IdentityList* in *SystemInformationBlockType1*;

2> set the *dedicatedInfoNAS* to include the information received from upper layers;

2> except for NB-IoT:

3> if resuming an RRC connection from a suspended RRC connection:

4> if the UE has radio link failure or handover failure information available in *VarRLF-Report* and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report*:

5> include *rlf-InfoAvailable*;

4> if the UE has MBSFN logged measurements available for E-UTRA and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:

5> include *logMeasAvailableMBSFN*;

4> else if the UE has logged measurements available for E-UTRA and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:

5> include *logMeasAvailable*;

5> if Bluetooth measurement results are included in the logged measurements the UE has available:

6> include *logMeasAvailableBT*;

5> if WLAN measurement results are included in the logged measurements the UE has available:

6> include *logMeasAvailableWLAN*;

4> if the UE has connection establishment failure information available in *VarConnEstFailReport* and if the RPLMN is equal to *plmn-Identity* stored in *VarConnEstFailReport*:

5> include *connEstFailInfoAvailable*;

4> include the *mobilityState* and set it to the mobility state (as specified in TS 36.304 [4]) of the UE just prior to entering RRC\_CONNECTED state;

4> if the UE has flight path information available:

5> include *flightPathInfoAvailable*;

3> if the UE supports storage of mobility history information and the UE has mobility history information available in *VarMobilityHistoryReport*:

4> include *mobilityHistoryAvail*;

3> if the *idleModeMeasurementReq* is included in the *RRCConnectionResume* message:

4> if the UE has idle/inactive measurement information concerning cells other than the PCell available in *VarMeasIdleReport*:

5> set the *measResultListIdle-r16* in the *RRCConnectionResumeComplete* message to the value of *measReportIdle-r15* in the *VarMeasIdleReport*;

5> set the *measResultListExtIdle* in the *RRCConnectionResumeComplete* message to the value of *measReportIdle-r16* in the *VarMeasIdleReport*, if available;

5> set the *measResultListIdleNR* in the *RRCConnectionResumeComplete* message to the value of *measReportIdleNR* in the *VarMeasIdleReport*, if available;

5> discard the *VarMeasIdleReport* upon successful delivery of the *RRCConnectionResumeComplete* message is confirmed by lower layers;

3> else:

4> if the SIB2 contains *idleModeMeasurements* and the UE has E-UTRA idle/inactive measurement information concerning cells other than the PCell available in *VarMeasIdleReport*; or

4> if the SIB2 contains *idleModeMeasurementsNR* and the UE has NR idle/inactive measurement information available in *VarMeasIdleReport*:

5> include the *idleMeasAvailable*;

3> if the *RRCConnectionResume* message includes *nr-SecondaryCellGroupConfig*:

4> include *scg-ConfigResponseNR* in accordance with TS 38.331 [82], clause 5.3.5.3;

2> for NB-IoT:

3> if the UE supports serving cell idle mode measurements reporting and *servingCellMeasInfo* is present in *SystemInformationBlockType2-NB*:

4> set the *measResultServCell* to include the measurements of the serving cell;

NOTE 2: The UE includes the latest results of the serving cell measurements as used for cell selection/ reselection evaluation, which are performed in accordance with the performance requirements as specified in TS 36.133 [16].

3> if the UE is connected to EPC:

4> if the UE has radio link failure information available in *VarRLF-Report-NB* and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report-NB*:

5> include *rlf-InfoAvailable*;

4> if the UE has ANR measurements information available in *VarANR-MeasReport-NB* and if the RPLMN is included in *plmn-IdentityList* stored in *VarANR-MeasReport-NB*:

5> include *anr-InfoAvailable*;

2> if the UE is connected to NTN:

3> include *gnss-validityDuration* in accordance with the remaining time of the GNSS validity duration;

3> if UE supports GNSS position fix in RRC\_CONNECTED and *gnss-PositionFixDurationReporting* is present in *SystemInformationBlockType2(-NB)*:

4> include *gnss-PositionFixDuration* in accordance with the time duration required for the UE to acquire a GNSS position;

1> if the UE is configured to operate in EN-DC as result of this procedure, forward *upperLayerIndication* to upper layers as if the UE has received this field from SIB2, otherwise indicate to upper layers the absence of this field;

1> submit the *RRCConnectionResumeComplete* message to lower layers for transmission;

1> for NB-IoT:

2> if the UE supports connected mode measurements and *connMeasConfig* is present in *SystemInformationBlockType3-NB*:

3> perform measurements as specified in 5.5.8.

2> if the received *RRCConnectionResume* message includes the *obtainLocationNB*:

3> attempt to have detailed location information available for any RLF report;

NOTE 3: The UE is requested to attempt to have valid detailed location information available at the time of RLF. The UE may not succeed e.g. because the user manually disabled the GPS hardware, due to no/poor satellite coverage. Further details, e.g. regarding when to activate GNSS, are up to UE implementation.

1> the procedure ends.

#### 5.3.3.4b Reception of the *RRCEarlyDataComplete* by the UE

The UE shall:

1> indicate to upper layers that the RRC connection has been established;

1> if stored, discard the cell reselection priority information provided by the *idleModeMobilityControlInfo* or inherited from another RAT;

1> if stored, discard the *altFreqPriorities* provided by the *RRCConnectionRelease*;

1> if stored, discard the dedicated offset provided by the *redirectedCarrierOffsetDedicated*;

1> stop timer T300;

1> stop timer T302, if running;

1> stop timer T303, if running;

1> stop timer T305, if running;

1> stop timer T306, if running;

1> stop timer T308, if running;

1> perform the actions as specified in 5.3.3.7;

1> stop timer T320, if running;

1> stop timer T322, if running;

1> stop timer T323, if running;

1> reset MAC and release the MAC configuration;

1> if the *RRCEarlyDataComplete* message includes *redirectedCarrierInfo* indicating redirection to *geran, utra-FDD* or *utra-TDD*; or

1> if the *RRCEarlyDataComplete* message includes *idleModeMobilityControlInfo* including *freqPriorityListGERAN* or *freqPriorityListUTRA-FDD* or *freqPriorityListUTRA-TDD*:

2> if upper layers indicate that redirect to GERAN or UTRAN without AS security is not allowed:

3> ignore the content of *RRCEarlyDataComplete*;

3> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'other', upon which the procedure ends;

1> forward the *dedicatedInfoNAS,* if received, to the upper layers;

1> if the *RRCEarlyDataComplete* message includes *idleModeMobilityControlInfo*:

2> store the cell reselection priority information provided by the *idleModeMobilityControlInfo*;

2> if the *t320* is included:

3> start timer T320, with the timer value set according to the value of *t320*;

1> else:

2> apply the cell reselection priority information broadcast in the system information;

1> for NB-IoT, if the *RRCEarlyDataComplete* message includes *redirectedCarrierInfo*:

2> if the *redirectedCarrierOffsetDedicated* isincluded in the *redirectedCarrierInfo*:

3> store the dedicated offsetfor the frequency in *redirectedCarrierInfo*;

3> start timer T322, with the timer value set according to the value of *T322* in *redirectedCarrierInfo*;

1> if the *extendedWaitTime* is present; and

1> if the UE supports delay tolerant access or the UE is a NB-IoT UE:

2> forward the *extendedWaitTime* to upper layers;

1> indicate the release of the RRC connection to upper layers together with the release cause 'other', upon which the procedure ends;

#### 5.3.3.5 Cell re-selection or cell selection while T300, T302, T303, T305, T306, T308 or T309 is running

The UE shall:

1> if cell selection or reselection occurs while T309 or T302 is running and if the UE is connected to 5GC:

2> stop timer T309 for all access categories, if running;

2> if in RRC\_INACTIVE and T302 is running:

3> perform the actions upon leaving RRC\_INACTIVE as specified in 5.3.12 with release cause 'RRC Resume failure';

2> else:

3> stop timer T302, if running;

3> perform the actions as specified in 5.3.16.4;

1> if in RRC\_INACTIVE:

2> if cell reselection occurs while T300 is running:

3> perform the actions upon leaving RRC\_INACTIVE as specified in 5.3.12 with release cause 'RRC Resume failure';

1> else if cell reselection occurs while T300, T302, T303, T305, T306, or T308 is running:

2> if timer T302, T303, T305, T306, and/or T308 is running and if the UE is connected to EPC:

3> stop timer T302, T303, T305, T306, and T308, whichever ones were running;

3> perform the actions as specified in 5.3.3.7;

2> if timer T300 is running:

3> stop timer T300;

3> if UE has sent *RRCConnectionResumeRequest* message and has not received *RRCConnectionResume* message:

4> reset MAC;

4> if UE is resuming an RRC connection after early security reactivation in accordance with conditions in 5.3.3.18:

5> perform the actions as specified in 5.3.3.9a;

4> else:

5> re-establish RLC for all RBs that are established;

5> suspend SRB1;

3> else:

4> reset MAC, release the MAC configuration and re-establish RLC for all RBs that are established;

3> inform upper layers about the failure to establish the RRC connection or failure to resume the RRC connection with suspend indication;

#### 5.3.3.6 T300 expiry

The UE shall:

1> if timer T300 expires:

2> if UE has sent *RRCConnectionResumeRequest* message and has not received *RRCConnectionResume* message:

3> reset MAC;

3> if UE is resuming an RRC connection after early security reactivation in accordance with conditions in 5.3.3.18:

4> perform the actions as specified in 5.3.3.9a;

3> else:

4> re-establish RLC for all RBs that are established;

4> suspend SRB1;

2> else:

3> reset MAC, release the MAC configuration and re-establish RLC for all RBs that are established;

2> if the UE is a NB-IoT UE:

3> if *connEstFailOffset* is included in *SystemInformationBlockType2-NB*:

4> use *connEstFailOffset* for the parameter Qoffsettemp for the concerned cell when performing cell selection and reselection according to TS 36.304 [4];

3> else:

4> use value of infinity for the parameter Qoffsettemp for the concerned cell when performing cell selection and reselection according to TS 36.304 [4];

NOTE 0: For NB-IoT, the number of times that the UE detects T300 expiry on the same cell before applying connEstFailOffset and the amount of time that the UE applies connEstFailOffset before removing the offset from evaluation of the cell is up to UE implementation.

2> else if the UE supports RRC Connection Establishment failure temporary Qoffset and T300 has expired a consecutive *connEstFailCount* times on the same cell for which *txFailParams* is included in *SystemInformationBlockType2*:

3> for a period as indicated by *connEstFailOffsetValidity*:

4> use *connEstFailOffset* for the parameter Qoffsettemp for the concerned cell when performing cell selection and reselection according to TS 36.304 [4], TS 25.304 [40] and TS 38.304 [92];

NOTE 1: When performing cell selection, if no suitable or acceptable cell can be found, it is up to UE implementation whether to stop using *connEstFailOffset* for the parameter Qoffsettemp during *connEstFailOffsetValidity* for the concerned cell.

2> except for NB-IoT, store the following connection establishment failure information in the *VarConnEstFailReport* by setting its fields as follows:

3> clear the information included in *VarConnEstFailReport*, if any;

3> set the *plmn-Identity* to the PLMN selected by upper layers (see TS 23.122 [11], TS 24.301 [35]) from the PLMN(s) included in the *plmn-IdentityList* in *SystemInformationBlockType1*;

3> set the *failedCellId* to the global cell identity of the cell where connection establishment failure is detected;

3> set the *measResultFailedCell* to include the RSRP and RSRQ, if available, of the cell where connection establishment failure is detected and based on measurements collected up to the moment the UE detected the failure;

3> if available, set the *measResultNeighCells*, in order of decreasing ranking-criterion as used for cell re-selection, to include neighbouring cell measurements for at most the following number of neighbouring cells: 6 intra-frequency and 3 inter-frequency neighbours per frequency as well as 3 inter-RAT neighbours, per frequency/ set of frequencies (GERAN) per RAT and according to the following:

4> for each neighbour cell included, include the optional fields that are available;

NOTE 2: The UE includes the latest results of the available measurements as used for cell reselection evaluation, which are performed in accordance with the performance requirements as specified in TS 36.133 [16].

3> if available, set the *logMeasResultListWLAN* to include the WLAN measurement results, in order of decreasing RSSI for WLAN APs;

3> if available, set the *logMeasResultListBT* to include the Bluetooth measurement results, in order of decreasing RSSI for Bluetooth beacons;

3> if detailed location information is available, set the content of the *locationInfo* as follows:

4> include the *locationCoordinates*;

4> include the *horizontalVelocity*, if available;

NOTE 3: Which location information related configuration is used by the UE to make the *logMeasResultListWLAN, logMeasResultListBT* and *locationInfo* available for inclusion in the *VarConnEstFailReport* is left to UE implementation.

3> set the *numberOfPreamblesSent* to indicate the number of preambles sent by MAC for the failed random access procedure;

3> set *contentionDetected* to indicate whether contention resolution was not successful as specified in TS 36.321 [6] for at least one of the transmitted preambles for the failed random access procedure;

3> set *maxTxPowerReached* to indicate whether or not the maximum power level was used for the last transmitted preamble, see TS 36.321 [6];

2> if in RRC\_INACTIVE:

3> perform the actions upon leaving RRC\_INACTIVE as specified in 5.3.12, with release cause 'RRC Resume failure';

2> else inform upper layers about the failure to establish the RRC connection or failure to resume the RRC connection with suspend indication, upon which the procedure ends;

The UE may discard the connection establishment failure information, i.e. release the UE variable *VarConnEstFailReport,* 48 hours after the failure is detected, upon power off or upon detach.

#### 5.3.3.7 T302, T303, T305, T306, or T308 expiry or stop

If the UE is connected to EPC, the UE shall:

1> if timer T302 expires or is stopped:

2> inform upper layers about barring alleviation for mobile terminating access;

2> if timer T303 is not running:

3> inform upper layers about barring alleviation for mobile originating calls;

2> if timer T305 is not running:

3> inform upper layers about barring alleviation for mobile originating signalling;

2> if timer T306 is not running:

3> inform upper layers about barring alleviation for mobile originating CS fallback;

2> if timer T308 is not running:

3> inform upper layers about barring alleviation for ACDC;

1> if timer T303 expires or is stopped:

2> if timer T302 is not running:

3> inform upper layers about barring alleviation for mobile originating calls;

1> if timer T305 expires or is stopped:

2> if timer T302 is not running:

3> inform upper layers about barring alleviation for mobile originating signalling;

1> if timer T306 expires or is stopped:

2> if timer T302 is not running:

3> inform upper layers about barring alleviation for mobile originating CS fallback;

1> if timer T308 expires or is stopped:

2> if timer T302 is not running:

3> inform upper layers about barring alleviation for ACDC;

#### 5.3.3.8 Reception of the *RRCConnectionReject* by the UE

The UE shall:

1> stop timer T300;

1> stop timer T302, if running;

1> reset MAC;

1> except for NB-IoT, start timer T302, with the timer value set to the *waitTime*;

1> if the UE is a NB-IoT UE; or

1> if the *extendedWaitTime* is present and the UE supports delay tolerant access:

2> forward the *extendedWaitTime* to upper layers;

1> if *deprioritisationReq* is included and the UE supports RRC Connection Reject with deprioritisation:

2> start or restart timer T325 with the timer value set to the *deprioritisationTimer* signalled;

2> store the *deprioritisationReq* until T325 expiry;

NOTE: The UE stores the deprioritisation request irrespective of any cell reselection absolute priority assignments (by dedicated or common signalling) and regardless of RRC connections in E-UTRAN or other RATs unless specified otherwise.

1> if the *RRCConnectionReject* is received in response to an *RRCConnectionResumeRequest* sent to resume a suspended RRC connection:

2> ifthe *rrc-SuspendIndication* is not present:

3> release all radio resources, including release of the RLC entity, the MAC configuration and the associated PDCP entity for all established or suspended RBs;

3> discard the stored UE AS context and *resumeIdentity*;

3> inform upper layers about the failure to resume the RRC connection without suspend indication and that access barring for mobile originating calls, mobile originating signalling, mobile terminating access and except for NB-IoT for mobile originating CS fallback is applicable, upon which the procedure ends;

2> else:

3> if the *RRCConnectionReject* is received in response to an *RRCConnectionResumeRequest* sent after early security reactivation in accordance with conditions in 5.3.3.18:

4> perform the actions as specified in 5.3.3.9a;

3> else:

4> suspend SRB1;

3> inform upper layers about the failure to resume the RRC connection with suspend indication and that access barring for mobile originating calls, mobile originating signalling, mobile terminating access and except for NB-IoT for mobile originating CS fallback is applicable, upon which the procedure ends;

1> else if the *RRCConnectionReject* is received in response to an *RRCConnectionResumeRequest* sent while in RRC\_INACTIVE:

2> release the default MAC configuration;

2> if *RRCConnectionReject* is received in response to a request from upper layers:

3> inform the upper layer that access barring is applicable for all access categories except categories '0' and '2';

2> if *RRCConnectionReject* is received in response to an *RRCConnectionResumeRequest*:

3> if resume is triggered by upper layers:

4> inform upper layers about the failure to resume the RRC connection;

3> if resume istriggered due to an RNA update:

4> set the variable *pendingRnaUpdate* to 'TRUE';

3> discard the current KeNB, KRRCenc key, KRRCint, KUPint key and KUPenc key;

3> suspend SRB1, upon which the procedure ends;

2> The UE shall continue to monitor RAN and CN paging while the timer T302 is running.

1> else:

2> release the default MAC configuration;

2> inform upper layers about the failure to establish the RRC connection and that access barring for mobile originating calls, mobile originating signalling, mobile terminating access and except for NB-IoT, for mobile originating CS fallback is applicable, upon which the procedure ends;

#### 5.3.3.9 Abortion of RRC connection establishment

If upper layers abort the RRC connection establishment procedure while the UE has not yet entered RRC\_CONNECTED, the UE shall:

1> stop timer T300, if running;

1> reset MAC, release the MAC configuration and re-establish RLC for all RBs that are established;

#### 5.3.3.9a Abortion of early security reactivation

The UE shall:

1> delete the KeNB, KRRCint, KRRCenc and KUPenc keys derived in accordance with 5.3.3.3a;

1> re-establish RLC entities for all SRBs and DRBs;

1> suspend all SRB(s) and DRB(s) except SRB0;

1> configure lower layers to suspend integrity protection and ciphering.

#### 5.3.3.10 Handling of SSAC related parameters

Upon request from the upper layers, the UE shall:

1> if *SystemInformationBlockType2* includes *ac-BarringPerPLMN-List* and the *ac-BarringPerPLMN-List* contains an *AC-BarringPerPLMN* entry with the *plmn-IdentityIndex* corresponding to the PLMN selected by upper layers (see TS 23.122 [11], TS 24.301 [35]):

2> select the *AC-BarringPerPLMN* entry with the *plmn-IdentityIndex* corresponding to the PLMN selected by upper layers;

2> in the remainder of this procedure, use the selected *AC-BarringPerPLMN* entry (i.e. presence or absence of access barring parameters in this entry) irrespective of the common access barring parameters included in *SystemInformationBlockType2*;

1> else:

2> in the remainder of this procedure use the common access barring parameters (i.e. presence or absence of these parameters) included in *SystemInformationBlockType2*;

1> set the local variables *BarringFactorForMMTEL-Voice* and *BarringTimeForMMTEL-Voice* as follows:

2> if *ssac-BarringForMMTEL-Voice* is present:

3> if the UE has one or more Access Classes, as stored on the USIM, with a value in the range 11..15, which is valid for the UE to use according to TS 22.011 [10] and TS 23.122 [11], and

NOTE: ACs 12, 13, 14 are only valid for use in the home country and ACs 11, 15 are only valid for use in the HPLMN/ EHPLMN.

3> if, for at least one of these Access Classes, the corresponding bit in the *ac-BarringForSpecialAC* contained in *ssac-BarringForMMTEL-Voice* is set to zero:

4> set *BarringFactorForMMTEL-Voice* to one and *BarringTimeForMMTEL-Voice* to zero;

3> else:

4> set *BarringFactorForMMTEL-Voice* and *BarringTimeForMMTEL-Voice* to the value of *ac-BarringFactor* and *ac-BarringTime* included in *ssac-BarringForMMTEL-Voice*, respectively;

2> else set *BarringFactorForMMTEL-Voice* to one and *BarringTimeForMMTEL-Voice* to zero;

1> set the local variables *BarringFactorForMMTEL-Video* and *BarringTimeForMMTEL-Video* as follows:

2> if *ssac-BarringForMMTEL-Video* is present:

3> if the UE has one or more Access Classes, as stored on the USIM, with a value in the range 11..15, which is valid for the UE to use according to TS 22.011 [10] and TS 23.122 [11], and

3> if, for at least one of these Access Classes, the corresponding bit in the *ac-BarringForSpecialAC* contained in *ssac-BarringForMMTEL-Video* is set to zero:

4> set *BarringFactorForMMTEL-Video* to one and *BarringTimeForMMTEL-Video* to zero;

3> else:

4> set *BarringFactorForMMTEL-Video* and *BarringTimeForMMTEL-Video* to the value of *ac-BarringFactor* and *ac-BarringTime* included in *ssac-BarringForMMTEL-Video*, respectively;

2> else set *BarringFactorForMMTEL-Video* to one and *BarringTimeForMMTEL-Video* to zero;

1> forward the variables *BarringFactorForMMTEL-Voice*, *BarringTimeForMMTEL-Voice*, *BarringFactorForMMTEL-Video* and *BarringTimeForMMTEL-Video* to the upper layers;

#### 5.3.3.11 Access barring check

1> if timer T302 or "Tbarring" is running:

2> consider access to the cell as barred;

1> else if *SystemInformationBlockType2* includes "AC barring parameter":

2> if the UE has one or more Access Classes, as stored on the USIM, with a value in the range 11..15, which is valid for the UE to use according to TS 22.011 [10] and TS 23.122 [11], and

NOTE: ACs 12, 13, 14 are only valid for use in the home country and ACs 11, 15 are only valid for use in the HPLMN/ EHPLMN.

2> for at least one of these valid Access Classes the corresponding bit in the *ac-BarringForSpecialAC* contained in "AC barring parameter" is set to *zero*:

3> consider access to the cell as not barred;

2> else if the establishment of the RRC connection is the result of release with redirect with *mpsPriorityIndication* (either in NR or E-UTRAN); and

2> if the corresponding bit for any of the Access Classes 12, 13 or 14 in the *ac-BarringForSpecialAC* contained in "AC barring parameter" is set to *zero*:

3> consider access to the cell as not barred;

2> else:

3> draw a random number '*rand*' uniformly distributed in the range: 0 ≤ *rand* < 1;

3> if '*rand*' is lower than the value indicated by *ac-BarringFactor* included in "AC barring parameter":

4> consider access to the cell as not barred;

3> else:

4> consider access to the cell as barred;

1> else:

2> consider access to the cell as not barred;

1> if access to the cell is barred and both timers T302 and "Tbarring" are not running:

2> draw a random number '*rand*' that is uniformly distributed in the range 0 ≤ *rand* < 1;

2> start timer "Tbarring" with the timer value calculated as follows, using the *ac-BarringTime* included in"AC barring parameter":

"Tbarring" = (0.7+ 0.6 \* *rand*) \* *ac-BarringTime*;

#### 5.3.3.12 EAB check

The UE shall:

1> if *SystemInformationBlockType14* is present:

2> if *eab-PerRSRP* is included:

3> if the *establishmentCause* received from higher layers is set to a value other than *emergency*; and

3> if the UE has no Access Class, as stored on the USIM, with a value in the range 11..15, which is valid for the UE to use according to TS 22.011 [10] and TS 23.122 [11] :

4> if *eab-PerRSRP* is set to *thresh0*:

5> consider access to the cell as barred when in enhanced coverage as specified in TS 36.304 [4];

4> else if *eab-PerRSRP* is set to *thresh1*:

5> if the measured RSRP is less than the first entry in *rsrp-ThresholdsPrachInfoList*:

6> consider access to the cell as barred;

5> else:

6> consider that only the resources indicated for the first CE level are configured;

4> else if *eab-PerRSRP* is set to *thresh2*:

5> if the measured RSRP is less than the second entry in *rsrp-ThresholdsPrachInfoList*:

6> consider access to the cell as barred;

5> else:

6> consider that only the resources indicated for the first and second CE levels are configured;

4> else if *eab-PerRSRP* is set to *thresh3*:

5> if the measured RSRP is less than the third entry in *rsrp-ThresholdsPrachInfoList*:

6> consider access to the cell as barred;

5> else:

6> consider that only the resources indicated for the first, second, and third CE levels are configured;

2> if access to the cell is not barred due to *eab-PerRSRP* and *eab-Param* is included:

3> if the *eab-Common* is included in the *eab-Param*:

4> if the UE belongs to the category of UEs as indicated in the *eab-Category* contained in *eab-Common*; and

4> if for the Access Class of the UE, as stored on the USIM and with a value in the range 0..9, the corresponding bit in the *eab-BarringBitmap* contained in *eab-Common* is set to *one*:

5> consider access to the cell as barred;

4> else:

5> consider access to the cell as not barred due to EAB;

3> else (the *eab-PerPLMN-List* is included in the *eab-Param*):

4> select the entry in the *eab-PerPLMN-List* corresponding to the PLMN selected by upper layers (see TS 23.122 [11], TS 24.301 [35]);

4> if the *eab-Config* for that PLMN is included:

5> if the UE belongs to the category of UEs as indicated in the *eab-Category* contained in *eab-Config*; and

5> if for the Access Class of the UE, as stored on the USIM and with a value in the range 0..9, the corresponding bit in the *eab-BarringBitmap* contained in *eab-Config* is set to *one*:

6> consider access to the cell as barred;

5> else:

6> consider access to the cell as not barred due to EAB;

4> else:

5> consider access to the cell as not barred due to EAB;

1> else:

2> consider access to the cell as not barred due to EAB;

#### 5.3.3.13 Access barring check for ACDC

The UE shall:

1> if timer T302 is running:

2> consider access to the cell as barred;

1> else if *SystemInformationBlockType2* includes "ACDC barring parameter":

2> draw a random number '*rand*' uniformly distributed in the range: 0 ≤ *rand* < 1;

2> if '*rand*' is lower than the value indicated by *ac-BarringFactor* included in "ACDC barring parameter":

3> consider access to the cell as not barred;

2> else:

3> consider access to the cell as barred;

1> else:

2> consider access to the cell as not barred;

1> if access to the cell is barred and timer T302 is not running:

2> draw a random number '*rand*' that is uniformly distributed in the range 0 ≤ *rand* < 1;

2> start timer "Tbarring" with the timer value calculated as follows, using the *ac-BarringTime* included in"ACDC barring parameter":

"Tbarring" = (0.7+ 0.6 \* *rand*) \* *ac-BarringTime*.

#### 5.3.3.14 Access Barring check for NB-IoT

The UE shall:

1> if the UE is connected to 5GC, *ab-Enabled-5GC* included in *MasterInformationBlock-NB* */ MasterInformationBlock-TDD-NB* is set to *TRUE* and *SystemInformationBlockType14-NB* is broadcast, or

1> if the UE is connected to EPC, *ab-Enabled* included in *MasterInformationBlock-NB* */ MasterInformationBlock-TDD-NB* is set to *TRUE* and *SystemInformationBlockType14-NB* is broadcast:

2> if *ab-PerNRSRP* is included:

3> if the *establishmentCause* received from higher layers is set to a value other than *mo-ExceptionData*; and

3> if the UE has no Access Class, as stored on the USIM, with a value in the range 11..15, which is valid for the UE to use according to TS 22.011 [10] and TS 23.122 [11]:

4> if *ab-PerNRSRP* is set to *thresh1*:

5> if the measured RSRP is less than the first entry in *rsrp-ThresholdsPrachInfoList*;

6> consider access to the cell as barred;

5> else:

6> consider that only the resources indicated for the first NPRACH repetition level are configured;

4> if *ab-PerNRSRP* is set to *thresh2*:

5> if the measured RSRP is less than the second entry in *rsrp-ThresholdsPrachInfoList*;

6> consider access to the cell as barred;

5> else:

6> consider that only the resources indicated for the first and second NPRACH repetition levels are configured;

1> if the UE is connected to EPC, *ab-Enabled* included in *MasterInformationBlock-NB* */ MasterInformationBlock-TDD-NB* is set to *TRUE* and *SystemInformationBlockType14-NB* is broadcast:

2> if access to the cell is not barred due to *ab-PerNRSRP* and *ab-Param* is included:

3> if the *ab-Common* is included in *ab-Param:*

4> if the UE belongs to the category of UEs as indicated in the *ab-Category* contained in *ab-Common*; and

4> if for the Access Class of the UE, as stored on the USIM and with a value in the range 0..9, the corresponding bit in the *ab-BarringBitmap* contained in *ab-Common* is set to *one*:

5> if the *establishmentCause* received from higher layers is set to *mo-ExceptionData* and *ab-BarringForExceptionData* is set to *FALSE* in the *ab-Common*:

6> consider access to the cell as not barred;

5> else:

6> if the UE has one or more Access Classes, as stored on the USIM, with a value in the range 11..15, which is valid for the UE to use according to TS 22.011 [10] and TS 23.122 [11] and for at least one of these valid Access Classes for the UE, the corresponding bit in the *ab-BarringForSpecialAC* contained in *ab-Common* is set to *zero*:

NOTE 1: ACs 12, 13, 14 are only valid for use in the home country and ACs 11, 15 are only valid for use in the HPLMN/ EHPLMN.

7> consider access to the cell as not barred;

6> else:

7> consider access to the cell as barred;

4> else:

5> consider access to the cell as not barred;

3> else (the *ab-PerPLMN-List* is included in the *ab-Param*):

4> select the *ab-PerPLMN* entry in *ab-PerPLMN-List* corresponding to the PLMN selected by upper layers (see TS 23.122 [11], TS 24.301 [35]);

4> if the *ab-Config* for that PLMN is included:

5> if the UE belongs to the category of UEs as indicated in the *ab-Category* contained in *ab-Config*; and

5> if for the Access Class of the UE, as stored on the USIM and with a value in the range 0..9, the corresponding bit in the *ab-BarringBitmap* contained in *ab-Config* is set to *one*:

6> if the *establishmentCause* received from higher layers is set to *mo-ExceptionData* and *ab-BarringForExceptionData* is set to *FALSE* in the *ab-Config*:

7> consider access to the cell as not barred;

6> else:

7> if the UE has one or more Access Classes, as stored on the USIM, with a value in the range 11..15, which is valid for the UE to use according to TS 22.011 [10] and TS 23.122 [11] and for at least one of these valid Access Classes for the UE, the corresponding bit in the *ab-BarringForSpecialAC* contained in *ab-Config* is set to *zero*:

NOTE 2: ACs 12, 13, 14 are only valid for use in the home country and ACs 11, 15 are only valid for use in the HPLMN/ EHPLMN.

8> consider access to the cell as not barred;

7> else:

8> consider access to the cell as barred;

5> else:

6> consider access to the cell as not barred;

4> else:

5> consider access to the cell as not barred;

1> else:

2> consider access to the cell as not barred;

#### 5.3.3.15 Failure to deliver NAS information in RRCConnectionSetupComplete message

The UE shall:

1> if the UE is a NB-IoT UE and radio link failure occurs before the successful delivery of *RRCConnectionSetupComplete* message has been confirmed by lower layers:

2> inform upper layers about the possible failure to deliver the NAS information contained in the *RRCConnectionSetupComplete* message;

#### 5.3.3.16 Integrity check failure from lower layers while T300 is running

The UE shall:

1> upon receiving integrity check failure indication from lower layers concerning SRB1 or SRB2 while T300 is running and if the UE is resuming the RRC connection after early security reactivation in accordance with conditions in 5.3.3.18:

2> discard the stored UE AS context and *resumeIdentity*;

2> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'other';

1> upon receiving integrity check failure indication from lower layers while T300 is running and if the UE is resuming the RRC connection from RRC\_INACTIVE:

2> perform the actions upon leaving RRC\_INACTIVE as specified in 5.3.12, with release cause 'RRC Resume failure';

#### 5.3.3.17 Inability to comply with *RRCConnectionResume*

The UE shall:

1> if the UE is unable to comply with (part of) the configuration included in the *RRCConnectionResume* message;

2> perform the actions upon leaving RRC\_INACTIVE as specified in 5.3.12 with release cause 'RRC Resume failure'.

NOTE 1: The UE may apply above failure handling also in case the *RRCConnectionResume* message causes a protocol error for which the generic error handling as defined in 5.7 specifies that the UE shall ignore the message.

NOTE 2: If the UE is unable to comply with part of the configuration, it does not apply any part of the configuration, i.e. there is no partial success/failure.

#### 5.3.3.18 Early security reactivation

The UE shall use early security reactivation when resuming a suspended RRC connection and at least one of the following conditions is met:

- the UE is initiating UP-EDT in accordance with conditions in 5.3.3.1b;

- the UE is initiating UP transmission using PUR in accordance with conditions in 5.3.3.1c;

- the UE is resuming a suspended RRC connection in 5GC;

- the UE supports early security reactivation*, SystemInformationBlockType2 (SystemInformationBlockType2-NB* in NB-IoT) includes *earlySecurityReactivation*, and the UE has a stored value of the *nextHopChainingCount* provided in the *RRCConnectionRelease* message with suspend indication during the preceding suspend procedure;

#### 5.3.3.19 Timing alignment validation for transmission using PUR

The UE shall consider the timing alignment value for transmission using PUR to be valid when the following conditions are fulfilled:

1> either *pur-TimeAlignmentTimer* is not configured or *pur-TimeAlignmentTimer* is running as confirmed by lower layers; and

1> either *pur-RSRP-ChangeThreshold* (*pur-NRSRP-ChangeThreshold* in NB-IoT) is not configured or the following conditions are fulfilled:

2> compared to the stored serving cell reference (N)RSRP value, the serving cell (N)RSRP has not increased by more than *increaseThresh*; and

2> compared to the stored serving cell reference (N)RSRP value, the serving cell (N)RSRP has not decreased by more than *decreaseThresh*;

#### 5.3.3.20 Maintenance of PUR occasions

The UE configured with *pur-Config* shall:

1> consider that the first PUR occasion occurs at the H-SFN/SFN/subframe given by:

- H-SFN = (H-SFNRef + offset) mod 1024 occuring after FLOOR (offset/1024) H-SFN cycles;

- SFN and subframe indicated by *startSFN* and *startSubframe*;

where:

- offset is given by *periodicityAndOffset*;

- H-SFNRef corresponds to the last subframe of the first transmission of *RRCConnectionRelease* message containing *pur-Config*, taking into account *hsfn-LSB-Info*;

- H-SFN cycle corresponds to the duration of 1024 H-SFNs;

1> if the *pur-NumOccasions* is set to *one*, for the first PUR occasion:

2> if transmission using PUR in accordance with conditions in 5.3.3.1c is not initiated; or

2> if transmission using PUR in accordance with conditions in 5.3.3.1c has been initiated, after the completion of the transmission using PUR:

3> if *pur-TimeAlignmentTimer* is configured, indicate to lower layers that *pur-TimeAlignmentTimer* is released;

3> release *pur-Config*;

3> discard previously stored *pur-Config*;

1> else:

2> consider that the subsequent PUR occasions occur periodically after the occurence of the first PUR occasion at the SFN/subframe indicated by *startSubframe* and *startSFN* and periodicity given by *periodicityAndOffset*;

2> if the *pur-ImplicitReleaseAfter* is configured, for each PUR occasion occurring while the UE is in RRC\_IDLE:

3> if transmission using PUR in accordance with conditions in 5.3.3.1c is not initiated; or

3> if PUR failure indication is received from lower layers:

4> consider the PUR occasion as skipped;

4> if *pur-ImplicitReleaseAfter* number of consecutive PUR occasions have been skipped:

5> if *pur-TimeAlignmentTimer* is configured, indicate to lower layers that *pur-TimeAlignmentTimer* is released;

5> release *pur-Config*;

5> discard previously stored *pur-Config*.

#### 5.3.3.21 UE actions upon indication of out-of-date GNSS position

Upon indication that the GNSS position has become out-of-date while in RRC\_CONNECTED, the UE considers GNSS validity duration expiry, and the UE shall:

1> if the UE does not support performing GNSS position fix in RRC\_CONNECTED and *ul-TransmissionExtensionEnabled* is not configured:

2> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'other';

1> else if *ul-TransmissionExtensionEnabled* is configured:

2> if *timeAlignmentTimer* is configured to be *infinity*:

3> start timer T390 with the timer value set to *ul-TransmissionExtensionValue*;

2> else:

3> start timer T390 with the timer value set to the remaining time of *timeAlignmentTimer*;

1> else if *ul-TransmissionExtensionEnabled* is not configured and no indication of network triggered GNSS measurement is received from lower layers:

2> if *gnss-AutonomousEnabled* is configured:

3> perform GNSS measurement using autonomous gaps as specified in clause 5.5.9;

2> else:

3> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'other'.

#### 5.3.3.22 Void

#### 5.3.3.23 UE actions upon detecting discontinuous coverage

In discontinuous coverage scenario, upon expiry of *t-Service* or being out of the current serving cell coverage, the UE shall:

1> if timer T310 is running:

2> stop timer T310, and perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'other'.

#### 5.3.3.24 T390 expiry

The UE shall:

1> if timer T390 expires and no indication of network triggered GNSS measurement has been received from lower layers:

2> if *gnss-AutonomousEnabled* is configured:

3> perform GNSS measurement using autonomous gaps as specified in clause 5.5.9;

2> else:

3> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'other'.

#### 5.3.3.25 UE actions upon receiving UL transmission extension indication

Upon indication from lower layers to extend the UL transmission, the UE shall:

1> if *ul-TransmissionExtensionEnabled* is configured:

2> if *timeAlignmentTimer* is configured to be *infinity:*

3> restart timer T390 with the timer value set to *ul-TransmissionExtensionValue*, if running*;*

2> else:

3> restart timer T390 with the timer value set to the configured value of *timeAlignmentTimer*, if running.

### 5.3.4 Initial security activation

#### 5.3.4.1 General



Figure 5.3.4.1-1: Security mode command, successful



Figure 5.3.4.1-2: Security mode command, failure

The purpose of this procedure is to activate AS security upon RRC connection establishment.

#### 5.3.4.2 Initiation

E-UTRAN initiates the security mode command procedure to a UE in RRC\_CONNECTED. Moreover, E-UTRAN applies the procedure as follows:

- when only SRB1, or for NB-IoT SRB1 and SRB1bis, is established, i.e. prior to establishment of SRB2 and/ or DRBs.

#### 5.3.4.3 Reception of the *SecurityModeCommand* by the UE

The UE shall:

1> derive the KeNB key, as specified in TS 33.401 [32] for E-UTRA/EPC, and TS 33.501 [86] for E-UTRA/5GC;

1> derive the KRRCint key associated with the *integrityProtAlgorithm* indicated in the *SecurityModeCommand* message, as specified in TS 33.401 [32];

1> request lower layers to verify the integrity protection of the *SecurityModeCommand* message, using the algorithm indicated by the *integrityProtAlgorithm* as included in the *SecurityModeCommand* message and the KRRCint key;

1> if the *SecurityModeCommand* message passes the integrity protection check:

2> derive the KRRCenc key and the KUPenc key associated with the *cipheringAlgorithm* indicated in the *SecurityModeCommand* message, as specified in TS 33.401 [32];

2> if connected as an RN; or

2> if capable of user plane integrity protection:

3> derive the KUPint key associated with the *integrityProtAlgorithm* indicated in the *SecurityModeCommand* message, as specified in TS 33.401 [32];

2> configure lower layers to apply integrity protection using the indicated algorithm and the KRRCint key immediately, i.e. integrity protection shall be applied to all subsequent messages received and sent by the UE, including the *SecurityModeComplete* message;

2> configure lower layers to apply ciphering using the indicated algorithm, the KRRCenc key and the KUPenc key after completing the procedure, i.e. ciphering shall be applied to all subsequent messages received and sent by the UE, except for the *SecurityModeComplete* message which is sent unciphered;

2> if connected as an RN:

3> configure lower layers to apply integrity protection using the indicated algorithm and the KUPint key, for DRBs that are subsequently configured to apply integrity protection, if any;

2> consider AS security to be activated;

2> upon RRC connection establishment, if UE does not need UL gaps during continuous uplink transmission:

3> configure lower layers to stop using UL gaps during continuous uplink transmission in FDD for *SecurityModeComplete* message and subsequent uplink transmission in RRC\_CONNECTED except for UL transmissions as specified in TS 36.211 [21];

2> submit the *SecurityModeComplete* message to lower layers for transmission, upon which the procedure ends;

1> else:

2> continue using the configuration used prior to the reception of the *SecurityModeCommand* message, i.e. neither apply integrity protection nor ciphering.

2> submit the *SecurityModeFailure* message to lower layers for transmission, upon which the procedure ends;

### 5.3.5 RRC connection reconfiguration

#### 5.3.5.1 General



Figure 5.3.5.1-1: RRC connection reconfiguration, successful



Figure 5.3.5.1-2: RRC connection reconfiguration, failure

The purpose of this procedure is to modify an RRC connection, e.g. to establish/ modify/ release RBs, to perform handover, to setup/ modify/ release measurements, to add/ modify/ release SCells, to add/modify/release conditional reconfigurations. As part of the procedure, NAS dedicated information may be transferred from E-UTRAN to the UE.

#### 5.3.5.2 Initiation

E-UTRAN may initiate the RRC connection reconfiguration procedure to a UE in RRC\_CONNECTED. E-UTRAN applies the procedure as follows:

- the *mobilityControlInfo* is included only when AS-security has been activated, and SRB2 with at least one DRB are setup and not suspended;

- the establishment of RBs (other than SRB1, that is established during RRC connection establishment) is included only when AS security has been activated;

- the addition of SCells is performed only when AS security has been activated;

- the addition, release or modification of conditional reconfigurations is performed only when AS security has been activated, and SRB2 with at least one DRB are setup and not suspended;

The UE initiates the RRC connection reconfiguration procedure while in RRC\_CONNECTED when a conditional reconfiguration (e.g. CHO, CPA, or inter-SN CPC) is executed i.e. upon the fulfilment of an execution condition, an associated *RRCConnectionReconfiguration* that is stored is applied.

NOTE: Embedding in an NR Reconfiguration is used for the transfer of IRAT DL DCCH information as used for V2X sidelink communication related information specified by NR RRC e.g. to configure dedicated pool related information, CBR measurements, provision of grant assistance.

#### 5.3.5.3 Reception of an *RRCConnectionReconfiguration* not including the *mobilityControlInfo* by the UE

If the *RRCConnectionReconfiguration* message does not include the *mobilityControlInfo* and theUE is able to comply with the configuration included in this message, the UE shall:

1> if the UE is in (NG)EN-DC and;

1> if the *RRCConnectionReconfiguration* does not include the *nr-SecondaryCellGroupConfig*:

2> if the *RRCConnectionReconfiguration* includes the *scg-State*:

3> perform SCG deactivation as specified in TS 38.331 [82], clause 5.3.5.13b;

2> else:

3> perform SCG activation without SN message as specified in TS 38.331 [82], clause 5.3.5.13b1;

1> if the received *RRCConnectionReconfiguration* includes the *daps-SourceRelease*:

2> reset source MCG MAC and release the source MCG MAC configuration;

2> for each DAPS bearer:

3> re-establish the RLC entity or entities for the source PCell;

3> release the RLC entity or entities and the associated DTCH logical channel for the source PCell;

3> reconfigure the PDCP entity to release DAPS, as specified in TS 36.323 [8];

2> for each SRB:

3> release the PDCP entity for the source PCell;

3> release the RLC entity and the associated DCCH logical channel for the source PCell;

2> release the physical channel configuration for the source PCell;

1> if this is the first *RRCConnectionReconfiguration* message after successful completion of the RRC connection re-establishment procedure:

2> re-establish PDCP for SRB2 configured with E-UTRA PDCP entity and for all DRBs that are established and configured with E-UTRA PDCP, if any;

2> re-establish RLC for SRB2 and for all DRBs that are established and configured with E-UTRA RLC, if any;

2> if the *RRCConnectionReconfiguration* message includes the *fullConfig*:

3> perform the radio configuration procedure as specified in 5.3.5.8;

2> if the *RRCConnectionReconfiguration* message includes the *radioResourceConfigDedicated*:

3> perform the radio resource configuration procedure as specified in 5.3.10.0;

NOTE 1: Void

NOTE 2: Void

1> else:

2> if the *RRCConnectionReconfiguration* message includes the *radioResourceConfigDedicated*:

3> perform the radio resource configuration procedure as specified in 5.3.10.0;

NOTE 3: If the *RRCConnectionReconfiguration* message includes the establishment of radio bearers other than SRB1, the UE may start using these radio bearers immediately, i.e. there is no need to wait for an outstanding acknowledgment of the *SecurityModeComplete* message.

1> if the received *RRCConnectionReconfiguration* includes the *sCellToReleaseList*:

2> perform SCell release as specified in 5.3.10.3a;

1> if the received *RRCConnectionReconfiguration* includes the *sCellToAddModList*:

2> perform SCell addition or modification as specified in 5.3.10.3b;

1> if the received *RRCConnectionReconfiguration* includes the *sCellGroupToReleaseList*:

2> perform SCell group release as specified in 5.3.10.3d;

1> if the received *RRCConnectionReconfiguration* includes the *sCellGroupToAddModList*:

2> perform SCell group addition or modification as specified in 5.3.10.3e;

1> if the received *RRCConnectionReconfiguration* includes the *scg-Configuration*; or

1> if the current UE configuration includes one or more split DRBs configured with *pdcp-Config* and the received *RRCConnectionReconfiguration* includes *radioResourceConfigDedicated* including *drb-ToAddModList*:

2> perform SCG reconfiguration as specified in 5.3.10.10;

1> if the received *RRCConnectionReconfiguration* includes the *nr-Config* and it is set to *release*: or

1> if the received *RRCConnectionReconfiguration* includes *endc-ReleaseAndAdd* and it is set to *TRUE*:

2> perform MR-DC release as specified in TS 38.331 [82], clause 5.3.5.10;

1> if the received *RRCConnectionReconfiguration* includes the *sk-Counter*:

2> perform key update procedure as specified in TS 38.331 [82], clause 5.3.5.7;

1> if the received *RRCConnectionReconfiguration* includes the *nr-SecondaryCellGroupConfig*:

2> perform NR RRC Reconfiguration as specified in TS 38.331 [82], clause 5.3.5.3;

1> if the received *RRCConnectionReconfiguration* includes the *nr-RadioBearerConfig1*:

2> perform radio bearer configuration as specified in TS 38.331 [82], clause 5.3.5.6;

1> if the received *RRCConnectionReconfiguration* includes the *nr-RadioBearerConfig2*:

2> perform radio bearer configuration as specified in TS 38.331 [82], clause 5.3.5.6;

1> if this is the first *RRCConnectionReconfiguration* message after successful completion of the RRC connection re-establishment procedure:

2> resume SRB2 and all DRBs that are suspended, if any, including RBs configured with NR PDCP;

NOTE 4: The handling of the radio bearers after the successful completion of the PDCP re-establishment, e.g. the re-transmission of unacknowledged PDCP SDUs (as well as the associated status reporting), the handling of the SN and the HFN, is specified in TS 36.323 [8].

NOTE 5: The UE may discard SRB2 messages and data that it receives prior to completing the reconfiguration used to resume these bearers.

1> if the received *RRCConnectionReconfiguration* includes the *systemInformationBlockType1Dedicated*:

2> perfom the actions upon reception of the *SystemInformationBlockType1* message as specified in 5.2.2.7*;*

1> if the received *RRCConnectionReconfiguration* includes the *systemInformationBlockType2Dedicated*:

2> perfom the actions upon reception of the *SystemInformationBlockType2* message as specified in 5.2.2.9;

1> if the received *RRCConnectionReconfiguration* includes the *systemInformationBlockType31Dedicated*:

2> perfom the actions upon reception of the *SystemInformationBlockType31* message as specified in 5.2.2.39;

1> if the *RRCConnectionReconfiguration* message includes the *dedicatedInfoNASList*:

2> forward each element of the *dedicatedInfoNASList* to upper layers in the same order as listed;

1> if the *RRCConnectionReconfiguration* message includes the *measConfig*:

2> perform the measurement configuration procedure as specified in 5.5.2;

1> perform the measurement identity autonomous removal as specified in 5.5.2.2a;

1> if the *RRCConnectionReconfiguration* message includes the *otherConfig*:

2> perform the other configuration procedure as specified in 5.3.10.9;

1> if the received *RRCConnectionReconfiguration* message includes the *obtainLocationNB*:

2> attempt to have detailed location information available for any RLF report;

NOTE 5a1: The UE is requested to attempt to have valid detailed location information available at the time of RLF. The UE may not succeed e.g. because the user manually disabled the GPS hardware, due to no/poor satellite coverage. Further details, e.g. regarding when to activate GNSS, are up to UE implementation.

1> if the *RRCConnectionReconfiguration* message includes the *sl-DiscConfig* or *sl-CommConfig*:

2> perform the sidelink dedicated configuration procedure as specified in 5.3.10.15;

1> if the *RRCConnectionReconfiguration* message includes the *sl-V2X-ConfigDedicated*:

2> perform the V2X sidelink communication dedicated configuration procedure as specified in 5.3.10.15a;

NOTE 5a: If the *sl-V2X-ConfigDedicated* was received embedded within an NR *RRCReconfiguration* message, the UE does not build an E-UTRA *RRCConnectionReconfigurationComplete* message for the received *sl-V2X-ConfigDedicated*.

1> if the *RRCConnectionReconfiguration* message includes the *sl-ConfigDedicatedForNR*:

2> perform the related procedures for NR sidelink communication in accordance with TS 38.331 [82], clause 5.3.5.14 and clause 5.5.2;

1> if the *RRCConnectionReconfiguration* message includes *wlan-OffloadInfo*:

2> perform the dedicated WLAN offload configuration procedure as specified in 5.6.12.2;

1> if the *RRCConnectionReconfiguration* message includes *rclwi-Configuration*:

2> perform the WLAN traffic steering command procedure as specified in 5.6.16.2;

1> if the *RRCConnectionReconfiguration* message includes *lwa-Configuration*:

2> perform the LWA configuration procedure as specified in 5.6.14.2;

1> if the *RRCConnectionReconfiguration* message includes *lwip-Configuration*:

2> perform the LWIP reconfiguration procedure as specified in 5.6.17.2;

1> upon RRC connection establishment, if UE does not need UL gaps during continuous uplink transmission:

2> configure lower layers to stop using UL gaps during continuous uplink transmission in FDD for *RRCConnectionReconfigurationComplete* message and subsequent uplink transmission in RRC\_CONNECTED except for UL transmissions as specified in TS36.211 [21];

1> if the *RRCConnectionReconfiguration* message includes the *conditionalReconfiguration*:

2> perform conditional reconfiguration as specified in 5.3.5.9;

NOTE 6: In case of conditional reconfiguration the text "if the received *RRCConnectionReconfiguration. . .*" corresponds to applying the stored *RRCConnectionReconfiguration* message (according to 5.3.5.9.5).

1> set the content of *RRCConnectionReconfigurationComplete* message as follows:

2> if the *RRCConnectionReconfiguration* message includes *perCC-GapIndicationRequest*:

3> include *perCC-GapIndicationList* and *numFreqEffective*;

2> if the frequencies are configured for reduced measurement performance:

3> include *numFreqEffectiveReduced*;

2> if the received *RRCConnectionReconfiguration* message included *nr-SecondaryCellGroupConfig*:

3> include *scg-ConfigResponseNR* in accordance with TS 38.331 [82], clause 5.3.5.3;

3> if the *RRCConnectionReconfiguration* message is applied due to a conditional reconfiguration execution and the *RRCConnectionReconfiguration* message does not include the *mobilityControlInfo*:

4> include in *selectedCondReconfigurationToApply* the *condReconfigurationId* of the conditional reconfiguration which has been executed;

1> if the UE is configured to operate in EN-DC as result of this procedure, forward *upperLayerIndication*, as if the UE receives this field from SIB2, to upper layers, otherwise indicate upper layers absence of this field;

1> if the UE is configured with NE-DC:

2> if the received *RRCConnectionReconfiguration* message was included in an NR *RRCResume* message:

3> transfer the *RRCConnectionReconfigurationComplete* message via SRB1 embedded in NR RRC message *RRCResumeComplete* as specified in TS 38.331 [82], clause 5.3.13.4;

2> else:

3> transfer the *RRCConnectionReconfigurationComplete* message via SRB1 embedded in NR RRC message *RRCReconfigurationComplete* as specified in TS 38.331 [82], clause 5.3.5.3;

1> else:

2> submit the *RRCConnectionReconfigurationComplete* message to lower layers for transmission using the new configuration, upon which the procedure ends;

#### 5.3.5.4 Reception of an *RRCConnectionReconfiguration* including the *mobilityControlInfo* by the UE (handover)

If the *RRCConnectionReconfiguration* message includes the *mobilityControlInfo* and theUE is able to comply with the configuration included in this message, the UE shall:

1> if the *RRCConnectionReconfiguration* is applied due to a conditional reconfiguration execution upon cell selection performed while timer T311 was running, as defined in 5.3.7.3:

2> remove all the entries within *VarConditionalReconfiguration*, if any;

1> if *daps-HO* is not configured for any DRB:

2> stop timer T310, if running;

2> if timer T316 is running:

3> stop timer T316;

3> clear the information included in *VarRLF-Report*, if any;

2> resume MCG transmission, if suspended;

1> stop timer T312, if running;

1> stop timer T317, if running;

1> start timer T304 with the timer value set to *t304,* as included in the *mobilityControlInfo*;

1> stop timer T370, if running;

1> if the *carrierFreq* is included:

2> consider the target PCell to be one on the frequency indicated by the *carrierFreq* with a physical cell identity indicated by the *targetPhysCellId*;

1> else:

2> consider the target PCell to be one on the frequency of the source PCell with a physical cell identity indicated by the *targetPhysCellId*;

1> if T309 is running:

2> stop timer T309 for all access categories;

2> perform the actions as specified in 5.3.16.4.

1> start synchronising to the DL of the target PCell;

NOTE 1: The UE should perform the handover as soon as possible following the reception of the RRC message triggering the handover, which could be before confirming successful reception (HARQ and ARQ) of this message.

1> if BL UE or UE in CE:

2> if *sameSFN-Indication* is not present in *mobilityControlInfo*:

3> acquire the *MasterInformationBlock* in the target PCell;

1> if *makeBeforeBreak* is configured:

2> perform the remainder of this procedure including and following resetting MAC after the UE has stopped the uplink transmission/downlink reception with the source PCell;

NOTE 1a: It is up to UE implementation when to stop the uplink transmission/ downlink reception with the source PCell to initiate re-tuning for connection to the target cell, as specified in TS 36.133 [16], if *makeBeforeBreak* is configured.

NOTE 1b: It is up to UE implementation when to stop the uplink transmission/ downlink reception with the source SCell(s) after receiving *RRCConnectionReconfiguration* message.

1> if *daps-HO* is configured for any DRB:

2> establish a MAC entity for the target PCell, with the same configuration as the MAC entity for the source PCell;

2> for each DRB configured with *daps-HO*:

3> establish the RLC entity or entities and the associated DTCH logical channel for the target PCell, with the same configurations as for the source PCell;

3> reconfigure the PDCP entity to configure DAPS as specified in TS36.323 [8].

2> for each DRB not configured with *daps-HO*:

3> re-establish PDCP;

3> re-establish the RLC entity and associate it, and the associated DTCH logical channel, to the target PCell;

2> for each SRB:

3> establish a PDCP entity for the target PCell, with the same configuration as the PDCP entity for the source PCell;

3> establish an RLC entity and an associated DCCH logical channel for the target PCell, with the same configuration as for the source PCell;

2> suspend the SRBs for the source PCell;

NOTE 1c: In order to understand if a *daps-HO* is configured, the UE needs to check the presence of the field *daps-HO* within the received *RadioResourceConfigDedicated* IE.

NOTE 1d: In DAPS handover, the UE may re-establish PDCP and RLC entity for a DRB not configured with *daps-HO* when MAC successfully completes the random access procedure. In this case, the UE suspends data transmission and reception for all DRBs not configured with *daps-HO* in the source PCell for the duration of the DAPS handover.

1> else (if *daps-HO* is not configured):

2> reset MCG MAC and SCG MAC, if configured;

2> release *uplinkDataCompression*, if configured;

2> re-establish PDCP for all RBs configured with *pdcp-config* that are established;

NOTE 2: The handling of the radio bearers after the successful completion of the PDCP re-establishment, e.g. the re-transmission of unacknowledged PDCP SDUs (as well as the associated status reporting), the handling of the SN and the HFN, is specified in TS 36.323 [8].

NOTE 2a: At handover the *reestablishPDCP* flag will be set for all RBs configured with NR PDCP in *nr-RadioBearerConfig1* or *nr-RadioBearerConfig2* TS 38.331 [82] which will cause the PDCP entity to be re-established also for these RBs.

2> re-establish MCG RLC and SCG RLC, if configured, for all RBs that are established;

1> for each SCell configured for the UE other than the PSCell:

2> if the received *RRCConnectionReconfiguration* message includes *sCellState* for the SCell and indicates *activated*:

3> configure lower layers to consider the SCell to be in activated state;

2> else if the received *RRCConnectionReconfiguration* message includes *sCellState* for the SCell and indicates *dormant*:

3> configure lower layers to consider the SCell to be in dormant state;

2> else:

3> configure lower layers to consider the SCell to be in deactivated state;

1> apply the value of the *newUE-Identity* as the C-RNTI in the target MCG;

1> if the *RRCConnectionReconfiguration* message includes the *fullConfig*:

2> perform the radio configuration procedure as specified in 5.3.5.8;

1> configure lower layers in accordance with the received *radioResourceConfigCommon*;

1> if the received *RRCConnectionReconfiguration* message includes the *rach-Skip*:

2> configure lower layers to apply the *rach-Skip* for the target MCG, as specified in TS 36.213 [23] and 36.321 [6];

1> if UE supports timing advance reporting and the received *radioResourceConfigCommon* includes the *ta-Report*:

2> instruct the associated MAC entity to trigger Timing Advance reporting;

1> configure lower layers in accordance with any additional fields, not covered in the previous, if included in the received mobilityControlInfo;

1> if the received *RRCConnectionReconfiguration* includes the *sCellToReleaseList*:

2> perform SCell release as specified in 5.3.10.3a;

1> if the received *RRCConnectionReconfiguration* includes the *sCellGroupToReleaseList*:

2> perform SCell group release as specified in 5.3.10.3d;

1> if the received *RRCConnectionReconfiguration* includes the *scg-Configuration*; or

1> if the current UE configuration includes one or more split DRBs and the received *RRCConnectionReconfiguration* includes *radioResourceConfigDedicated* including *drb-ToAddModList*:

2> perform SCG reconfiguration as specified in 5.3.10.10;

1> if the *RRCConnectionReconfiguration* message includes the *radioResourceConfigDedicated*:

2> perform the radio resource configuration procedure as specified in 5.3.10.0;

1> if the *securityConfigHO* (without suffix) is included in the *RRCConnectionReconfiguration*:

2> if the *keyChangeIndicator* received in the *securityConfigHO* is set to *TRUE*:

3> update the KeNB key based on the KASME key taken into use with the latest successful NAS SMC procedure, as specified in TS 33.401 [32];

2> else:

3> update the KeNB key based on the current KeNB or the NH, using the *nextHopChainingCount* value indicated in the *securityConfigHO*, as specified in TS 33.401 [32];

NOTE 2b: If the UE needs to update the S-KeNB key as specified in 5.3.10.10, the UE updates the S-KeNB after updating the KeNB key.

2> store the *nextHopChainingCount* value;

2> if the *securityAlgorithmConfig* is included in the *securityConfigHO*:

3> derive the KRRCint key associated with the *integrityProtAlgorithm*, as specified in TS 33.401 [32];

3> if connected as an RN; or

3> if capable of user plane integrity protection:

4> derive the KUPint key associated with the *integrityProtAlgorithm*, as specified in TS 33.401 [32];

3> derive the KRRCenc key and the KUPenc key associated with the *cipheringAlgorithm*, as specified in TS 33.401 [32];

2> else:

3> derive the KRRCint key associated with the current integrity algorithm, as specified in TS 33.401 [32];

3> if connected as an RN; or

3> if capable of user plane integrity protection:

4> derive the KUPint key associated with the current integrity algorithm, as specified in TS 33.401 [32];

3> derive the KRRCenc key and the KUPenc key associated with the current ciphering algorithm, as specified in TS 33.401 [32];

2> configure lower layers to apply the integrity protection algorithm and the KRRCint key, i.e. the integrity protection configuration shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;

2> configure lower layers to apply the ciphering algorithm, the KRRCenc key and the KUPenc key, i.e. the ciphering configuration shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;

NOTE 2c: For a DRB configured for DAPS HO, the new ciphering algorithm and the KUPenc key is applied for traffic exchange between the UE and the target MCG while the old ciphering algorithm and KUPenc key is applied for traffic exchange between the UE and the source MCG.

1> else if the *securityConfigHO-v1530* is included in the *RRCConnectionReconfiguration*:

2> if the *nas-Container* is received:

3> forward the *nas-Container* to upper layers;

2> if the *keyChangeIndicator-r15* is received and is set to *TRUE*:

3> update the KeNB key based on the KAMF key, as specified in TS 33.501 [86];

2> else:

3> update the KeNB key based on the current KeNB or the NH, using the received *nextHopChainingCount-r15*, as specified in TS 33.501 [86];

2> store the *nextHopChainingCount-r15* value;

2> if the security*AlgorithmConfig-r15* is received:

3> derive the KRRCint key associated with the *integrityProtAlgorithm*, as specified in TS 33.401 [32];

3> derive the KRRCenc key and the KUPenc key associated with the *cipheringAlgorithm*, as specified in TS 33.401 [32];

2> else:

3> derive the KRRCint key associated with the current integrity algorithm, as specified in TS 33.401 [32];

3> derive the KRRCenc key and the KUPenc key associated with the current ciphering algorithm, as specified in TS 33.401 [32];

1> if the received *RRCConnectionReconfiguration* includes the *nr-Config* and it is set to *release*; or

1> if the received *RRCConnectionReconfiguration* includes *endc-ReleaseAndAdd* and it is set to *TRUE*:

2> perform MR-DC release as specified in TS 38.331 [82], clause 5.3.5.10;

1> if the received *RRCConnectionReconfiguration* includes the *sk-Counter*:

2> perform key update procedure as specified in in TS 38.331 [82], clause 5.3.5.7;

1> if the received *RRCConnectionReconfiguration* includes the *nr-SecondaryCellGroupConfig*:

2> perform NR RRC Reconfiguration as specified in TS 38.331 [82], clause 5.3.5.3.

1> if the received *RRCConnectionReconfiguration* includes the *nr-RadioBearerConfig1*:

2> perform radio bearer configuration as specified in TS 38.331 [82], clause 5.3.5.6;

1> if the received *RRCConnectionReconfiguration* includes the *nr-RadioBearerConfig2*:

2> perform radio bearer configuration as specified in TS 38.331 [82], clause 5.3.5.6.

1> if connected as an RN:

2> configure lower layers to apply the integrity protection algorithm and the KUPint key, for current or subsequently established DRBs that are configured to apply integrity protection, if any;

1> if the received *RRCConnectionReconfiguration* includes the *sCellToAddModList*:

2> perform SCell addition or modification as specified in 5.3.10.3b;

1> if the received *RRCConnectionReconfiguration* includes the *sCellGroupToAddModList*:

2> perform SCell group addition or modification as specified in 5.3.10.3e;

1> if the received *RRCConnectionReconfiguration* includes the *systemInformationBlockType1Dedicated*:

2> perfom the actions upon reception of the *SystemInformationBlockType1* message as specified in 5.2.2.7;

1> if the received *RRCConnectionReconfiguration* includes the *systemInformationBlockType31Dedicated*:

2> perform the actions upon reception of the *SystemInformationBlockType31* message as specified in 5.2.2.39;

1> perform the measurement related actions as specified in 5.5.6.1;

1> if the *RRCConnectionReconfiguration* message includes the *measConfig*:

2> perform the measurement configuration procedure as specified in 5.5.2;

1> perform the measurement identity autonomous removal as specified in 5.5.2.2a;

1> release *reportProximityConfig* and clear any associated proximity status reporting timer;

1> if the *RRCConnectionReconfiguration* message includes the *otherConfig*:

2> perform the other configuration procedure as specified in 5.3.10.9;

1> if the *RRCConnectionReconfiguration* message includes the *sl-DiscConfig* or *sl-CommConfig*:

2> perform the sidelink dedicated configuration procedure as specified in 5.3.10.15;

1> if the *RRCConnectionReconfiguration* message includes *wlan-OffloadInfo*:

2> perform the dedicated WLAN offload configuration procedure as specified in 5.6.12.2;

1> if *handoverWithoutWT-Change* is not configured:

2> release the LWA configuration, if configured, as described in 5.6.14.3;

1> release the LWIP configuration, if configured, as described in 5.6.17.3;

1> if the *RRCConnectionReconfiguration* message includes *rclwi-Configuration*:

2> perform the WLAN traffic steering command procedure as specified in 5.6.16.2;

1> if the *RRCConnectionReconfiguration* message includes *lwa-Configuration*:

2> perform the LWA configuration procedure as specified in 5.6.14.2;

1> if the *RRCConnectionReconfiguration* message includes *lwip-Configuration*:

2> perform the LWIP reconfiguration procedure as specified in 5.6.17.2;

1> if the *RRCConnectionReconfiguration* message includes the *sl-V2X-ConfigDedicated* or *mobilityControlInfoV2X*:

2> perform the V2X sidelink communication dedicated configuration procedure as specified in 5.3.10.15a;

NOTE 2d: In case of conditional reconfiguration the text "if the received *RRCConnectionReconfiguration. . .*" corresponds to applying the stored *RRCConnectionReconfiguration* message (according to 5.3.5.9.5).

1> if the UE is configured to operate in EN-DC as result of this procedure, forward *upperLayerIndication*, as if the UE receives this field from SIB2, to upper layers, otherwise indicate upper layers absence of this field;

1> set the content of *RRCConnectionReconfigurationComplete* message as follows:

2> if the UE has radio link failure or handover failure information available in *VarRLF-Report* and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report*:

3> include *rlf-InfoAvailable*;

2> if the UE has MBSFN logged measurements available for E-UTRA and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport* and if T330 is not running:

3> include *logMeasAvailableMBSFN*;

2> else if the UE has logged measurements available for E-UTRA and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:

3> include the *logMeasAvailable*;

3> if Bluetooth measurement results are included in the logged measurements the UE has available:

4> include *logMeasAvailableBT*;

3> if WLAN measurement results are included in the logged measurements the UE has available:

4> include *logMeasAvailableWLAN*;

2> if the UE has connection establishment failure information available in *VarConnEstFailReport* and if the RPLMN is equal to *plmn-Identity* stored in *VarConnEstFailReport*:

3> include *connEstFailInfoAvailable*;

2> if the *RRCConnectionReconfiguration* message includes *perCC-GapIndicationRequest*:

3> include *perCC-GapIndicationList* and *numFreqEffective*;

2> if the frequencies are configured for reduced measurement performance:

3> include *numFreqEffectiveReduced*;

2> if the UE has flight path information available:

3> include *flightPathInfoAvailable*;

2> if the received *RRCConnectionReconfiguration* message included *nr-SecondaryCellGroupConfig*:

3> include *scg-ConfigResponseNR* in accordance with TS 38.331 [82], clause 5.3.5.3;

2> if the target cell is an NTN cell:

3> include *gnss-validityDuration* in accordance with the remaining time of the GNSS validity duration;

3> if the *RRCConnectionReconfiguration* message includes *gnss-PositionFixDurationReporting*:

4> include *gnss-PositionFixDuration* in accordance with the time duration required for the UE to acquire a GNSS position;

1> submit the *RRCConnectionReconfigurationComplete* message to lower layers for transmission;

1> if MAC successfully completes the random access procedure; or

1> if MAC indicates the successful reception of a PDCCH transmission addressed to C-RNTI and if *rach-Skip* is configured:

2> stop timer T304;

2> if *daps-HO* is configured for any DRB:

3> stop timer T310 for the source PCell, if running;

3> for each DAPS bearer trigger UL data switching, as specified in TS 36.323 [8];

2> release *rach-Skip*;

2> apply the parts of the CQI reporting configuration, the scheduling request configuration and the sounding RS configuration that do not require the UE to know the SFN of the target PCell, if any;

2> apply the parts of the measurement and the radio resource configuration that require the UE to know the SFN of the target PCell (e.g. measurement gaps, periodic CQI reporting, scheduling request configuration, sounding RS configuration), if any, upon acquiring the SFN of the target PCell;

NOTE 3: Whenever the UE shall setup or reconfigure a configuration in accordance with a field that is received it applies the new configuration, except for the cases addressed by the above statements.

2> if the UE is configured to provide IDC indications:

3> if the UE has initiated the transmission of an *InDeviceCoexIndication* message during the last 1 second preceding reception of the *RRCConnectionReconfiguration* message including *mobilityControlInfo*; or

3> if the *RRCConnectionReconfiguration* message is applied due to a conditional reconfiguration execution and the UE has initiated transmission of an *InDeviceCoexIndication* message since it was configured to do so in accordance with 5.6.9.2:

4> initiate transmission of the *InDeviceCoexIndication* message in accordance with 5.6.9.3;

2> if the UE is configured to provide power preference indications, overheating assistance information, SPS assistance information, delay budget report or maximum bandwidth preference indications:

3> if the UE has initiated the transmission of a *UEAssistanceInformation* message during the last 1 second preceding reception of the *RRCConnectionReconfiguration* message including *mobilityControlInfo*; or

3> if the *RRCConnectionReconfiguration* message is applied due to a conditional reconfiguration execution, and the UE has initiated transmission of a *UEAssistanceInformation* message for the corresponding cell group since it was configured to do so in accordance with 5.6.10.2:

4> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.6.10.3;

2> if *SystemInformationBlockType15* is broadcast by the PCell:

3> if the UE has initiated the transmission of a *MBMSInterestIndication* message during the last 1 second preceding reception of the *RRCConnectionReconfiguration* message including *mobilityControlInfo*; or

3> if the *RRCConnectionReconfiguration* message is applied due to a conditional reconfiguration execution and the UE supports MBMS reception and the UE has initiated transmission of an *MBMSInterestIndication* message since it was configured to do so in accordance with 5.8.5.2:

4> ensure having a valid version of *SystemInformationBlockType15* for the PCell;

4> determine the set of MBMS frequencies of interest in accordance with 5.8.5.3;

4> determine the set of MBMS services of interest in accordance with 5.8.5.3a;

4> initiate transmission of the *MBMSInterestIndication* message in accordance with 5.8.5.4;

2> if *SystemInformationBlockType18* is broadcast by the target PCell; and the UE initiated the transmission of a *SidelinkUEInformation* message indicating a change of sidelink communication related parameters relevant in target PCell (i.e. change of *commRxInterestedFreq* or *commTxResourceReq*, *commTxResourceReqUC* if *SystemInformationBlockType18* includes *commTxResourceUC-ReqAllowed* or *commTxResourceInfoReqRelay* if PCell broadcasts *SystemInformationBlockType19* including *discConfigRelay*) during the last 1 second preceding reception of the *RRCConnectionReconfiguration* message including *mobilityControlInfo*; or

2> if *SystemInformationBlockType19* is broadcast by the target PCell; and the UE initiated the transmission of a *SidelinkUEInformation* message indicating a change of sidelink discovery related parameters relevant in target PCell (i.e. change of *discRxInterest* or *discTxResourceReq*, *discTxResourceReqPS* if *SystemInformationBlockType19* includes *discConfigPS* or *discRxGapReq* or *discTxGapReq* if the UE is configured with *gapRequestsAllowedDedicated* set to *true* or if the UE is not configured with *gapRequestsAllowedDedicated* and *SystemInformationBlockType19* includes *gapRequestsAllowedCommon*) during the last 1 second preceding reception of the *RRCConnectionReconfiguration* message including *mobilityControlInfo*; or

2> if *SystemInformationBlockType21* is broadcast by the target PCell; and the UE initiated the transmission of a *SidelinkUEInformation* message indicating a change of V2X sidelink communication related parameters relevant in target PCell (i.e. change of *v2x-CommRxInterestedFreqList* or *v2x-CommTxResourceReq*) during the last 1 second preceding reception of the *RRCConnectionReconfiguration* message including *mobilityControlInfo*; or

2> if the *RRCConnectionReconfiguration* message is applied due to a conditional reconfiguration execution, and at least one of *SystemInformationBlockType18*, *SystemInformationBlockType19*, and *SystemInformationBlockType21* is broadcast by the target PCell, and the UE has initiated transmission of a *SidelinkUEInformation* message since it was configured to do so in accordance with 5.10.2.2:

3> initiate transmission of the *SidelinkUEInformation* message in accordance with 5.10.2.3;

2> remove all the entries within *VarConditionalReconfiguration*, if any;

2> for each *measId*, if the associated *reportConfig* is *condReconfigurationTriggerEUTRA*:

3> remove the entry with the matching *measId* from the *measIdList* within the *VarMeasConfig*;

3> remove the entry with the matching *reportConfigId* from the *reportConfigList* within the *VarMeasConfig*;

3> if the *measObjectId* is only included in a *MeasIdToAddMod*:

4> remove the entry with the matching *measObjectId* from the *measObjectList* within the *VarMeasConfig*;

2> the procedure ends;

NOTE 4: The UE is not required to determine the SFN of the target PCell by acquiring system information from that cell before performing RACH access in the target PCell, except for BL UEs or UEs in CE when *sameSFN-Indication* is not present in *mobilityControlInfo*.

#### 5.3.5.5 Reconfiguration failure

The UE shall:

1> if the UE is unable to comply with (part of) the configuration included in the *RRCConnectionReconfiguration* message or if the upper layers indicate that the *nas-Container* is invalid:

2> continue using the configuration used prior to the reception of *RRCConnectionReconfiguration* message;

2> if the UE is in NE-DC:

3> perform the actions as specified in TS 38.331 [82], clause 5.3.7;

2> else if security has not been activated:

3> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause other;

2> else:

3> initiate the connection re-establishment procedure as specified in 5.3.7, upon which the connection reconfiguration procedure ends;

NOTE 1: The UE may apply above failure handling also in case the *RRCConnectionReconfiguration* message causes a protocol error for which the generic error handling as defined in 5.7 specifies that the UE shall ignore the message.

NOTE 2: If the UE is unable to comply with part of the configuration, it does not apply any part of the configuration, i.e. there is no partial success/ failure.

NOTE 3: The compliance also covers the NR configuration carried within octet strings e.g. field *nr-SecondaryCellGroupConfig*. I.e. the failure behaviour defined also applies in case the UE cannot comply with the NR configuration or with the combination of (parts of) the LTE and NR configurations.

NOTE 4: The compliance also covers the NR sidelink configuration carried within an octet string, e.g. field *sl-ConfigDedicatedNR*, i.e. the failure behaviour defined also applies in case the UE cannot comply with the embedded NR sidelink configuration.

#### 5.3.5.6 T304 expiry (handover failure)

If T304 expires (handover failure), the UE shall:

NOTE 1: Following T304 expiry any dedicated preamble, if provided within the *rach-ConfigDedicated*, is not available for use by the UE anymore.

1> if no DAPS bearer is configured; or

1> if any DAPS beareris configured and radio link failure has been detected for the source MCG in accordance with 5.3.11.3:

2> if *attemptCondReconf* is not configured:

3> revert back to the configuration used in the source PCell, excluding the configuration configured by the *physicalConfigDedicated*,the *mac-MainConfig* and the *sps-Config*;

2> else:

3> revert back to the configuration used in the source PCell;

NOTE 1a: In the context above, "the configuration" includes state variables and parameters of each radio bearer. PDCP entities associtated with RLC UM and SRB bearers are reset after the successful RRC connection re-establishment procedure according to clause 5.2 in TS 36.323 [8]. In the above, "the configuration" includes the RB configuration using NR PDCP, if configured (i.e. by *nr-RadioBearerConfig1* and *nr-RadioBearerConfig2*).

2> store the following handover failure information in *VarRLF-Report* by setting its fields as follows:

3> clear the information included in *VarRLF-Report*, if any;

3> set the *plmn-IdentityList* to include the list of EPLMNs stored by the UE (i.e. includes the RPLMN);

3> set the *measResultLastServCell* to include the RSRP and RSRQ, if available, of the source PCell based on measurements collected up to the moment the UE detected handover failure and in accordance with the following;

4> if the UE includes *rsrqResult*, include the *lastServCellRSRQ-Type*;

3> set the *measResultNeighCells* to include the best measured cells, other than the source PCell, ordered such that the best cell is listed first, and based on measurements collected up to the moment the UE detected handover failure, and set its fields as follows;

4> if the UE was configured to perform measurements for one or more EUTRA frequencies, include the *measResultListEUTRA*;

4> if the UE includes *rsrqResult*, include the *rsrq-Type*;

4> if the UE was configured to perform measurement reporting for one or more neighbouring UTRA frequencies, include the *measResultListUTRA*;

4> if the UE was configured to perform measurement reporting for one or more neighbouring GERAN frequencies, include the *measResultListGERAN*;

4> if the UE was configured to perform measurement reporting for one or more neighbouring CDMA2000 frequencies, include the *measResultsCDMA2000*;

4> if the UE was configured to perform measurement reporting, not related to NR sidelink communication, for one or more neighbouring NR frequencies, include the *measResultListNR*;

4> for each neighbour cell included, include the optional fields that are available;

NOTE 2: The measured quantities are filtered by the L3 filter as configured in the mobility measurement configuration. The measurements are based on the time domain measurement resource restriction, if configured. Exclude-listed cells are not required to be reported.

3> if available, set the *logMeasResultListWLAN* to include the WLAN measurement results, in order of decreasing RSSI for WLAN APs;

3> if available, set the *logMeasResultListBT* to include the Bluetooth measurement results, in order of decreasing RSSI for Bluetooth beacons;

3> if detailed location information is available, set the content of the *locationInfo* as follows:

4> include the *locationCoordinates*;

4> include the *horizontalVelocity*, if available;

3> if last *RRCConnectionReconfiguration* message including *mobilityControlInfo* concerned a failed intra-RAT handover (E-UTRA to E-UTRA):

4> set the *failedPCellId* to the global cell identity, if available, and otherwise to the physical cell identity and carrier frequency of the target PCell of the failed handover;

4> include *previousPCellId* and set it to the global cell identity of the PCell where the last *RRCConnectionReconfiguration* message including *mobilityControlInfo* was received;

4> set the *timeConnFailure* to the elapsed time since reception of the last *RRCConnectionReconfiguration* message including the *mobilityControlInfo*;

3> else if last *MobilityFromEUTRACommand* concerned a failed inter-RAT handover from E-UTRA to NR:

4> set the *failedNR-PCellId* to the global cell identity and tracking area code, if available, and otherwise to the physical cell identity and carrier frequency of the target PCell of the failed handover;

4> include *previousPCellId* and set it to the global cell identity of the PCell where the last *MobilityFromEUTRACommand* message was received;

4> set the *timeConnFailure* to the elapsed time since reception of the last *MobilityFromEUTRACommand* message;

3> set the *connectionFailureType* to '*hof*';

3> set the *c-RNTI* to the C-RNTI used in the source PCell;

2> initiate the connection re-establishment procedure as specified in 5.3.7, upon which the RRC connection reconfiguration procedure ends;

1> else (any DAPS bearer is configured and radio link failure has not been detected for the source MCG):

2> release the MAC entity for the target PCell;

2> for each DAPS bearer:

3> re-establish the RLC entity for the target PCell;

3> release the RLC entity or entities and the associated DTCH logical channel for the target PCell;

3> reconfigure the PDCP entity to release DAPS as specified in TS 36.323 [8];

2> for each non-DAPS bearer:

3> revert back to the configuration used for the DRB in the source PCell, including PDCP and RLC states and the security configuration;

2> for each SRB:

3> discard any PDCP SDUs along with the PDCP data PDUs for the source PCell;

3> re-establish the RLC entity for the source PCell;

3> release the PDCP entity for the target PCell;

3> release the RLC entity and the associated DCCH logical channel for the target PCell;

2> release the physical channel configuration for the target PCell;

2> resume the SRBs for the source PCell;

2> initiate the failure information procedure as specified in 5.6.21 to report a DAPS HO failure.

The UE may discard the handover failure information, i.e. release the UE variable *VarRLF-Report,* 48 hours after the failure is detected, upon power off or upon detach.

NOTE 3: E-UTRAN may retrieve the handover failure information using the UE information procedure with *rlf-ReportReq* set to *true*, as specified in 5.6.5.3.

#### 5.3.5.7 Void

#### 5.3.5.7a T307 expiry (SCG change failure)

The UE shall:

1> if T307 expires:

NOTE 1: Following T307 expiry any dedicated preamble, if provided within the *rach-ConfigDedicatedSCG*, is not available for use by the UE anymore.

2> if the UE is configured with DC; or

2> if the UE is configured with NE-DC and MCG transmission is not suspended:

3> initiate the SCG failure information procedure as specified in 5.6.13 to report SCG change failure;

2> else:

3> initiate the connection re-establishment procedure as specified in TS 38.331 [82] 5.3.7;

#### 5.3.5.8 Radio Configuration involving full configuration option

The UE shall:

1> if the UE is connected to EPC:

2> release/ clear all current dedicated radio configurations except for the following:

- the MCG C-RNTI,

- the MCG security configuration,

- the PDCP, RLC, logical channel configurations for the RBs,

- the logged measurement configuration;

- the *serviceType*;

1> else if the UE is connected to 5GC:

2> release/ clear all current dedicated radio configurations except for the following:

- the MCG C-RNTI,

- the MCG security configuration,

- the configurations (SDAP if configured, PDCP, RLC and logical channel) for the RBs;

- the logged measurement configuration;

NOTE 1: Radio configuration is not just the resource configuration but includes other configurations like *MeasConfig* and *OtherConfig*. In case (NG)EN-DC is configured, this also includes the entire NR SCG configuration. Such NR SCG configuration does not include the DRB configuration as configured by *nr-RadioBearerConfig1* and nr-*RadioBearerConfig2*).

1> if the *RRCConnectionReconfiguration* message includes the *measConfigAppLayer* set to *setup* and the *measConfigAppLayer* includes the *serviceType* stored in the current UE configuration:

2> discard the *measConfigAppLayer*;

2> consider the *measConfigAppLayer* as not received;

1> else if a *serviceType* is stored in the current UE configuration:

2> release the stored *serviceType*;

2> inform upper layers to clear the stored application layer measurement configuration;

2> discard received application layer measurement report information from upper layers;

2> consider itself not to be configured to send application layer measurement report;

1> if the *RRCConnectionReconfiguration* message includes the *mobilityControlInfo*:

2> release/ clear all current common radio configurations;

2> use the default values specified in 9.2.5 for timer T310, T311 and constant N310, N311;

1> else:

2> use values for timers T301, T310, T311 and constants N310, N311, as included in *ue-TimersAndConstants* received in *SystemInformationBlockType2* (or *SystemInformationBlockType2-NB* in NB-IoT);

1> apply the default physical channel configuration as specified in 9.2.4;

1> apply the default semi-persistent scheduling configuration as specified in 9.2.3;

1> apply the default MAC main configuration as specified in 9.2.2;

1> if the UE is a NB-IoT UE; or

1> for each *srb-Identity* value included in the *srb-ToAddModList* (SRB reconfiguration):

2> apply the specified configuration defined in 9.1.2 for the corresponding SRB;

2> apply the corresponding default RLC configuration for the SRB specified in 9.2.1.1 for SRB1 or in 9.2.1.2 for SRB2;

2> apply the corresponding default logical channel configuration for the SRB as specified in 9.2.1.1 for SRB1 or in 9.2.1.2 for SRB2;

2> if the corresponding SRB was configured with NR PDCP and the UE is connected to EPC:

3> release the NR PDCP entity and establish it with an E-UTRA PDCP entity and with the current (MCG) security configuration;

NOTE 1a: The UE applies the LTE ciphering and integrity protection algorithms that are equivalent to the previously configured NR security algorithms.

3> associate the RLC bearer of this SRB with the established PDCP entity;

NOTE 2: This is to get the SRBs (SRB1 and SRB2 for handover and SRB2 for reconfiguration after reestablishment) to a known state from which the reconfiguration message can do further configuration.

2> else if the UE is connected to 5GC:

3> apply the corresponding default PDCP configuration for the SRB as specified in TS 38.331 [82], clause 9.2.1;

1> for each *srb-Identity* value which was configured in the *srb-ToAddModListExt* but is not added in the RRC message configuring the full configuration:

2> release the RLC entity or entities;

2> release the DCCH logical channel;

2> release the PDCP entity;

1> if the UE is connected to EPC:

2> for each *eps-BearerIdentity* value included in the *drb-ToAddModList* or *nr-RadioBearerConfig1 or nr-RadioBearerConfig2* that is part of the current E-UTRA and NR UE configuration:

3> release the E-UTRA or NR PDCP entity;

3> release the RLC entity or entities;

3> release the DTCH logical channel;

3> release the *drb-identity*;

NOTE 3: This will retain the *eps-bearerIdentity* but remove the DRBs including *drb-identity* of these bearers from the current UE configuration and trigger the setup of the DRBs within the AS in clause 5.3.10.3 using the new configuration. The *eps-bearerIdentity* acts as the anchor for associating the released and re-setup DRB. In the AS the DRB re-setup is equivalent with a new DRB setup (including new PDCP and logical channel configurations).

2> for each *eps-BearerIdentity* value that is part of the current E-UTRA and NR UE configuration but not added with same *eps-BearerIdentity* in *drb-ToAddModList* nor in *nr-RadioBearerConfig1* nor in *nr-RadioBearerConfig2*:

3> perform DRB release as specified in 5.3.10.2;

1> if the UE is connected to 5GC:

2> except for NB-IoT:

3> for each *pdu-Session* that is part of the current NR UE configuration:

4> release the SDAP entity (clause 5.1.2 in TS 37.324 [97]);

4> release the NR PDCP entity for each DRB associated to the *pdu-Session*;

4> release the RLC entity or entities for each DRB associated to the *pdu-Session*;

4> release the DTCH logical channel for each DRB associated to the *pdu-Session*;

4> release the *drb-identity* for each DRB associated to the *pdu-Session*;

NOTE 4: This will retain the *pdu-Session* but remove the DRBs including *drb-identity* of these bearers from the current NR UE configuration and trigger the setup of the DRBs within the AS in clause 5.3.10.3 using the new configuration. The *pdu-Session* acts as the anchor for associating the released and re-setup DRB. In the AS the DRB re-setup is equivalent with a new DRB setup (including new PDCP and logical channel configurations).

3> for each *pdu-Session* that is part of the current NR UE configuration but not added with same *pdu-Session* in *nr-RadioBearerConfig1* nor in *nr-RadioBearerConfig2*:

4> if the procedure was triggered due to handover:

5> indicate the release of the user plane resources for the *pdu-Session* to upper layers after successful handover;

4> else:

5> indicate the release of the user plane resources for the *pdu-Session* to upper layers immediately;

2> for NB-IoT UE:

3> for each *pdu-Session* that is part of the current UE configuration:

4> release the PDCP entity for the DRB associated to the *pdu-Session*;

4> release the RLC entity for the DRB associated to the *pdu-Session*;

4> release the DTCH logical channel for the DRB associated to the *pdu-Session*;

4> release the *drb-identity* for the DRB associated to the *pdu-Session*;

3> for each *pdu-Session* that is part of the current UE configuration but not added with same *pdu-Session in drb-ToAddModList*:

4> indicate the release of the user plane resources for the *pdu-Session* to upper layers;

#### 5.3.5.9 Conditional reconfiguration

##### 5.3.5.9.1 General

The network configures the UE with conditional reconfiguration (i.e. conditional handover, conditional PSCell addition, or inter-SN conditional PSCell change) including per candidate target cell an *RRCConnectionReconfiguration* to be stored and to be applied upon the fulfilment of an associated execution condition.

The UE shall:

1> if the received *conditionalReconfiguration* includes the *condReconfigurationToRemoveList*:

2> perform the conditional reconfiguration removal procedure as specified in 5.3.5.9.2;

1> if the received *conditionalReconfiguration* includes the *condReconfigurationToAddModList*:

2> perform the conditional reconfiguration addition/modification procedure as specified in 5.3.5.9.3;

##### 5.3.5.9.2 Conditional reconfiguration removal

The UE shall:

1> for each *CondReconfigurationId* included in the *condReconfigurationToRemoveList* that is part of the current UE configuration in *VarConditionalReconfiguration*:

2> remove the entry with the matching *condReconfigurationId* from the *condReconfigurationList* within the *VarConditionalReconfiguration*.

NOTE: The UE does not consider the message as erroneous if the *condReconfigurationToRemoveList* includes any *CondReconfigurationId* value that is not part of the current UE configuration.

##### 5.3.5.9.3 Conditional reconfiguration addition/modification

The UE shall:

1> for each *condReconfigurationId* included in the *condReconfigurationToAddModList*:

2> if an entry with the matching *condReconfigurationId* exists in the *condReconfigurationList* within the *VarConditionalReconfiguration*:

3> if the entry in *condReconfigurationToAddModList* includes a *triggerCondition* or *triggerConditionSN*;

4> replace *triggerCondition* or *triggerConditionSN* within the *VarConditionalReconfiguration* with the value received for this *condReconfigurationId*

3> if the entry in *condReconfigurationToAddModList* includes an *condReconfigurationToApply*;

4> replace *condReconfigurationToApply* within the *VarConditionalReconfiguration* with the value received for this *condReconfigurationId*;

2> else:

3> add a new entry for this *condReconfigurationId* within the *VarConditionalReconfiguration*;

3> store the associated *RRCConnectionReconfiguration* in *VarConditionalReconfiguration*.

##### 5.3.5.9.4 Conditional reconfiguration evaluation

If AS security has been activated successfully, the UE shall:

1> if *VarConditionalReconfiguration* includes at least one *condReconfigurationId*:

2> perform conditional reconfiguration evaluation;

1> for each *condReconfigurationId* within the *VarConditionalReconfiguration*:

2> if the *RRCConnectionReconfiguration* within *condReconfigurationToApply* includes the *MobilityControlInfo*:

3> consider the cell which has a physical cell identity matching the value indicated in the *MobilityControlInfo* within *condReconfigurationToApply* to be an applicable cell;

2> else if the *RRCConnectionReconfiguration* within *condReconfigurationToApply* includes the *nr-SecondaryCellGroupConfig*:

3> consider the cell which has a physical cell identity matching the value indicated in the *nr-SecondaryCellGroupConfig* within the received *condReconfigurationToApply* to be an applicable cell;

2> if *triggerConditionSN* is configured (in case of SN initiated inter-SN CPC for EN-DC):

3> perform the conditional reconfiguration evaluation as specified in TS 38.331 [82], clause 5.3.5.13.4a;

3> the procedure ends;

2> for each *measId* included in the *measIdList* within *VarMeasConfig* indicated in the *triggerCondition* associated to *condReconfigurationId:*

3> if the *condEventId* is associated with *condEventD1* or *condEventD2*, and if the entry conditions applicable for this event associated with the *condReconfigurationId*, i.e. the event corresponding with the *condEventId* of the corresponding *condReconfigurationTriggerEUTRA* within *VarConditionalReconfiguration*, are fulfilled for the applicable cell during the corresponding *timeToTrigger* defined for this event within the *VarConditionalReconfig*; or

3> if the *condEventId* is associated with *condEventT1*, and if the entry condition applicable for this event associated with the *condReconfigurationId*, i.e. the event corresponding with the *condEventId* of the corresponding *condReconfigurationTriggerEUTRA* within *VarConditionalReconfiguration*, is fulfilled for the applicable cell; or

3> if the *condEventId* is associated with *condEventA3*, *condEventA4,* *condEventA5* or *condEventB1*, and if the entry condition(s) applicable for this event associated with the *condReconfigurationId*, i.e. the event corresponding with the *condEventId* of the corresponding *condReconfigurationTriggerEUTRA* within *VarConditionalReconfiguration*, or the event corresponding with the *condEventId* of the corresponding *condReconfigurationTriggerNR* within *VarConditionalReconfiguration*, is fulfilled for the applicable cell for all measurements after layer 3 filtering taken during the corresponding *timeToTrigger* defined for this event within the *VarConditionalReconfiguration*:

4> consider the entry condition for the associated *measId* within *triggerCondition* as fulfilled;

3> if the *measId* for this event associated with the *condReconfigurationId* has been modified; or

3> if the *condEventId* is associated with *condEventD1* or *condEventD2*, and if the leaving condition(s) applicable for this event associated with the *condReconfigurationId*, i.e. the event corresponding with the *condEventId* of the corresponding *condReconfigurationTriggerEUTRA* within *VarConditionalReconfiguration*, is fulfilled for the applicable cell during the corresponding *timeToTrigger* defined for this event within the *VarConditionalReconfig*; or

3> if the *condEventId* is associated with *condEventT1*, and if the leaving condition applicable for this event associated with the *condReconfigurationId*, i.e. the event corresponding with the *condEventId* of the corresponding *condReconfigurationTriggerEUTRA* within *VarConditionalReconfiguration*, is fulfilled for the applicable cell; or

3> if the *condEventId* is associated with *condEventA3*, *condEventA4,* *condEventA5* or *condEventB1*, and if the leaving condition(s) applicable for this event associated with the *condReconfigurationId*, i.e. the event corresponding with the *condEventId(s)* of the corresponding *condReconfigurationTriggerEUTRA* within *VarConditionalReconfiguration*, or the event corresponding with the *condEventId* of the corresponding *condReconfigurationTriggerNR* within *VarConditionalReconfiguration*, is fulfilled for the applicable cells for all measurements after layer 3 filtering taken during the corresponding *timeToTrigger* defined for this event within the *VarConditionalReconfiguration*:

4> consider the event associated to that *measId* to be not fulfilled;

2> if trigger conditions for all associated *measId*(s) within *triggerCondition* are fulfilled:

3> consider the target cell candidate within the stored *condReconfigurationToApply*, associated to that *condReconfigurationId*, as a triggered cell;

3> initiate the conditional reconfiguration execution, as specified in 5.3.5.9.5;

##### 5.3.5.9.5 Conditional reconfiguration execution

The UE shall:

1> if more than one triggered cell exists:

2> select one of the triggered cells as the selected cell for conditional reconfiguration;

1> else:

2> consider the triggered cell as the selected cell for conditional reconfiguration;

1> for the selected cell of conditional reconfiguration:

2> apply the stored *condReconfigurationToApply* associated to that *condReconfigurationId* and perform the actions as specified in 5.3.5.4, or perform the actions as specified in 5.3.5.3;

##### 5.3.5.9.6 VarConditionalReconfiguration remove

The UE shall:

1> remove all the entries within *VarConditionalReconfiguration*;

1> for each *measId*, that is part of the current UE configuration in *VarMeasConfig*, if the associated *reportConfig* has *condReconfigurationTriggerEUTRA*/*condReconfigurationTriggerNR* configured:

2> remove the entry with the matching *reportConfigId* from the *reportConfigList* within the *VarMeasConfig*;

2> if the associated *measObjectId* is only associated with *condReconfigurationTriggerEUTRA*/ *condReconfigurationTriggerNR*:

3> remove the entry with the matching *measObjectId* from the *measObjectList* within the *VarMeasConfig*;

2> remove the entry with the matching *measId* from the *measIdList* within the *VarMeasConfig*;

##### 5.3.5.9.7 VarConditionalReconfiguration CPC remove

The UE shall:

1> remove all the entries within *VarConditionalReconfiguration* for which the *RRCConnectionReconfiguration* within *condReconfigurationToApply* does not include the *MobilityControlInfo*.

### 5.3.6 Counter check

#### 5.3.6.1 General



Figure 5.3.6.1-1: Counter check procedure

The counter check procedure is used by E-UTRAN to request the UE to verify the amount of data sent/ received on each DRB. More specifically, the UE is requested to check if, for each DRB, the most significant bits of the COUNT match with the values indicated by E-UTRAN.

NOTE: The procedure enables E-UTRAN to detect packet insertion by an intruder (a 'man in the middle').

#### 5.3.6.2 Initiation

E-UTRAN initiates the procedure by sending a *CounterCheck* message.

NOTE: E-UTRAN may initiate the procedure when any of the COUNT values reaches a specific value.

#### 5.3.6.3 Reception of the *CounterCheck* message by the UE

Upon receiving the *CounterCheck* message, the UE shall:

1> for each DRB that is established:

2> if no COUNT exists for a given direction (uplink or downlink) because it is a uni-directional bearer configured only for the other direction:

3> assume the COUNT value to be 0 for the unused direction;

2> if the *drb-Identity* is not included in the *drb-CountMSB-InfoList*:

3> if the DRB is configured with E-UTRA PDCP:

4> include the DRB in the *drb-CountInfoList* in the *CounterCheckResponse* message by including the *drb-Identity*, the *count-Uplink* and the *count-Downlink* set to the value of the corresponding COUNT;

3> else if the DRB is configured with NR PDCP:

4> include the DRB in the *drb-CountInfoList* in the *CounterCheckResponse* message by including the *drb-Identity*, the *count-Uplink* and the *count-Downlink* set to the value of TX\_NEXT – 1 and RX\_NEXT – 1 (specified in TS 38.323 [83]), respectively;

2> else if, for at least one direction, the most significant bits of the COUNT are different from the value indicated in the *drb-CountMSB-InfoList*:

3> if the DRB is configured with E-UTRA PDCP:

4> include the DRB in the *drb-CountInfoList* in the *CounterCheckResponse* message by including the *drb-Identity*, the *count-Uplink* and the *count-Downlink* set to the value of the corresponding COUNT;

3> else if the DRB is configured with NR PDCP:

4> include the DRB in the *drb-CountInfoList* in the *CounterCheckResponse* message by including the *drb-Identity*, the *count-Uplink* and the *count-Downlink* set to the value of TX\_NEXT – 1 and RX\_NEXT – 1 (specified in TS 38.323 [83]), respectively;

1> for each DRB that is included in the *drb-CountMSB-InfoList* in the *CounterCheck* message that is not established:

2> include the DRB in the *drb-CountInfoList* in the *CounterCheckResponse* message by including the *drb-Identity*, the *count-Uplink* and the *count-Downlink* with the most significant bits set identical to the corresponding values in the *drb-CountMSB-InfoList* and the least significant bits set to zero;

1> submit the *CounterCheckResponse* message to lower layers for transmission upon which the procedure ends;

### 5.3.7 RRC connection re-establishment

#### 5.3.7.1 General



Figure 5.3.7.1-1: RRC connection re-establishment, successful



Figure 5.3.7.1-2: RRC connection re-establishment, failure

The purpose of this procedure is to re-establish the RRC connection, which involves the resumption of SRB1 (SRB1bis for a NB-IoT UE for which AS security has not been activated) operation, the re-activation of security (except for a NB-IoT UE for which AS security has not been activated) and the configuration of only the PCell.

Except for a NB-IoT UE for which AS security has not been activated, a UE in RRC\_CONNECTED, for which security has been activated, may initiate the procedure in order to continue the RRC connection. The connection re-establishment succeeds only if the concerned cell is prepared i.e. has a valid UE context. In case E-UTRAN accepts the re-establishment, SRB1 operation resumes while the operation of other radio bearers remains suspended. If AS security has not been activated, the UE does not initiate the procedure but instead moves to RRC\_IDLE directly.

When AS security has not been activated, a NB-IoT UE supporting RRC connection re-establishment for the Control Plane CIoT EPS/5GS optimisation in RRC\_CONNECTED may initiate the procedure in order to continue the RRC connection.

E-UTRAN applies the procedure as follows:

- When AS security has been activated:

- to reconfigure SRB1 and to resume data transfer only for this RB;

- to re-activate AS security without changing algorithms.

- For a NB-IoT UE supporting RRC connection re-establishment for the Control Plane CIoT EPS/5GS optimisation, when AS security has not been activated:

- to re-establish SRB1bis and to continue data transfer for this RB.

#### 5.3.7.1a Condition for re-establishing RRC Connection in NTN

If s*ystemInformationBlockType31* (*systemInformationBlockType31-NB* in NB-IoT) is broadcast, a RRC connection re-establishment is initiated only if the UE has a valid GNSS position.

NOTE: The UE may need to re-acquire the GNSS position before re-establishing the connection to avoid interruption during the connection.

#### 5.3.7.2 Initiation

The UE shall only initiate the procedure either when AS security has been activated or for a NB-IoT UE supporting RRC connection re-establishment for the Control Plane CIoT EPS/5GS optimisation. The UE initiates the procedure when one of the following conditions is met:

1> upon detecting radio link failure and T316 is not configured, in accordance with 5.3.11; or

1> upon detecting radio link failure of the MCG while SCG transmission is suspended, in accordance with 5.3.11; or

1> upon detecting radio link failure of the MCG while NR PSCell change or PSCell addition is ongoing, in accordance with 5.3.11; or

1> upon handover failure, in accordance with 5.3.5.6; or

1> upon mobility from E-UTRA failure, in accordance with 5.4.3.5; or

1> except when resuming an RRC connection after early security reactivation in accordance with conditions in 5.3.3.18, upon integrity check failure indication from lower layers concerning SRB1 or SRB2; or

1> upon an RRC connection reconfiguration failure, in accordance with 5.3.5.5; or

1> upon an RRC connection reconfiguration failure, in accordance with TS38.331 [82], clause 5.3.5.8; or

1> upon detecting radio link failure for the SCG while MCG transmission is suspended, in accordance with TS 38.331 [82] clause 5.3.10.3 in (NG)EN-DC; or

1> upon SCG change failure while MCG transmission is suspended, in accordance with TS 38.331 [82] clause 5.3.5.8.3 in (NG)EN-DC; or

1> upon SCG configuration failure while MCG transmission is suspended in accordance with clause TS 38.331 [82] clause 5.3.5.8.2 in (NG)EN-DC; or

1> upon integrity check failure indication from SCG lower layers concerning SRB3 while MCG transmission is suspended; or

1> upon T316 expiry, in accordance with clause 5.6.26.5.

NOTE: When resuming an RRC connection after early security reactivation in accordance with conditions in 5.3.3.18, integrity check failure indication from lower layers is handled in accordance with clause 5.3.3.16.

Upon initiation of the procedure, the UE shall:

1> stop timer T310, if running;

1> stop timer T312, if running;

1> stop timer T313, if running;

1> stop timer T316, if running;

1> stop timer T307, if running;

1> start timer T311;

1> stop timer T370, if running;

1> stop timer T390, if running;

1> if the UE is not configured with *attemptCondReconf*:

2> release *uplinkDataCompression*, if configured;

2> suspend all RBs, including RBs configured with NR PDCP, except SRB0;

2> reset MAC;

2> release the MCG SCell(s), if configured, in accordance with 5.3.10.3a;

2> release the SCell group(s), if configured, in accordance with 5.3.10.3d;

2> apply the default physical channel configuration as specified in 9.2.4;

2> except for NB-IoT, for the MCG, apply the default semi-persistent scheduling configuration as specified in 9.2.3;

2> for NB-IoT, release *schedulingRequestConfig*, if configured;

2> for NB-IoT, release *obtainLocationNB*, if configured;

2> for the MCG, apply the default MAC main configuration as specified in 9.2.2;

2> release *powerPrefIndicationConfig*, if configured and stop timer T340, if running;

2> release *reportProximityConfig*, if configured and clear any associated proximity status reporting timer;

2> release *obtainLocationConfig*, if configured;

2> release *idc-Config*, if configured;

2> release *sps-AssistanceInfoReport*, if configured;

2> release *scg-DeactivationPreferenceConfig*, if configured and stop timer T346, if running;

2> release *measSubframePatternPCell*, if configured;

2> release the entire SCG configuration, if configured, except for the DRB configuration (as configured by *drb-ToAddModListSCG*);

2> if (NG)EN-DC is configured:

3> perform MR-DC release, as specified in TS 38.331[82], clause 5.3.5.10;

3> release *p-MaxEUTRA*, if configured;

3> release *p-MaxUE-FR1*, if configured;

3> release *tdm-PatternConfig* or *tdm-PatternConfig2*, if configured;

2> release *naics-Info* for the PCell, if configured;

2> if connected as an RN and configured with an RN subframe configuration:

3> release the RN subframe configuration;

2> release the LWA configuration, if configured, as described in 5.6.14.3;

2> release the LWIP configuration, if configured, as described in 5.6.17.3;

2> release *delayBudgetReportingConfig*, if configured and stop timer T342, if running;

2> release *bw-PreferenceIndicationTimer*, if configured and stop timer T341, if running;

2> release *overheatingAssistanceConfig* and *overheatingAssistanceConfigForSCG*, if configured and stop timer T345, if running;

2> release *ailc-BitConfig*, if configured;

2> if the UE has a stored *pur-Config* and the cell is different from the cell where *pur-Config* was provided:

3> if *pur-TimeAlignmentTimer* is configured, indicate to lower layers that *pur-TimeAlignmentTimer* is released;

3> release *pur-Config*;

3> discard previously stored *pur-Config*.

1> if any DAPS bearer is configured:

2> release the MAC entity for the source PCell;

2> for each DAPS bearer:

3> re-establish the RLC entity for the source PCell;

3> release the RLC entity and the associated DTCH logical channel for the source PCell;

3> reconfigure the PDCP entity to release DAPS, as specified in TS 36.323 [8];

2> for each SRB:

3> release the PDCP entity for the source PCell;

3> release the RLC entity and the associated DCCH logical channel for the source PCell;

2> release the physical channel configuration for the source PCell;

1> perform cell selection in accordance with the cell selection process as specified in TS 36.304 [4];

#### 5.3.7.3 Actions following cell selection while T311 is running

Upon selecting a suitable E-UTRA cell, the UE shall:

1> if T309 is running:

2> stop timer T309 for all access categories;

2> perform the actions as specified in 5.3.16.4.

1> if the UE is connected to 5GC and the selected cell is only connected to EPC; or

1> if the UE is connected to EPC and the selected cell is only connected to 5GC:

2> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'RRC connection failure';

1> else:

2> stop timer T311;

2> if the cell selection is triggered by detecting radio link failure of the MCG or handover failure (including intra-E-UTRA handover and mobility from E-UTRA); and

2> if *attemptCondReconf* is configured; and

2> if the selected cell is not configured with *condEventT1*, or the selected cell is configured with *condEventT1* and leaving condition has not been fulfilled; and

2> if the selected cell is one of the target candidate cells in *VarConditionalReconfiguration*:

3> apply the stored *condReconfigurationToApply* of the selected cell and perform the actions as specified in 5.3.5.4;

2> else:

3> if the UE is configured with *attemptCondReconf*:

4> release *uplinkDataCompression*, if configured;

4> suspend all RBs, including RBs configured with NR PDCP, except SRB0;

4> reset MAC;

4> release the MCG SCell(s), if configured, in accordance with 5.3.10.3a;

4> release the SCell group(s), if configured, in accordance with 5.3.10.3d;

4> apply the default physical channel configuration as specified in 9.2.4;

4> for the MCG, apply the default semi-persistent scheduling configuration as specified in 9.2.3;

4> for the MCG, apply the default MAC main configuration as specified in 9.2.2;

4> release *powerPrefIndicationConfig*, if configured and stop timer T340, if running;

4> release *reportProximityConfig*, if configured and clear any associated proximity status reporting timer;

4> release *obtainLocationConfig*, if configured;

4> release *idc-Config*, if configured;

4> release *sps-AssistanceInfoReport*, if configured;

4> release *scg-DeactivationPreferenceConfig*, if configured and stop timer T346, if running;

4> release *measSubframePatternPCell*, if configured;

4> release the entire SCG configuration, if configured, except for the DRB configuration (as configured by *drb-ToAddModListSCG*);

4> if (NG)EN-DC is configured:

5> perform MR-DC release, as specified in TS 38.331[82], clause 5.3.5.10;

5> release *p-MaxEUTRA*, if configured;

5> release *p-MaxUE-FR1*, if configured;

5> release *tdm-PatternConfig* or *tdm-PatternConfig2*, if configured;

4> release *naics-Info* for the PCell, if configured;

4> if connected as an RN and configured with an RN subframe configuration:

5> release the RN subframe configuration;

4> release the LWA configuration, if configured, as described in 5.6.14.3;

4> release the LWIP configuration, if configured, as described in 5.6.17.3;

4> release *delayBudgetReportingConfig*, if configured and stop timer T342, if running;

4> release *bw-PreferenceIndicationTimer*, if configured and stop timer T341, if running;

4> release *overheatingAssistanceConfig* and *overheatingAssistanceConfigForSCG*, if configured and stop timer T345, if running;

4> release *ailc-BitConfig*, if configured;

3> remove all the entries within *VarConditionalReconfiguration*, if any;

3> for each *measId*, that is part of the current UE configuration in *VarMeasConfig*, if the associated *reportConfig* has *condReconfigurationTriggerEUTRA/condReconfigurationTriggerNR* configured:

4> remove the entry with the matching *reportConfigId* from the *reportConfigList* within the *VarMeasConfig*;

4> if the associated *measObjectId* is only associated with *condReconfigurationTriggerEUTRA/condReconfigurationTriggerNR*:

5> remove the entry with the matching *measObjectId* from the *measObjectList* within the *VarMeasConfig*;

4> remove the entry with the matching *measId* from the *measIdList* within the *VarMeasConfig*;

3> start timer T301;

3> apply the *timeAlignmentTimerCommon* included in *SystemInformationBlockType2*;

3> if UE supports timing advance reporting and *ta-Report* is included in *SystemInformationBlockType2 (SystemInformationBlockType2-NB* in NB-IoT):

4> instruct the associated MAC entity to trigger Timing Advance reporting;

3> if the UE is a NB-IoT UE connected to EPC, the UE supports RRC connection re-establishment for the Control Plane CIoT EPS optimisation and AS security has not been activated; and

3> if *cp-reestablishment* is not included in *SystemInformationBlockType2-NB*:

4> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'RRC connection failure';

3> else:

4> initiate transmission of the *RRCConnectionReestablishmentRequest* message in accordance with 5.3.7.4;

NOTE: This procedure applies also if the UE returns to the source PCell.

Upon selecting an inter-RAT cell, the UE shall:

1> if the selected cell is a UTRA cell, and if the UE supports Radio Link Failure Report for Inter-RAT MRO, include *selectedUTRA-CellId* in the *VarRLF-Report* and set it to the physical cell identity and carrier frequency of the selected UTRA cell;

1> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'RRC connection failure';

#### 5.3.7.4 Actions related to transmission of *RRCConnectionReestablishmentRequest* message

If the procedure was initiated due to radio link failure or handover failure, the UE shall:

1> set the *reestablishmentCellId* in the *VarRLF-Report* (*VarRLF-Report-NB* in NB-IoT) to the global cell identity of the selected cell;

The UE shall set the contents of *RRCConnectionReestablishmentRequest* message as follows:

1> except for a NB-IoT UE for which AS security has not been activated, set the *ue-Identity* as follows:

2> set the *c-RNTI* to the C-RNTI used in the source PCell (handover and mobility from E-UTRA failure) or used in the PCell in which the trigger for the re-establishment occurred (other cases);

2> set the *physCellId* to the physical cell identity of the source PCell (handover and mobility from E-UTRA failure) or of the PCell in which the trigger for the re-establishment occurred (other cases);

2> set the *shortMAC-I* to the 16 least significant bits of the MAC-I calculated:

3> over the ASN.1 encoded as per clause 8 (i.e., a multiple of 8 bits) *VarShortMAC-Input* (or *VarShortMAC-Input-NB* in NB-IoT);

3> with the KRRCint key and integrity protection algorithm that was used in the source PCell (handover and mobility from E-UTRA failure) or of the PCell in which the trigger for the re-establishment occurred (other cases); and

3> with all input bits for COUNT, BEARER and DIRECTION set to binary ones;

1> for a NB-IoT UE for which AS security has not been activated, set the *ue-Identity* as follows:

2> request upper layers for calculated ul-NAS-MAC and ul-NAS-Count using the *cellIdentity* indicated in *SystemInformationBlockType1-NB* of the current cell;

2> if the UE is connected to 5GC:

3> set the *truncated5G-S-TMSI* to the truncated 5G-S-TMSI provided by higher layers;

2> else:

3> set the *s-TMSI* to the S-TMSI provided by upper layers;

2> set the *ul-NAS-MAC* to the ul-NAS-MAC value provided by upper layers;

2> set the *ul-NAS-Count* to the ul-NAS-Count value provided by upper layers;

1> set the *reestablishmentCause* as follows:

2> if the re-establishment procedure was initiated due to reconfiguration failure as specified in 5.3.5.5 (the UE is unable to comply with the reconfiguration):

3> set the *reestablishmentCause* to the value *reconfigurationFailure*;

2> else if the re-establishment procedure was initiated due to handover failure as specified in 5.3.5.6 (intra-LTE handover failure) or 5.4.3.5 (inter-RAT mobility from EUTRA failure):

3> set the *reestablishmentCause* to the value *handoverFailure*;

2> else:

3> set the *reestablishmentCause* to the value *otherFailure*;

1> if the UE is a NB-IoT UE:

2> if the UE supports DL channel quality reporting in MSG3 and *cqi-Reporting* is present in *SystemInformationBlockType2-NB*:

3> set the *cqi-NPDCCH* to include the latest results of the downlink channel quality measurements of the carrier where the random access response is received as specified in TS 36.133 [16];

NOTE: The downlink channel quality measurements use measurement period T1 or T2, as defined in TS 36.133 [16].

2> if the UE is connected to EPC, set *earlyContentionResolution* to TRUE;

The UE shall submit the *RRCConnectionReestablishmentRequest* message to lower layers for transmission.

#### 5.3.7.5 Reception of the *RRCConnectionReestablishment* by the UE

NOTE 1: Prior to this, lower layer signalling is used to allocate a C-RNTI. For further details see TS 36.321 [6];

The UE shall:

1> stop timer T301;

1> consider the current cell to be the PCell;

1> except for a NB-IoT UE for which AS security has not been activated:

2> if SRB1 was configured with NR PDCP and the UE is connected to EPC:

3> for SRB1, release the NR PDCP entity and establish an E-UTRA PDCP entity with the current (MCG) security configuration;

NOTE 1a: The UE applies the LTE ciphering and integrity protection algorithms that are equivalent to the previously configured NR security algorithms.

2> else:

3> for SRB1, re-establish the PDCP entity;

2> re-establish RLC for SRB1;

2> perform the radio resource configuration procedure in accordance with the received *radioResourceConfigDedicated* and as specified in 5.3.10.0;

2> resume SRB1;

NOTE 2: E-UTRAN should not transmit any message on SRB1 prior to receiving the *RRCConnectionReestablishmentComplete* message.

2> if UE is connected to EPC, update the KeNB key based on the KASME key to which the current KeNB is associated, using the *nextHopChainingCount* value indicated in the *RRCConnectionReestablishment* message, as specified in TS 33.401 [32];

2> else if UE is connected to 5GC, update the KeNB key based on the KAMF key to which the current KeNB is associated, using the *nextHopChainingCount* value indicated in the *RRCConnectionReestablishment* message, as specified in TS 33.501 [86];

2> store the *nextHopChainingCount* value;

2> derive the KRRCint key associated with the previously configured integrity algorithm, as specified in TS 33.401 [32];

2> derive the KRRCenc key and the KUPenc key associated with the previously configured ciphering algorithm, as specified in TS 33.401 [32];

2> if connected as an RN; or

2> if capable of user plane integrity protection:

3> derive the KUPint key associated with the previously configured integrity algorithm, as specified in TS 33.401 [32];

2> configure lower layers to activate integrity protection using the previously configured algorithm and the KRRCint key immediately, i.e., integrity protection shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;

2> if connected as an RN:

3> configure lower layers to apply integrity protection using the previously configured algorithm and the KUPint key, for subsequently resumed or subsequently established DRBs that are configured to apply integrity protection, if any;

2> configure lower layers to apply ciphering using the previously configured algorithm, the KRRCenc key and the KUPenc key immediately, i.e., ciphering shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;

2> if the UE is not a NB-IoT UE:

3> set the content of *RRCConnectionReestablishmentComplete* message as follows:

4> if the UE has radio link failure or handover failure information available in *VarRLF-Report* and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report*:

5> include the *rlf-InfoAvailable*;

4> if the UE has MBSFN logged measurements available for E-UTRA and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport* and if T330 is not running:

5> include *logMeasAvailableMBSFN*;

4> else if the UE has logged measurements available for E-UTRA and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:

5> include the *logMeasAvailable*;

5> if Bluetooth measurement results are included in the logged measurements the UE has available:

6> include the *logMeasAvailableBT*;

5> if WLAN measurement results are included in the logged measurements the UE has available:

6> include the *logMeasAvailableWLAN*;

4> if the UE has connection establishment failure information available in *VarConnEstFailReport* and if the RPLMN is equal to *plmn-Identity* stored in *VarConnEstFailReport*:

5> include the *connEstFailInfoAvailable*;

4> if the UE has flight path information available:

5> include *flightPathInfoAvailable*;

3> perform the measurement related actions as specified in 5.5.6.1;

3> perform the measurement identity autonomous removal as specified in 5.5.2.2a;

2> else:

3> if the UE supports serving cell idle mode measurements reporting and *servingCellMeasInfo* is present in *SystemInformationBlockType2-NB*:

4> set the *measResultServCell* to include the measurements of the serving cell;

NOTE 2a: The UE includes the latest results of the serving cell measurements as used for cell selection/ reselection evaluation, which are performed in accordance with the performance requirements as specified in TS 36.133 [16].

3> if the UE is connected to EPC:

4> if the UE has radio link failure information available in *VarRLF-Report-NB* and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report-NB*:

5> include the *rlf-InfoAvailable*;

4> if the UE has ANR measurements information available in *VarANR-MeasurementReport-NB* and if the RPLMN is included in *plmn-IdentityList* stored in *VarANR-MeasurementReport-NB*:

5> include the *anr-InfoAvailable*;

2> if the UE is connected to NTN:

3> include *gnss-validityDuration* in accordance with the remaining time of the GNSS validity duration;

3> if UE supports GNSS position fix in RRC\_CONNECTED and *gnss-PositionFixDurationReporting* is present in *SystemInformationBlockType2(-NB)*:

4> include *gnss-PositionFixDuration* in accordance with the time duration required for the UE to acquire a GNSS position;

2> submit the *RRCConnectionReestablishmentComplete* message to lower layers for transmission;

2> if *SystemInformationBlockType15* is broadcast by the PCell:

3> if the UE has transmitted an *MBMSInterestIndication* message during the last 1 second preceding detection of radio link failure:

4> ensure having a valid version of *SystemInformationBlockType15* for the PCell;

4> determine the set of MBMS frequencies of interest in accordance with 5.8.5.3;

4> determine the set of MBMS services of interest in accordance with 5.8.5.3a;

4> initiate transmission of the *MBMSInterestIndication* message in accordance with 5.8.5.4;

2> if *SystemInformationBlockType18* is broadcast by the PCell; and the UE transmitted a *SidelinkUEInformation* message indicating a change of sidelink communication related parameters relevant in PCell (i.e. change of *commRxInterestedFreq* or *commTxResourceReq*, *commTxResourceReqUC* if *SystemInformationBlockType18* includes *commTxResourceUC-ReqAllowed* or *commTxResourceInfoReqRelay* if PCell broadcasts *SystemInformationBlockType19* including *discConfigRelay*) during the last 1 second preceding detection of radio link failure; or

2> if *SystemInformationBlockType19* is broadcast by the PCell; and the UE transmitted a *SidelinkUEInformation* message indicating a change of sidelink discovery related parameters relevant in PCell (i.e. change of *discRxInterest* or *discTxResourceReq*, *discTxResourceReqPS* if *SystemInformationBlockType19* includes *discConfigPS* or *discRxGapReq* or *discTxGapReq* if the UE is configured with *gapRequestsAllowedDedicated* set to *true* or if the UE is not configured with *gapRequestsAllowedDedicated* and *SystemInformationBlockType19* includes *gapRequestsAllowedCommon*) during the last 1 second preceding detection of radio link failure; or

2> if *SystemInformationBlockType21* including *sl-V2X-ConfigCommon* is broadcast by the PCell; and the UE transmitted a *SidelinkUEInformation* message indicating a change of V2X sidelink communication related parameters relevant in PCell (i.e. change of *v2x-CommRxInterestedFreqList* or *v2x-CommTxResourceReq*) during the last 1 second preceding detection of radio link failure:

3> initiate transmission of the *SidelinkUEInformation* message in accordance with 5.10.2.3;

1> for a NB-IoT UE for which AS security has not been activated:

2> validate *dl-NAS-MAC*, as specified in TS 33.401 [32];

2> if *dl-NAS-MAC* check fails:

3> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'RRC connection failure', upon which the procedure ends;

2> except for a UE that only supports the Control Plane CIoT EPS/5GS optimisation:

3> re-establish PDCP for SRB1;

3> re-establish RLC for SRB1;

2> re-establish RLC for SRB1bis;

2> perform the radio resource configuration procedure in accordance with the received *radioResourceConfigDedicated* and as specified in 5.3.10.0;

2> except for a UE that only supports the Control Plane CIoT EPS/5GS optimisation:

3> resume SRB1;

2> resume SRB1bis;

NOTE 3: E-UTRAN should not transmit any message on SRB1bis prior to receiving the *RRCConnectionReestablishmentComplete* message.

2> if the UE supports serving cell idle mode measurements reporting and *servingCellMeasInfo* is present in *SystemInformationBlockType2-NB*:

3> set the *measResultServCell* to include the measurements of the serving cell;

NOTE 4: The UE includes the latest results of the serving cell measurements as used for cell selection/ reselection evaluation, which are performed in accordance with the performance requirements as specified in TS 36.133 [16].

2> if the UE is connected to NTN:

3> include *gnss-validityDuration* in accordance with the remaining time of the GNSS validity duration;

3> if UE supports GNSS position fix in RRC\_CONNECTED and *gnss-PositionFixDurationReporting* is present in *SystemInformationBlockType2(-NB)*:

4> include *gnss-PositionFixDuration* in accordance with the time duration required for the UE to acquire a GNSS position;

2> submit the *RRCConnectionReestablishmentComplete* message to lower layers for transmission;

1> for NB-IoT:

2> if the UE supports connected mode measurements and *connMeasConfig* is present in *SystemInformationBlockType3-NB*:

3> perform measurements as specified in 5.5.8.

1> the procedure ends;

#### 5.3.7.6 T311 expiry

Upon T311 expiry, the UE shall:

1> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'RRC connection failure';

#### 5.3.7.7 T301 expiry or selected cell no longer suitable

The UE shall:

1> if timer T301 expires; or

1> if the selected cell becomes no longer suitable according to the cell selection criteria as specified in TS 36.304 [4]:

2> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'RRC connection failure';

#### 5.3.7.8 Reception of *RRCConnectionReestablishmentReject* by the UE

Upon receiving the *RRCConnectionReestablishmentReject* message, the UE shall:

1> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'RRC connection failure';

### 5.3.8 RRC connection release

#### 5.3.8.1 General



Figure 5.3.8.1-1: RRC connection release, successful

The purpose of this procedure is:

- to release the RRC connection, which includes the release of the established radio bearers as well as all radio resources; or

- to suspend the RRC connection for both suspended RRC connection or RRC\_INACTIVE, which includes the suspension of the established radio bearers;

- to configure, reconfigure or release radio resources for transmission using PUR;

- to complete the UP-EDT procedure and UP transmission using PUR, which includes the release or suspension of the established radio bearers.

#### 5.3.8.2 Initiation

E-UTRAN initiates the RRC connection release procedure to a UE in RRC\_CONNECTED or in RRC\_INACTIVE or to complete UP-EDT or UP transmission using PUR.

#### 5.3.8.3 Reception of the *RRCConnectionRelease* by the UE

The UE shall:

1> except for NB-IoT, BL UEs or UEs in CE, delay the following actions defined in this clause 60 ms from the moment the *RRCConnectionRelease* message was received or optionally when lower layers indicate that the receipt of the *RRCConnectionRelease* message has been successfully acknowledged, whichever is earlier;

1> for BL UEs or UEs in CE, delay the following actions defined in this clause 1.25 seconds from the moment the *RRCConnectionRelease* message was received or optionally when lower layers indicate that the receipt of the *RRCConnectionRelease* message has been successfully acknowledged, whichever is earlier;

1> for NB-IoT, delay the following actions defined in this clause 10 seconds from the moment the *RRCConnectionRelease* message was received or optionally when lower layers indicate that the receipt of the *RRCConnectionRelease* message has been successfully acknowledged, whichever is earlier.

NOTE 0: For BL UEs, UEs in CE and NB-IoT, when STATUS reporting, as defined in TS 36.322 [7], has not been triggered and the UE has sent positive HARQ feedback (ACK), as defined in TS 36.321 [6], the lower layers can be considered to have indicated that the receipt of the *RRCConnectionRelease* message has been successfully acknowledged.

NOTE 0a: For BL UEs, UEs in CE and NB-IoT, when the *RRCConnectionRelease* message is received on a HARQ process with disabled HARQ feedback, and when STATUS reporting, as defined in TS 36.322 [7], has not been triggered, the lower layers can be considered to have indicated that the receipt of the *RRCConnectionRelease* message has been successfully acknowledged.

1> stop T380, if running;

1> if timer T316 is running;

2> stop timer T316;

2> clear the information included in *VarRLF-Report*, if any;

1> for NB-IoT:

2> if the UE has reported *anr-InfoAvailable*, clear *VarANR-MeasConfig-NB* and *VarANR-MeasReport-NB*;

2> if the UE has reported *rlf-InfoAvailable*, clear *VarRLF-Report-NB*;

1> if the *RRCConnectionRelease* message is received in response to an *RRCConnectionResumeRequest* for EDT or for UP transmission using PUR:

2> indicate to upper layers that the suspended RRC connection has been resumed;

2> discard the stored UE AS context and *resumeIdentity*;

2> stop timer T300;

2> stop timer T302, if running;

2> stop timer T303, if running;

2> stop timer T305, if running;

2> stop timer T306, if running;

2> stop timer T308, if running;

2> perform the actions as specified in 5.3.3.7;

2> stop timer T320, if running;

2> stop timer T322, if running;

2> stop timer T323, if running;

1> except for UEs using the Control Plane CIoT 5GS optimisation, if ASsecurity is not activated and if UE is connected to 5GC:

2> ignore any field included in *RRCConnectionRelease* message except *waitTime*;

2> perform the actions upon leaving RRC\_CONNECTED or RRC\_INACTIVE as specified in 5.3.12 with the release cause '*other'* upon which the procedure ends;

1> if the *RRCConnectionRelease* message includes *redirectedCarrierInfo* indicating redirection to *geran, utra-FDD, utra-TDD or utra-TDD-r10*; or

1> if the *RRCConnectionRelease* message includes *idleModeMobilityControlInfo* including *freqPriorityListGERAN* or *freqPriorityListUTRA-FDD* or *freqPriorityListUTRA-TDD*:

2> if AS security has not been activated; and

2> if upper layers indicate that redirect to GERAN or UTRAN without AS security is not allowed (see TS 24.301 [35]):

3> ignore the content of the *RRCConnectionRelease*;

3> perform the actions upon leaving RRC\_CONNECTED or RRC\_INACTIVE as specified in 5.3.12, with release cause 'other', upon which the procedure ends;

1> if AS security has not been activated:

2> ignore the content of *redirectedCarrierInfo*, if included and indicating redirection to *nr*;

2> ignore the content of *idleModeMobilityControlInfo*, if included and including *freqPriorityListNR*;

2> ignore the *altFreqPriorities* and T323, if included;

2> if the UE ignores the content of *redirectedCarrierInfo* or of *idleModeMobilityControlInfo*,or of *altFreqPriorities* and T323:

3> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'other', upon which the procedure ends;

1> if the *RRCConnectionRelease* message includes *redirectedCarrierInfo* indicating redirection to *eutra* and if UE is connected to 5GC:

2> if *cn-Type* is included:

3> after the cell selection, indicate the available CN Type(s) and the received *cn-Type* to upper layers;

NOTE 1: Handling the case if the E-UTRA cell selected after the redirection does not support the core network type specified by the *cn-Type,* is up to UE implementation.

1> if the *RRCConnectionRelease* message includes the *idleModeMobilityControlInfo*:

2> store the cell reselection priority information provided by the *idleModeMobilityControlInfo*;

2> if the *t320* is included:

3> start timer T320, with the timer value set according to the value of *t320*;

1> else if the *RRCConnectionRelease* message includes the *altFreqPriorities*:

2> store the received *altFreqPriorities*;

2> for E-UTRA frequency, apply the alternative cell reselection priority information broadcast in the system information if available, otherwise apply the cell reselection priority broadcast in the system information;

2> for inter-RAT frequency, apply the cell reselection priority broadcast in the system information;

2> if the *t323* is included:

3> start timer T323, with the timer value set according to the value of *t323*;

1> else:

2> apply the cell reselection priority information broadcast in the system information;

1> if the *RRCConnectionRelease* message includes the *releaseMeasIdleConfig*:

2> if timer T331 is running:

3> stop timer T331;

3> perform the actions as specified in 5.6.20.3;

1> if the *RRCConnectionRelease* message includes the *measIdleConfig*:

2> clear *VarMeasIdleConfig* and *VarMeasIdleReport*;

2> store the received *measIdleDuration* in *VarMeasIdleConfig*;

2> start or restart T331 with the value of *measIdleDuration*;

2> if the *measIdleConfig* contains *measIdleCarrierListEUTRA*:

3> store the received *measIdleCarrierListEUTRA* in *VarMeasIdleConfig*;

2> if the *measIdleConfig* contains *measIdleCarrierListNR*:

3> store the received *measIdleCarrierListNR* in *VarMeasIdleConfig*;

2> if the *measIdleConfig* contains *validityAreaList*:

3> store the received *validityAreaList* in *VarMeasIdleConfig*;

NOTE 2: If the *measIdleConfig* contains neither *measIdleCarrierListEUTRA* nor *measIdleCarrierListNR*, UE may receive *measIdleCarrierListEUTRA* and/or *measIdleCarrierListNR* as specified in 5.6.20.1a.

1> for NB-IoT, if the *RRCConnectionRelease* message includes the *anr-MeasConfig*:

2> clear *VarANR-MeasConfig-NB* and *VarANR-MeasReport-NB*;

2> store the received *anr-QualityThreshold* in *VarANR-MeasConfig-NB*;

2> if the *anr-MeasConfig* contains *anr-CarrierList*:

3> store the received *anr-CarrierList* in *VarANR-MeasConfig-NB*;

2> set *plmn-IdentityList* in *VarANR-MeasReport-NB* to include the list of EPLMNs stored by the UE (i.e. includes the RPLMN);

2> set *servCellIdentity* in *VarANR-MeasReport-NB* to the global cell identity of the Pcell;

2> start performing ANR measurements as specified in 5.6.24;

1> if the *RRCConnectionRelease* message includes the *pur-Config*:

2> if *pur-Config* is set to *setup*:

3> store or replace the PUR configuration provided by the *pur-Config*;

3> if *pur-TimeAlignmentTimer* is included in the received *pur-Config*:

4> configure lower layers in accordance with *pur-TimeAlignmentTimer*;

3> else:

4> if *pur-TimeAlignmentTimer* is configured, indicate to lower layers that *pur-TimeAlignmentTimer* is released;

3> if *pur-RSRP-ChangeThreshold* (*pur-NRSRP-ChangeThreshold* in NB-IoT) is included in the received *pur-Config* and set to *setup*; or

3> if *pur-RSRP-ChangeThreshold* (*pur-NRSRP-ChangeThreshold* in NB-IoT) is configured and *pur-TimeAlignmentTimer* is included in the received *pur-Config*:

4> store or replace the serving cell reference (N)RSRP value with the current serving cell (N)RSRP value (see 5.3.3.19);

3> start maintenance of PUR occasions as specified in 5.3.3.20;

2> else:

3> if *pur-TimeAlignmentTimer* is configured, indicate to lower layers that *pur-TimeAlignmentTimer* is released;

3> release *pur-Config*, if configured;

3> discard previously stored *pur-Config*;

1> for NB-IoT, if the *RRCConnectionRelease* message includes the *redirectedCarrierInfo*:

2> if the *redirectedCarrierOffsetDedicated* isincluded in the *redirectedCarrierInfo*:

3> store the dedicated offsetfor the frequency in *redirectedCarrierInfo*;

3> start timer T322, with the timer value set according to the value of *T322* in *redirectedCarrierInfo*;

1> if the *releaseCause* received in the *RRCConnectionRelease* message indicates *loadBalancingTAURequired*:

2> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'load balancing TAU required';

1> else if the *releaseCause* received in the *RRCConnectionRelease* message indicates *cs-FallbackHighPriority*:

2> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'CS Fallback High Priority';

1> else:

2> if the *extendedWaitTime* is present; and

2> if the UE supports delay tolerant access or the UE is a NB-IoT UE:

3> forward the *extendedWaitTime* to upper layers;

2> if the *extendedWaitTime-CPdata* is present and the NB-IoT UE only supports the Control Plane CIoT EPS optimisation:

3> forward the *extendedWaitTime-CPdata* to upper layers;

2> if the *releaseCause* received in the *RRCConnectionRelease* message indicates *rrc-Suspend*:

3> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'RRC suspension';

2> else if *rrc-InactiveConfig* is included:

3> perform the actions upon entering RRC\_INACTIVE as specified in 5.3.8.7;

2> else:

3> perform the actions upon leaving RRC\_CONNECTED or RRC\_INACTIVE as specified in 5.3.12, with release cause 'other';

#### 5.3.8.4 T320 expiry

The UE shall:

1> if T320 expires:

2> if stored, discard the cell reselection priority information provided by the *idleModeMobilityControlInfo* or inherited from another RAT;

2> apply the cell reselection priority information broadcast in the system information;

#### 5.3.8.5 T322 expiry or stop

The UE shall:

1> if T322 expires or is stopped:

2> discard the *redirectedCarrierOffsetDedicated* provided in *RRCConnectionRelease* message;

#### 5.3.8.6 UE actions upon receiving the expiry of *DataInactivityTimer*

Upon receiving the expiry of *DataInactivityTimer* from lower layers while in RRC\_CONNECTED, the UE shall:

1> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'RRC connection failure';

#### 5.3.8.7 UE actions upon entering RRC\_INACTIVE

Upon entering RRC\_INACTIVE, the UE shall:

1> reset MAC and release the default MAC configuration if any;

1> stop all timers that are running except T302, T309, T320, T323, T325 and T330;

1> re-establish RLC entities for all SRBs and DRBs;

1> if the *RRCConnectionRelease* message is including the *waitTime*:

2> start timer T302, with the timer value set according to the *waitTime*;

2> inform the upper layer that access barring is applicable for all access categories except categories '0' and '2';

1> if T309 is running:

2> stop timer T309 for all access categories;

2> perform the actions as specified in 5.3.16.4.

1> apply the received *rrc-InactiveConfig*;

1> derive the DRX cycle as specified in TS 36.304 [4], clause 7.1;

1> if the *RRCConnectionRelease* message was received in response to an *RRCConnectionResumeRequest*:

2> in the stored UE Inactive AS context:

3> replace the KeNB and KRRCint keys with the current KeNB and KRRCint keys;

3> replace the C-RNTI with the temporary C-RNTI which the UE has used to receive the *RRCConnectionRelease* message;

3> replace the *cellIdentity* with the *cellIdentity* of the PCell at the time the UE has received the *RRCConnectionRelease* message;

3> replace the previously stored physical cell identitywith the physical cell identity of the PCell at the time the UE has received the *RRCConnectionRelease* message;

1> else:

2> store in the UE Inactive AS Context, the current KeNB and KRRCint keys, the ROHC state, the stored QoS flow to DRB mapping rules, the C-RNTI used in the source PCell, the *cellIdentity* and the physical cell identity of the source PCell, the *spCellConfigCommon* within *ReconfigurationWithSync* of the PSCell (if configured), and all other parameters configured;

1> if the *periodic-RNAU-timer* is included:

2> start timer T380, with the timer value set to the *periodic-RNAU-timer*;

1> suspend all SRB(s) and DRB(s), except SRB0;

1> indicate PDCP suspend to lower layers of all DRBs;

1> indicate the suspension of the RRC connection to upper layers;

1> enter RRC\_INACTIVE and perform procedures as specified in TS 36.304 [4], clause 5.2.7;

Upon selecting to an inter-RAT cell or switching to another CN type, the UE shall:

1> perform the actions upon leaving RRC\_INACTIVE as specified in 5.3.12, with release cause 'other';

#### 5.3.8.8 T323 expiry

The UE shall:

1> if T323 expires:

2> if stored, discard the *altFreqPriorities* provided by the *RRCConnectionRelease*;

2> apply the cell reselection priority information broadcast in the system information via *cellReselectionPriority* and *cellReselectionSubPriority*;

### 5.3.9 RRC connection release requested by upper layers

#### 5.3.9.1 General

The purpose of this procedure is to release the RRC connection. Access to the current PCell may be barred as a result of this procedure.

#### 5.3.9.2 Initiation

The UE initiates the procedure when upper layers request the release of the RRC connection as specified in TS 24. 301 [35] for E-UTRA/EPC and TS 24.501 [95] for E-UTRA/5GC. The UE shall not initiate the procedure for power saving purposes.

The UE shall:

1> if the upper layers indicate barring of the PCell:

2> treat the PCell used prior to entering RRC\_IDLE as barred according to TS 36.304 [4];

1> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'other';

### 5.3.10 Radio resource configuration

#### 5.3.10.0 General

The UE shall:

1> if the received *radioResourceConfigDedicated* includes the *srb-ToAddModList*:

2> perform the SRB addition or reconfiguration as specified in 5.3.10.1;

1> if the received *radioResourceConfigDedicated* includes the *drb-ToReleaseList*:

2> perform DRB release as specified in 5.3.10.2;

1> if the received *radioResourceConfigDedicated* includes the *drb-ToAddModList*:

2> perform DRB addition or reconfiguration as specified in 5.3.10.3;

1> if the received *radioResourceConfigDedicated* includes the *mac-MainConfig*:

2> perform MAC main reconfiguration as specified in 5.3.10.4;

1> if the received *radioResourceConfigDedicated* includes *sps-Config*:

2> perform SPS reconfiguration according to 5.3.10.5;

1> if the received *radioResourceConfigDedicated* includes the *physicalConfigDedicated*:

2> reconfigure the physical channel configuration as specified in 5.3.10.6.

1> if the received *radioResourceConfigDedicated* includes the *rlf-TimersAndConstants* or the *rlf-TimersAndConstantsMCG-Failure*:

2> reconfigure the values of timers and constants as specified in 5.3.10.7;

1> if the received *radioResourceConfigDedicated* includes the *measSubframePatternPCell*:

2> reconfigure the time domain measurement resource restriction for the serving cell as specified in 5.3.10.8;

1> if the received *radioResourceConfigDedicated* includes the *naics-Info*:

2> perform NAICS neighbour cell information reconfiguration for the PCell as specified in 5.3.10.13;

1> ifthe received *RadioResourceConfigDedicatedPSCell* includes the *naics-Info*:

2> perform NAICS neighbour cell information reconfiguration for the PSCell as specified in 5.3.10.13;

1> ifthe received *RadioResourceConfigDedicatedSCell-r10* includes the *naics-Info*:

2> perform NAICS neighbour cell information reconfiguration for the SCell as specified in 5.3.10.13;

1> if the received *radioResourceConfigDedicated* includes the *srb-ToReleaseList*:

2> perform SRB release as specified in 5.3.10.17;

1> ifthe received *radioResourceConfigDedicated* includes the *schedulingRequestConfig*:

2> perform scheduling request reconfiguration for the SCell as specified in 5.3.10.18;

1> if the UE has initiated transmission using PUR in accordance with conditions in 5.3.3.1c:

2> if the received *radioResourceConfigDedicated* includes *newUE-Identity*:

3> apply the value of the *newUE-Identity* as the C-RNTI;

2> else:

3> apply the value of the *pur-RNTI* as the C-RNTI.

#### 5.3.10.1 SRB addition/ modification

The UE shall:

1> if the UE is a NB-IoT UE and SRB1 is not established; or

1> for each *srb-Identity* value included in the *srb-ToAddModList* that is not part of the current UE configuration (SRB establishment):

2> if the UE is not a NB-IoT UE that only supports the Control Plane CIoT EPS optimisation or the Control Plane CIoT 5GS optimisation:

3> apply the specified configuration defined in 9.1.2 for the corresponding SRB;

3> establish a primary (MCG) RLC entity in accordance with the received *rlc-Config*;

3> establish a primary (MCG) DCCH logical channel in accordance with the received *logicalChannelConfig* andwith the logical channel identity set in accordance with 9.1.2;

3> if the same *srb-Identity* is included in NR *srb-ToAddModList*:

4> after processing *nr-RadioBearerConfig1* and *nr-RadioBearerConfig2* if present in the *RRCConnectionReconfiguration* message which triggered the execution of the SRB addition/modification procedure, associate MCG RLC bearer with the NR PDCP entity associated with the same value of *srb-Identity* in the current UE configuraton as specified in TS 38.331 [82];

3> else:

4> establish a PDCP entity and configure it with the current (MCG) security configuration, if applicable;

3> if *rlc-BearerConfigSecondary* is received with value *setup*:

4> establish a secondary MCG RLC entity or entities and an associated DCCH logical channel in accordance with the received *rlc-BearerConfigSecondary* and associate these with the E-UTRA PDCP entity with the same value of *srb-Identity* within the current UE configuration;

4> configure the E-UTRA PDCP entity to activate duplication with *t-Reordering* set to *infinity*;

2> if the UE is a NB-IoT UE:

3> apply the specified configuration defined in 9.1.2 for SRB1bis;

3> establish an (MCG) RLC entity in accordance with the received *rlc-Config*;

3> establish a (MCG) DCCH logical channel in accordance with the received *logicalChannelConfig* andwith the logical channel identity set in accordance with 9.1.2.1a;

1> if the UE is a NB-IoT UE and SRB1 is established; or

1> for each *srb-Identity* value included in the *srb-ToAddModList* that is part of the current UE configuration (SRB reconfiguration):

2> if *pdcp-verChange* is included (i.e, NR PDCP to E-UTRA PDCP change):

3> establish an (E-UTRA) PDCP entity and configure it with the current (MCG) security configuration;

NOTE 1: The UE applies the LTE ciphering and integrity protection algorithms that are equivalent to the previously configured NR security algorithms.

3> associate the primary RLC bearer of this SRB with the established PDCP entity;

3> release the NR PDCP entity of this SRB;

2> reconfigure the primary RLC entity in accordance with the received *rlc-Config*;

2> reconfigure the primary DCCH logical channel in accordance with the received *logicalChannelConfig*;

2> if *rlc-BearerConfigSecondary* is included with value *release*:

3> release the secondary MCG RLC entity or entities as well as the associated DCCH logical channel;

2> if *rlc-BearerConfigSecondary* is received with value *setup*:

3> if the current SRB configuration does not include a secondary RLC bearer:

4> establish a secondary MCG RLC entity or entities and an associated DCCH logical channel in accordance with the received *rlc-BearerConfigSecondary* and associate these with the E-UTRA PDCP entity with the same value of *srb-Identity* within the current UE configuration;

4> configure the E-UTRA PDCP entity to activate duplication with *t-Reordering* set to *infinity*;

3> else:

4> reconfigure the secondary MCG RLC entity or entities and the associated DCCH logical channel in accordance with the received *rlc-BearerConfigSecondary*;

NOTE 2: In case of SRB reconfiguration at a DAPS HO, the reconfiguration is applied to the entities/resources for the target MCG.

#### 5.3.10.1a SCG RLC bearer addition or reconfiguration for SRBs

The UE shall:

1> for each *srb-Identity* value included in the *srb-ToAddModListSCG* that is not part of the current UE E-UTRA SCG configuration (i.e. SCG RLC bearer establishment):

2> apply the specified configuration defined in 9.1.2 for the corresponding SRB;

2> establish an (SCG) RLC entity in accordance with the received *rlc-Config*;

2> establish a (SCG) DCCH logical channel in accordance with the received *logicalChannelConfig* andwith the logical channel identity set in accordance with 9.1.2;

2> if the UE is configured with DC:

3> associate the established SCG RLC bearer and DCCH logical channel with the E-UTRA PDCP entity with the same value of *srb-Identity* within the current UE configuration;

3> configure the E-UTRA PDCP entity to activate duplication with *t-Reordering* set to *infinity*;

2> else (i.e. the UE is configured with NE-DC):

3> associate the SCG RLC bearer and DCCH logical channel with the NR PDCP entity, i.e. as configured by NR see TS 38.331 [82], identified with the same *srb-Identity* within the current UE configuration;

1> for each *srb-Identity* value included in the *srb-ToAddModListSCG* that is part of the current UE SCG configuration (SCG RLC bearer reconfiguration):

2> re-establish the SCG RLC entity, if *reestablishRLC* is included;

2> reconfigure the RLC entity in accordance with the received *rlc-Config*;

2> reconfigure the DCCH logical channel in accordance with the received *logicalChannelConfig*;

#### 5.3.10.2 DRB release

The UE shall:

1> for each *drb-Identity* value included in the *drb-ToReleaseList* or *drb-ToReleaseListSCG* that is part of the current UE configuration (DRB or RLC bearer release); or

1> for each *drb-identity* value that is to be released as the result of full configuration option according to 5.3.5.8:

2> if release of this DRB is result of full configuration option according to 5.3.5.8:

3> release the E-UTRA or NR PDCP entity;

2> else if this DRB is configured with *pdcp-config*:

3> release the E-UTRA PDCP entity;

2> else (release the RLC bearer configuration of MCG or of SCG):

3> re-establish the RLC entity as specified in 36.322 for this DRB;

2> release the RLC entity or entities;

2> release the DTCH logical channel;

2> if the UE is connected to EPC:

3> if the DRB was configured with *pdcp-config* and new DRB is not added with same *eps-BearerIdentity* in *drb-ToAddModList* nor *nr-radioBearerConfig1* nor in *nr-radioBearerConfig2*:

4> if the procedure was triggered due to handover:

5> indicate the release of the DRB and the *eps-BearerIdentity* of the released DRB to upper layers after successful handover;

4> else:

5> indicate the release of the DRB and the *eps-BearerIdentity* of the released DRB to upper layers immediately.

2> if the UE is a NB-IoT UE connected to 5GC:

3> if the DRB was configured with *pdu-session* and new DRB is not added with same *pdu-Session* in *drb-ToAddModList*:

4> indicate the release of the DRB and the *pdu-Session* of the released DRB to upper layers immediately;

NOTE 1: The UE does not consider the message as erroneous if the *drb-ToReleaseList* includes any *drb-Identity* value that is not part of the current UE configuration.

NOTE 2: The association of *eps-BearerIdentity* to an NR PDCP configuration as defined in TS 38.331 [82] can be included in the same message that releases an DRB associated to the same *eps-BearerIdentity*.

#### 5.3.10.3 DRB addition/ modification

The UE shall:

1> for each *drb-Identity* value included in the *drb-ToAddModList* that is not part of the current UE configuration (DRB establishment including the case when full configuration option is used):

2> if the concerned entry of *drb-ToAddModList* includes the *drb-TypeLWA* set to *TRUE* (i.e. add LWA DRB):

3> perform the LWA specific DRB addition or reconfiguration as specified in 5.3.10.3a2;

2> if the concerned entry of *drb-ToAddModList* includes the *drb-TypeLWIP* (i.e. add LWIP DRB):

3> perform LWIP specific DRB addition or reconfiguration as specified in 5.3.10.3a3;

2> else if *drb-ToAddModListSCG* is not received or does not include the *drb-Identity* value (i.e. add MCG DRB or MCG RLC bearer):

3> if *pdcp-Config* is received, establish a PDCP entity and configure it with the current MCG security configuration and in accordance with the received *pdcp-Config*;

3> if *rlc-Config* is received, establish a (primary) MCG RLC entity or entities in accordance with the received rlc-Config;

3> if *logicalChannelIdentity* and *logicalChannelConfig* are received, establish a (primary) MCG DTCH logical channel in accordance with the received *logicalChannelIdentity* and the received *logicalChannelConfig*;

3> if *rlc-BearerConfigSecondary* is received with value *setup*:

4> establish a secondary MCG RLC entity or entities and an associated DTCH logical channel in accordance with the received *rlc-BearerConfigSecondary* and associate these with the E-UTRA PDCP entity with the same value of *drb-Identity* within the current UE configuration;

3> if *pdcp-Config* is not received, after processing *nr-RadioBearerConfig1* and *nr-RadioBearerConfig2* if present in the *RRCConnectionReconfiguration* message which triggered the execution of the DRB addition/modification procedure, associate MCG RLC bearer with the NR PDCP entity associated with the same value of *drb-Identity* in the current UE configuration as specified in TS 38.331 [82];

2> if the UE is a NB-IoT UE connected to 5GC:

3> if *cipheringDisabled* is included in *pdcp-Config*:

4> instruct the PDCP entity not to apply ciphering;

3> if a DRB was configured with the same *pdu-Session* (fullConfig):

4> associate the established DRB with corresponding included *pdu-Session*;

3> else if the entry of *drb-ToAddModList* includes *pdcp-config* (establishment of bearer):

4> indicate the establishment of the DRB(s) and the *pdu-Session* of the established DRB(s) to upper layers;

2> else:

3> if a DRB was configured with the same *eps-BearerIdentity* (fullConfig or change to E-UTRA PDCP):

4> associate the established DRB with corresponding included *eps-BearerIdentity*;

3> else if the entry of *drb-ToAddModList* includes *pdcp-config* (establishment of bearer with E-UTRA PDCP):

4> indicate the establishment of the DRB(s) and the *eps-BearerIdentity* of the established DRB(s) to upper layers;

1> for each *drb-Identity* value included in the *drb-ToAddModList* that is part of the current UE configuration (DRB reconfiguration):

2> if the DRB indicated by *drb-Identity* is an LWA DRB (i.e. LWA to LTE only or reconfigure LWA DRB):

3> perform the LWA specific DRB reconfiguration as specified in 5.3.10.3a2;

2> else if the concerned entry of *drb-ToAddModList* includes the *drb-TypeLWA* set to *TRUE* (i.e. LTE only to LWA DRB):

3> perform the LWA specific DRB reconfiguration as specified in 5.3.10.3a2;

2> if the concerned entry of *drb-ToAddModList* includes the *drb-TypeLWIP* (i.e. add or reconfigure LWIP DRB):

3> perform LWIP specific DRB addition or reconfiguration as specified in 5.3.10.3a3;

2> if *drb-ToAddModListSCG* is not received or does not include the *drb-Identity* value:

3> if the DRB indicated by *drb-Identity* is an MCG DRB or configured with MCG RLC bearer (reconfigure MCG RLC bearer or reconfigure MCG DRB):

4> if the *pdcp-Config* is included:

5> reconfigure the PDCP entity in accordance with the received *pdcp-Config*;

4> if the *rlc-Config* is included:

5> if *reestablishRLC* is received:

6> re-establish the primary RLC entity of this DRB;

6> if the *logicalChannelIdentity* is included and the DRB indicated by *drb-Identity* is configured with MCG RLC bearer (reconfigure logical channel identity of MCG RLC bearer):

7> reconfigure the primary DTCH logical channel identity in accordance with the received *logicalChannelIdentity*;

5> reconfigure the primary RLC entity or entities in accordance with the received *rlc-Config*;

4> if the *logicalChannelConfig* is included:

5> reconfigure the primary DTCH logical channel in accordance with the received *logicalChannelConfig*;

4> if *rlc-BearerConfigSecondary* is included with value *release*:

5> release the secondary MCG RLC entity or entities as well as the associated DTCH logical channel;

4> if *rlc-BearerConfigSecondary* is included with value *setup*;

5> if the current DRB configuration does not include a secondary RLC bearer:

6> establish a secondary MCG RLC entity or entities and an associated DTCH logical channel in accordance with the received *rlc-BearerConfigSecondary* and associate these with the E-UTRA PDCP entity with the same value of *drb-Identity* within the current UE configuration;

5> else:

6> reconfigure the secondary MCG RLC entity or entities and the associated DTCH logical channel in accordance with the received *rlc-BearerConfigSecondary*;

NOTE 1: Removal and addition of DRB with *pdcp-Config* with the same *drb-Identity* in a single *radioResourceConfigDedicated* is not supported. In case *drb-Identity* is removed and added due to handover or re-establishment with the full configuration option, the eNB can use the same value of *drb-Identity*.

NOTE 2: In case of DRB reconfiguration at a DAPS HO, the reconfiguration is applied to the entities/resources for the target MCG

#### 5.3.10.3a1 DC specific DRB addition or reconfiguration

For the *drb-Identity* value for which this procedure is initiated, the UE shall:

1> if *drb-ToAddModListSCG* is received and includes the *drb-Identity* value; and *drb-Identity* value is not part of the current UE configuration (i.e. DC specific DRB establishment):

2> if *drb-ToAddModList* is received and includes the *drb-Identity* value (i.e. add split DRB):

3> establish a PDCP entity and configure it with the current MCG security configuration and in accordance with the *pdcp-Config* included in *drb-ToAddModList*;

3> establish an MCG RLC entity and an MCG DTCH logical channel in accordance with the *rlc-Config, logicalChannelIdentity* and *logicalChannelConfig* included in *drb-ToAddModList*;

3> establish an SCG RLC entity and an SCG DTCH logical channel in accordance with the *rlc-ConfigSCG, logicalChannelIdentitySCG* and *logicalChannelConfigSCG* included in *drb-ToAddModListSCG*;

2> else (i.e. add SCG DRB):

3> establish a PDCP entity and configure it with the current SCG security configuration and in accordance with the *pdcp-Config* included in *drb-ToAddModListSCG*;

3> establish a primary SCG RLC entity or entities and a primary SCG DTCH logical channel in accordance with the *rlc-ConfigSCG, logicalChannelIdentitySCG* and *logicalChannelConfigSCG* included in *drb-ToAddModListSCG*;

3> if *rlc-BearerConfigSecondary* is included with value *setup*;

4> establish a secondary SCG RLC entity or entities and an associated DTCH logical channel in accordance with the received *rlc-BearerConfigSecondary* and associate these with the E-UTRA PDCP entity with the same value of *srb-Identity* within the current UE configuration;

2> indicate the establishment of the DRB(s) and the *eps-BearerIdentity* of the established DRB(s) to upper layers;

1> else (i.e. DC specific DRB modification; *drb-ToAddModList* and/ or *drb-ToAddModListSCG* received):

2> if the DRB indicated by *drb-Identity* is a split DRB:

3> if *drb-ToAddModList* is received and includes the *drb-Identity* value, while for this entry *drb-TypeChange* is included and set to *toMCG* (i.e. split to MCG):

4> release the SCG RLC entity or entities and the SCG DTCH logical channel(s);

4> reconfigure the PDCP entity in accordance with the *pdcp-Config*, if included in *drb-ToAddModList*;

4> reconfigure the primary MCG RLC entity and/ or the primary MCG DTCH logical channel in accordance with the *rlc-Config* and *logicalChannelConfig*, if included in *drb-ToAddModList*;

4> if *rlc-BearerConfigSecondary* is included with value *setup*;

5> establish a secondary MCG RLC entity or entities and an associated DTCH logical channel in accordance with the received *rlc-BearerConfigSecondary* and associate these with the E-UTRA PDCP entity with the same value of *srb-Identity* within the current UE configuration;

3> else (i.e. reconfigure split):

4> reconfigure the PDCP entity in accordance with the *pdcp-Config*, if included in *drb-ToAddModList*;

4> reconfigure the MCG RLC entity and/ or the MCG DTCH logical channel in accordance with the *rlc-Config* and *logicalChannelConfig*, if included in *drb-ToAddModList*;

4> reconfigure the SCG RLC entity and/ or the SCG DTCH logical channel in accordance with the *rlc-ConfigSCG* and *logicalChannelConfigSCG*, if included in *drb-ToAddModListSCG*;

2> if the DRB indicated by *drb-Identity* is an SCG DRB:

3> if *drb-ToAddModList* is received and includes the *drb-Identity* value, while for this entry *drb-TypeChange* is included and set to *toMCG* (i.e. SCG to MCG):

4> reconfigure the PDCP entity with the current MCG security configuration and in accordance with the *pdcp-Config*, if included in *drb-ToAddModList*;

4> reconfigure the SCG RLC entity or entities (both primary and secondary, if configured) and the SCG DTCH logical channel (both primary and secondary, if configured) to be an MCG RLC entity or entities and an MCG DTCH logical channel;

4> reconfigure the primary MCG RLC entity or entities and/ or the primary MCG DTCH logical channel in accordance with the *rlc-Config, logicalChannelIdentity* and *logicalChannelConfig*, if included in *drb-ToAddModList*;

4> if *rlc-BearerConfigSecondary* is included with value *release*:

5> release the secondary MCG RLC entity or entities as well as the associated DTCH logical channel;

4> if *rlc-BearerConfigSecondary* is included with value *setup*;

5> if the current DRB configuration does not include a secondary RLC bearer:

6> establish a secondary MCG RLC entity or entities and an associated DTCH logical channel in accordance with the received *rlc-BearerConfigSecondary* and associate these with the E-UTRA PDCP entity with the same value of *srb-Identity* within the current UE configuration;

5> else:

6> reconfigure the secondary MCG RLC entity or entities and the associated DTCH logical channel in accordance with the received *rlc-BearerConfigSecondary*;

3> else (i.e. *drb-ToAddModListSCG* is received and includes the *drb-Identity* value i.e. reconfigure SCG):

4> reconfigure the PDCP entity in accordance with the *pdcp-Config*, if included in *drb-ToAddModListSCG*;

4> reconfigure the primary SCG RLC entity or entities and/ or the primary SCG DTCH logical channel in accordance with the *rlc-ConfigSCG* and *logicalChannelConfigSCG*, if included in *drb-ToAddModListSCG*;

4> if *rlc-BearerConfigSecondary* is included with value *release*:

5> release the secondary SCG RLC entity or entities as well as the associated DTCH logical channel;

4> if *rlc-BearerConfigSecondary* is included with value *setup*;

5> if the current DRB configuration does not include a secondary RLC bearer:

6> establish a secondary SCG RLC entity or entities and an associated DTCH logical channel in accordance with the received *rlc-BearerConfigSecondary* and associate these with the E-UTRA PDCP entity with the same value of *srb-Identity* within the current UE configuration;

5> else:

6> reconfigure the secondary SCG RLC entity or entities and the associated DTCH logical channel in accordance with the received *rlc-BearerConfigSecondary*;

2> if the DRB indicated by *drb-Identity* is an MCG DRB:

3> if *drb-ToAddModListSCG* is received and includes the *drb-Identity* value, while for this entry *drb-Type* is included and set to *split* (i.e. MCG to split):

4> reconfigure the PDCP entity in accordance with the *pdcp-Config*, if included in *drb-ToAddModList*;

4> reconfigure the primary MCG RLC entity and/ or the primary MCG DTCH logical channel in accordance with the *rlc-Config* and *logicalChannelConfig*, if included in *drb-ToAddModList*;

4> if *rlc-BearerConfigSecondary* is included with value *release*:

5> release the secondary MCG RLC entity or entities as well as the associated DTCH logical channel;

4> establish an SCG RLC entity and an SCG DTCH logical channel in accordance with the *rlc-ConfigSCG, logicalChannelIdentitySCG* and *logicalChannelConfigSCG*, included in *drb-ToAddModListSCG*;

3> else (i.e. *drb-Type* is included and set to *scg* i.e. MCG to SCG):

4> reconfigure the PDCP entity with the current SCG security configuration and in accordance with the *pdcp-Config*, if included in *drb-ToAddModListSCG*;

4> reconfigure the MCG RLC entity or entities (both primary and secondary, if configured) and the MCG DTCH logical channel (both primary and secondary, if configured) to be an SCG RLC entity or entities and an SCG DTCH logical channel;

4> reconfigure the primary SCG RLC entity or entities and/ or the primary SCG DTCH logical channel in accordance with the *rlc-ConfigSCG*, *logicalChannelIdentitySCG* and *logicalChannelConfigSCG*, if included in *drb-ToAddModListSCG*;

4> if *rlc-BearerConfigSecondary* is included with value *release*:

5> release the secondary SCG RLC entity or entities as well as the associated DTCH logical channel;

4> if *rlc-BearerConfigSecondary* is included with value *setup*;

5> if the current DRB configuration does not include a secondary RLC bearer:

6> establish a secondary SCG RLC entity or entities and an associated DTCH logical channel in accordance with the received *rlc-BearerConfigSecondary* and associate these with the E-UTRA PDCP entity with the same value of *srb-Identity* within the current UE configuration;

5> else:

6> reconfigure the secondary SCG RLC entity or entities and the associated DTCH logical channel in accordance with the received *rlc-BearerConfigSecondary*;

#### 5.3.10.3a2 LWA specific DRB addition or reconfiguration

For the *drb-Identity* value for which this procedure is initiated, the UE shall:

1> if the *drb-Identity* value is not part of the current UE configuration (i.e. add LWA DRB):

2> establish a PDCP entity and configure it with the current security configuration and in accordance with the *pdcp-Config* included in *drb-ToAddModList*;

2> establish an RLC entity and an DTCH logical channel in accordance with the *rlc-Config, logicalChannelIdentity* and *logicalChannelConfig* included in *drb-ToAddModList*;

2> enable data handling for this DRB at the LWAAP entity;

2> if *lwa-WLAN-AC* is configured:

3> apply the received *lwa-WLAN-AC* when performing transmissions of packets for this DRB over WLAN;

2> indicate the establishment of the DRB and the *eps-BearerIdentity* of the established DRB to upper layers;

1> else if the DRB indicated by *drb-Identity* is not an LWA DRB (i.e. LTE only to LWA DRB):

2> reconfigure the PDCP entity in accordance with the *pdcp-Config*, if included in *drb-ToAddModList*;

2> reconfigure the RLC entity and/ or the DTCH logical channel in accordance with the *rlc-Config* and *logicalChannelConfig*, if included in *drb-ToAddModList*;

2> enable data handling for this DRB at the LWAAP entity;

2> if *lwa-WLAN-AC* is configured:

3> apply the received *lwa-WLAN-AC* when performing transmissions of packets for this DRB over WLAN;

1> else if the concerned entry of *drb-ToAddModList* includes the *drb-TypeLWA* set to *FALSE* (i.e. LWA to LTE only DRB):

2> reconfigure the PDCP entity in accordance with the *pdcp-Config*, if included in *drb-ToAddModList*;

2> reconfigure the RLC entity and/ or the DTCH logical channel in accordance with the *rlc-Config* and *logicalChannelConfig*, if included in *drb-ToAddModList*;

2> perform PDCP data recovery as specified in TS 36.323 [8] if bearer is configured with RLC AM;

2> disable data handling for this DRB at the LWAAP entity;

1> else (i.e. reconfigure LWA DRB):

2> reconfigure the PDCP entity in accordance with the *pdcp-Config*, if included in *drb-ToAddModList*;

2> reconfigure the RLC entity and/ or the DTCH logical channel in accordance with the *rlc-Config* and *logicalChannelConfig*, if included in *drb-ToAddModList*;

2> if *lwa-WLAN-AC* is configured:

3>apply the received *lwa-WLAN-AC* when performing transmissions of packets for this DRB over WLAN;

#### 5.3.10.3a3 LWIP specific DRB addition or reconfiguration

For the *drb-Identity* value for which this procedure is initiated, the UE shall:

1> if the *drb-TypeLWIP* is set to *lwip*:

2> indicate to higher layers to use LWIP resources in both UL and DL for the DRB associated with the *drb-Identity*;

2> if *lwip-DL-Aggregation* is set to TRUE:

3> indicate to higher layers to apply decoding of LWIPEP header with GRE sequence number for both LTE and WLAN DL reception for the DRB associated with the *drb-Identity*;

2> if *lwip-DL-Aggregation* is set to FALSE:

3> indicate to higher layers to stop decoding of LWIPEP header with GRE sequence number for both LTE and WLAN DL reception for the DRB associated with the *drb-Identity*;

2> if *lwip-UL-Aggregation* is set to TRUE:

3> indicate to higher layers to insert LWIPEP header with GRE sequence number for both LTE and WLAN UL transmissions for the DRB associated with the *drb-Identity*;

2> if *lwip-UL-Aggregation* is set to FALSE:

3> indicate to higher layers to stop inserting LWIPEP header with GRE sequence number for both LTE and WLAN UL transmissions for the DRB associated with the *drb-Identity*;

1> if the *drb-TypeLWIP* is set to *lwip-DL-only*:

2> indicate to higher layers to use LWIP resources in the DL only for the DRB associated with the *drb-Identity*;

2> if *lwip-DL-Aggregation* is set to TRUE:

3> indicate to higher layers to apply decoding of LWIPEP header with GRE sequence number for both LTE and WLAN DL reception for the DRB associated with the *drb-Identity*;

1> if the *drb-TypeLWIP* is set to *lwip-UL-only*:

2> indicate to higher layers to use LWIP resources in the UL only for the DRB associated with the *drb-Identity*;

2> if *lwip-UL-Aggregation* is set to TRUE:

3> indicate to higher layers to insert LWIPEP header with GRE sequence number for both LTE and WLAN UL transmissions for the DRB associated with the *drb-Identity*;

1> if the *drb-TypeLWIP* is set to *eutran*:

2> indicate to higher layers to stop using LWIP resources for the DRB associated with the *drb-Identity*;

#### 5.3.10.3a4 SCG RLC bearer addition or reconfiguration for DRBs in NE-DC

The UE shall:

1> for each *drb-Identity* value included in *drb-ToAddModListSCG*:

2> if *drb-Identity* value is not part of the current UE E-UTRA SCG configuration (SCG RLC bearer establishment):

3> establish an SCG RLC entity or entities and an SCG DTCH logical channel in accordance with the *rlc-ConfigSCG*, *logicalChannelIdentitySCG* and *logicalChannelConfigSCG* included in *drb-ToAddModListSCG*;

3> associate the SCG RLC bearer and DTCH logical channel with the NR PDCP entity, i.e. as configured by NR see TS 38.331 [82], identified with the same *drb-Identity* within the current UE configuration;

2> else:

3> re-establish the SCG RLC entity of this DRB, if *reestablishRLC* is included in *rlc-Config*;

3> reconfigure the SCG RLC entity or entities and/ or the SCG DTCH logical channel in accordance with the *rlc-ConfigSCG* and *logicalChannelConfigSCG*, if included in *drb-ToAddModListSCG*;

#### 5.3.10.3a SCell release

The UE shall:

1> if the release is triggered by reception of the *sCellToReleaseList* or the *sCellToReleaseListSCG*:

2> for each *sCellIndex* value included either in the *sCellToReleaseList* or in the *sCellToReleaseListSCG*:

3> if the current UE configuration includes an SCell with value *sCellIndex*:

4> release the SCell;

1> if the release is triggered by RRC connection re-establishment; or

1> if the release is triggered when the UE is resuming an RRC connection from a suspended RRC connection or from RRC\_INACTIVE as specified in clause 5.3.3.2:

2> release all SCells that are part of the current UE configuration;

#### 5.3.10.3b SCell addition/ modification

The UE shall:

1> for each *sCellIndex* value included either in the *sCellToAddModList* or in the *sCellToAddModListSCG* that is not part of the current UE configuration (SCell addition):

2> add the SCell, corresponding to the *cellIdentification*, in accordance with the *radioResourceConfigCommonSCell* and *radioResourceConfigDedicatedSCell*, both included either in the *sCellToAddModList* or in the *sCellToAddModListSCG*;

2> if *sCellState* is configured for the SCell and indicates *activated*:

3> configure lower layers to consider the SCell to be in activated state;

2> else if *sCellState* is configured for the SCell and indicates *dormant*:

3> configure lower layers to consider the SCell to be in dormant state;

2> else:

3> configure lower layers to consider the SCell to be in deactivated state;

2> for each *measId* included in the *measIdList* within *VarMeasConfig*:

3> if SCells are not applicable for the associated measurement; and

3> if the concerned SCell is included in *cellsTriggeredList* defined within the *VarMeasReportList* for this *measId*:

4> remove the concerned SCell from *cellsTriggeredList* defined within the *VarMeasReportList* for this *measId*;

1> for each *sCellIndex* value included either in the *sCellToAddModList* or in the *sCellToAddModListSCG* that is part of the current UE configuration (SCell modification):

2> modify the SCell configuration in accordance with the *radioResourceConfigDedicatedSCell*, included either in the *sCellToAddModList* or in the *sCellToAddModListSCG*;

2> if the *sCellToAddModList* was received within an *RRCConnectionResume* or *sCellToAddModListSCG* was received within *RRCConnectionReconfiguration* with *mobilityControlInfoSCG* embedded in an NR *RRCResume* or embedded in an NR *RRCReconfiguration* message:

3> if the *sCellState* is configured for the SCell and indicates *activated*:

4> configure lower layers to consider the SCell to be in activated state;

3> else if *sCellState* is configured for the SCell and indicates *dormant*:

4> configure lower layers to consider the SCell to be in dormant state;

3> else:

4> configure lower layers to consider the SCell to be in deactivated state;

#### 5.3.10.3c PSCell addition or modification

The UE shall:

1> if the PSCell is not part of the current UE configuration (i.e. PSCell addition):

2> add the PSCell, corresponding to the *cellIdentification*, in accordance with the received *radioResourceConfigCommonPSCell* and *radioResourceConfigDedicatedPSCell*;

2> configure lower layers to consider the PSCell to be in activated state;

1> if the PSCell is part of the current UE configuration (i.e. PSCell modification):

2> modify the PSCell configuration in accordance with the received *radioResourceConfigDedicatedPSCell*;

#### 5.3.10.3d SCell group release

The UE shall:

1> if the release is triggered by reception of the *sCellGroupToReleaseList*:

2> for each *sCellGroupIndex* value included in the *sCellGroupToReleaseList*:

3> if the current UE configuration includes an SCell with value *sCellGroupIndex*:

4> consider the SCell not to be part of the SCell group indicated by *sCellGroupIndex;*

4> consider the *sCellConfigCommon* of the SCell group to be not applicable for the SCell*;*

3> release the SCell group;

1> if the release is triggered by RRC connection re-establishment:

2> release all SCell groups that are part of the current UE configuration;

#### 5.3.10.3e SCell group addition/ modification

The UE shall:

1> for each *sCellGroupIndex* value included in the *sCellGroupToAddModList* that is part of the current UE configuration (SCell group modification):

2> for each *sCellIndex* value included in the *sCellToReleaseList* that is part of the SCell group indicated by *sCellGroupIndex* (SCell deletion from SCell group):

3> consider the *sCellConfigCommon* of the SCell group to be not applicable for the SCell*;*

3> consider the SCell not to be part of the SCell group indicated by *sCellGroupIndex*

2> for each *sCellIndex* value included in the *sCellToAddModList* that is not part of the SCell group indicated by *sCellGroupIndex* (SCell addition to SCell group):

3> consider the SCell to be part of the SCell group indicated by *sCellGroupIndex;*

3> apply the SCell configuration for parameters not already configured as part of the current SCell configuration in accordance with the *sCellConfigCommon* for the SCell group;

2> if *sCellConfigCommon* is included (modify the SCell group configuration):

3> for each SCell that is part of the current SCell group indicated by *sCellGroupIndex*:

4> apply the SCell configuration for parameters not already configured as part of the current SCell configuration in accordance with the *sCellConfigCommon* for the SCell group;

1> for each *sCellGroupIndex* value included in the *sCellGroupToAddModList* that is not part of the current UE configuration (SCell group addition):

2> for each *sCellIndex* value included in the *sCellToAddModList* (SCell addition to the group):

3> consider the SCell to be part of the SCell group indicated by *sCellGroupIndex*

3> apply the SCell configuration for parameters not already configured as part of the current SCell configuration in accordance with the *sCellConfigCommon* for the SCell group;

#### 5.3.10.4 MAC main reconfiguration

Except for NB-IoT, the UE shall:

1> if the procedure is triggered to perform SCG MAC main reconfiguration:

2> if SCG MAC is not part of the current UE configuration (i.e. SCG establishment):

3> create an SCG MAC entity;

2> reconfigure the SCG MAC main configuration as specified in the following i.e. assuming it concerns the SCG MAC whenever MAC main configuration is referenced and that it is based on the received *mac-MainConfigSCG* instead of *mac-MainConfig*:

1> reconfigure the MAC main configuration in accordance with the received *mac-MainConfig* other than *stag-ToReleaseList* and *stag-ToAddModList*;

1> if the received *mac-MainConfig* includes the *stag-ToReleaseList*:

2> for each *STAG-Id* value included in the *stag-ToReleaseList* that is part of the current UE configuration:

3> release the STAG indicated by *STAG-Id*;

1> if the received *mac-MainConfig* includes the *stag-ToAddModList*:

2> for each *stag-Id* value included in *stag-ToAddModList* that is not part of the current UE configuration (STAG addition):

3> add the STAG, corresponding to the *stag-Id*, in accordance with the received *timeAlignmentTimerSTAG*;

2> for each *stag-Id* value included in *stag-ToAddModList* that is part of the current UE configuration (STAG modification):

3> reconfigure the STAG, corresponding to the *stag-Id*, in accordance with the received *timeAlignmentTimerSTAG*;

NOTE: In case of MAC main reconfiguration at a DAPS HO, the reconfiguration is applied to the MAC entity for the target MCG.

For NB-IoT, the UE shall:

1> reconfigure the MAC main configuration in accordance with the received *mac-MainConfig*;

#### 5.3.10.5 Semi-persistent scheduling reconfiguration

The UE shall:

1> reconfigure the semi-persistent scheduling in accordance with the received *sps-Config*;

#### 5.3.10.6 Physical channel reconfiguration

Except for NB-IoT, the UE shall:

1> if the *antennaInfo-r10* is included in the received *physicalConfigDedicated* and the previous version of this field that was received by the UE was *antennaInfo* (without suffix i.e. the version defined in REL-8):

2> apply the default antenna configuration as specified in 9.2.4;

1> if the *cqi-ReportConfig-r10* is included in the received *physicalConfigDedicated* and the previous version of this field that was received by the UE was *cqi-ReportConfig* (without suffix i.e. the version defined in REL-8):

2> apply the default CQI reporting configuration as specified in 9.2.4;

NOTE 1: Application of the default configuration involves release of all extensions introduced in REL-9 and later.

1> reconfigure the physical channel configuration in accordance with the received *physicalConfigDedicated*;

1> if the *antennaInfo* is included and set to *explicitValue*:

2> if the configured *transmissionMode* is *tm1*, *tm2*, *tm5*, *tm6* or *tm7*; or

2> if the configured *transmissionMode* is *tm8* and *pmi-RI-Report* is not present; or

2> if the configured *transmissionMode* is *tm9* and *pmi-RI-Report* is not present; or

2> if the configured *transmissionMode* is *tm9* and *pmi-RI-Report* is present and *antennaPortsCount* within *csi-RS* is set to *an1*:

3> release *ri-ConfigIndex* in *cqi-ReportPeriodic*, if previously configured;

1> else if the *antennaInfo* is included and set to *defaultValue*:

2> release *ri-ConfigIndex* in *cqi-ReportPeriodic*, if previously configured;

1> if the *pusch-EnhancementsConfig* is included in the received *physicalConfigDedicated*, for the associated serving cell:

2> if PUSCH enhancement mode is previously released or not configured and *pusch-EnhancementsConfig* is set to *setup*, or

2> if PUSCH enhancement mode is previously configured and *pusch-EnhancementConfig* is set to *release*:

3> instruct the associated MAC entity to perform partial reset;

1> if the procedure was not triggered due to handover and *ce-Mode* is included in the received *physicalConfigDedicated*, for the associated serving cell:

2> if *ce-Mode* is not currently configured and *ce-Mode* is set to *setup*, or

2> if *ce-Mode* is currently configured and *ce-Mode* is set to *release*:

3> instruct the associated MAC entity to perform partial reset;

For NB-IoT, the UE shall:

1> if the *carrierConfigDedicated* is not included in the received *physicalConfigDedicated*:

2> if the UE is configured with a carrier configuration previously received in *carrierConfigDedicated*:

3> use the carrier configuration received in *carrierConfigDedicated*;

2> else:

3> use the carrier configuration received in system information for the uplink and downlink carrier used during the random access procedure;

1> else:

2> if *schedulingRequestConfig* is not received or does not include the *sr-SPS-BSR-Config*:

3> instruct lower layers to clear existing configured uplink grants for BSR (if any);

2> use the carrier configuration received in *carrierConfigDedicated*;

2> start to use the new carrier immediately after the last transport block carrying the RRC message has been acknowledged by the MAC layer, and any subsequent RRC response message sent for the current RRC procedure is therefore sent on the new carrier;

1> reconfigure the physical channel configuration in accordance with the received *physicalConfigDedicated*.

NOTE 2: In case of physical channel reconfiguration at a DAPS HO, the reconfiguration is applied for the target PCell.

#### 5.3.10.7 Radio Link Failure Timers and Constants reconfiguration

The UE shall:

1> if the received *rlf-TimersAndConstants* is set to *release*:

2> use values for timers T301, T310, T311 and constants N310, N311, as included in *ue-TimersAndConstants* received in *SystemInformationBlockType2*(or *SystemInformationBlockType2-NB* in NB-IoT);

1> else:

2> reconfigure the value of timers and constants in accordance with received *rlf-TimersAndConstants*;

NOTE: In case of a DAPS HO, the timer and constant values are to be applied in the target MCG after timer T304 has been stopped.

1> if the received *rlf-TimersAndConstantsSCG* is set to *release*:

2> stop timer T313, if running, and

2> release the value of timer *t313* as well as constants *n313* and *n314*;

1> else:

2> reconfigure the value of timers and constants in accordance with received *rlf-TimersAndConstantsSCG*;

1> if the received *rlf-TimersAndConstantsMCG-Failure* is set to *release*:

2> stop timer T316, if running, and

2> release the value of timer *t316*;

1> else:

2> reconfigure the value of the timer in accordance with received *rlf-TimersAndConstantsMCG-Failure*;

#### 5.3.10.8 Time domain measurement resource restriction for serving cell

The UE shall:

1> if the received *measSubframePatternPCell* is set to *release*:

2> release the time domain measurement resource restriction for the PCell, if previously configured;

1> else:

2> apply the time domain measurement resource restriction for the PCell in accordance with the received *measSubframePatternPCell;*

#### 5.3.10.9 Other configuration

The UE shall:

1> if the received *otherConfig* includes the *reportProximityConfig*:

2> if *proximityIndicationEUTRA* is set to *enabled*:

3> consider itself to be configured to provide proximity indications for E-UTRA frequencies in accordance with 5.3.14;

2> else:

3> consider itself not to be configured to provide proximity indications for E-UTRA frequencies;

2> if *proximityIndicationUTRA* is set to *enabled*:

3> consider itself to be configured to provide proximity indications for UTRA frequencies in accordance with 5.3.14;

2> else:

3> consider itself not to be configured to provide proximity indications for UTRA frequencies;

1> if the received *otherConfig* includes the *obtainLocation*:

2> attempt to have detailed location information available for any subsequent measurement report;

NOTE 1: The UE is requested to attempt to have valid detailed location information available whenever sending a measurement report for which it is configured to include available detailed location information. The UE may not succeed e.g. because the user manually disabled the GPS hardware, due to no/poor satellite coverage. Further details, e.g. regarding when to activate GNSS, are up to UE implementation.

NOTE 1a: Any subsequent measurement report includes RLF report and SCGFailureInformationNR.

1> if the received *otherConfig* includes the *bt-NameListConfig*:

2> if *bt-NameListConfig* is set to *setup*, attempt to have Bluetooth measurement results available for subsequent measurement report;

1> if the received *otherConfig* includes the *wlan-NameListConfig*:

2> if *wlan-NameListConfig* is set to *setup*, attempt to have WLAN measurement results available for subsequent measurement report;

1> if the received *otherConfig* includes the *measUncomBarPre*:

2> if *measUncomBarPre* is set to *true*, attempt to have barometer measurement results available for subsequent measurement report;

NOTE 2: The UE is requested to attempt to have valid Bluetooth measurements, WLAN measurements and Uncompensated Barometric Pressure Sensor measurements whenever sending a measurement report for which it is configured to include these measurements. The UE may not succeed e.g. because the user manually disabled the WLAN, Bluetooth or Sensor hardware. Further details, e.g. regarding when to activate WLAN, Bluetooth or Sensor, are up to UE implementation.

1> if the received *otherConfig* includes the *idc-Config*:

2> if *idc-Indication* is included (i.e. set to *setup*):

3> consider itself to be configured to provide IDC indications in accordance with 5.6.9;

3> if *idc-Indication-UL-CA* is included (i.e. set to *setup*):

4> consider itself to be configured to indicate UL CA related information in IDC indications in accordance with 5.6.9;

3> if *idc-HardwareSharingIndication* is included (i.e. set to setup):

4> consider itself to be configured to indicate IDC hardware sharing problem indications in IDC indications in accordance with 5.6.9;

3> if *idc-Indication-MRDC* is included (i.e. set to *setup*):

4> consider itself to be configured to provide IDC indications for MR-DC in accordance with 5.6.9;

2> else:

3> consider itself not to be configured to provide IDC indications;

2> if *autonomousDenialParameters* is included:

3> consider itself to be allowed to deny any transmission in a particular UL subframe if during the number of subframes indicated by *autonomousDenialValidity*, preceeding and including this particular subframe, it autonomously denied fewer UL subframes than indicated by *autonomousDenialSubframes*;

2> else:

3> consider itself not to be allowed to deny any UL transmission;

1> if the received *otherConfig* includes the *powerPrefIndicationConfig*:

2> if *powerPrefIndicationConfig* is set to *setup*:

3> consider itself to be configured to provide power preference indications in accordance with 5.6.10;

2> else:

3> consider itself not to be configured to provide power preference indications;

1> if the received *otherConfig* includes the sps-*AssistanceInfoReport*:

2> if *sps-AssistanceInfoReport* is set to TRUE:

3> consider itself to be configured to provide SPS assistance information in accordance with 5.6.10;

2> else

3> consider itself not to be configured to provide SPS assistance information;

1> if the received *otherConfig* includes the *bw-PreferenceIndicationTimer*:

2> consider itself to be configured to provide maximum PDSCH/PUSCH bandwidth preference indication in accordance with 5.6.10;

1> else:

2> consider itself not to be configured to provide maximum PDSCH/PUSCH bandwidth indication preference;

1> if the received *otherConfig* includes the *delayBudgetReportingConfig*:

2> if *delayBudgetReportingConfig* is set to *setup*:

3> consider itself to be configured to send delay budget reports in accordance with 5.6.10;

2> else:

3> consider itself not to be configured to send delay budget reports and stop timer T342, if running;

1> if the received *otherConfig* includes the *overheatingAssistanceConfig*:

2> if *overheatingAssistanceConfig* is set to *setup*:

3> consider itself to be configured to provide overheating assistance information in accordance with 5.6.10;

3> if *overheatingAssistanceConfigForSCG* is included:

4> if *overheatingAssistanceConfigForSCG* is set to true:

5> consider itself to be configured to provide overheating assistance information for NR SCG in accordance with 5.6.10;

4> else if *overheatingAssistanceConfigForSCG* is set to false:

5> consider itself not to be configured to provide overheating assistance information for NR SCG and stop timer T345, if running;

2> else:

3> consider itself not to be configured to provide overheating assistance information and stop timer T345, if running;

1> for BL UEs or UEs in CE, if the received *otherConfig* includes the *rlm-ReportConfig*:

2> if *rlm-ReportConfig* is set to *setup*:

3> consider itself to be configured to detect "early-out-of-sync" and "early-in-sync" RLM events as specified in 5.3.11;

3> if *rlmReportRep-MPDCCH* is set to *setup*:

4> consider itself to be configured to report *rlmReportRep-MPDCCH* in accordance with 5.6.10;

2> else:

3> consider itself not to be configured to detect "early-out-of-sync" and "early-in-sync" RLM events and stop timer T343, timer T344, timer T314 and timer T315 if running;

1> if the received *otherConfig* includes the *measConfigAppLayer*:

2> if *measConfigAppLayer* is set to setup:

3> forward *measConfigAppLayerContainer* to upper layers considering the *serviceType*;

3> consider itself to be configured to send application layer measurement report in accordance with 5.6.19;

2> else:

3> inform upper layers to clear the stored application layer measurement configuration;

3> discard received application layer measurement report information from upper layers;

3> consider itself not to be configured to send application layer measurement report.

1> if the received *otherConfig* includes the *ailc-BitConfig*:

2> if *ailc-BitConfig* is set to TRUE:

3> consider itself to be configured to provide assistance information bit for local cache as specified in TS 36.323 [8], clause 6.2.3;

2> else:

3> consider itself not to be configured to provide assistance information bit for local cache;

#### 5.3.10.10 SCG reconfiguration

The UE shall:

1> if *makeBeforeBreakSCG* is configured:

2> stop timer T313, if running;

2> start timer T307 with the timer value set to t307, as included in the *mobilityControlInfoSCG*;

2> start synchronising to the DL of the target PSCell, if needed;

2> perform the remainder of this procedure including and following resetting MAC after the UE has stopped the uplink transmission/downlink reception with the source PSCell;

NOTE 0a: It is up to UE implementation when to stop the uplink transmission/ downlink reception with the source PSCell to initiate re-tuning for the connection to the target cell, as specified in TS 36.133 [16], if *makeBeforeBreakSCG* is configured.

NOTE 0b: It is up to UE implementation when to stop the uplink transmission/ downlink reception with the source SCG SCell(s) after receiving *mobilityControlInfoSCG*.

1> if *scg-Configuration* is received and is set to *release* or includes the *mobilityControlInfoSCG* (i.e. SCG release/ change):

2> if *mobilityControlInfo* is not received (i.e. SCG release/ change without HO):

3> reset SCG MAC, if configured;

3> if the UE is not configured with NE-DC:

4> for each *drb-Identity* value that is part of the current UE configuration:

5> if the DRB indicated by *drb-Identity* is an SCG DRB:

6> re-establish the PDCP entity and the SCG RLC entity or entities;

5> if the DRB indicated by *drb-Identity* is a split DRB:

6> perform PDCP data recovery and re-establish the SCG RLC entity;

5> if the DRB indicated by *drb-Identity* is an MCG DRB; and

5> *drb-ToAddModListSCG* is received and includes the *drb-Identity* value, while for this entry *drb-Type* is included and set to *scg* (i.e. MCG to SCG):

6> re-establish the PDCP entity and the MCG RLC entity or entities;

3> configure lower layers to consider the SCG SCell(s), except for the PSCell, to be in deactivated state;

1> if *scg-Configuration* is received and is set to *release*:

2> release the entire SCG configuration, except for the DRB configuration (i.e. as configured by *drb-ToAddModListSCG*);

2> if the current UE configuration includes one or more split or SCG DRBs and the received *RRCConnectionReconfiguration* message includes *radioResourceConfigDedicated* including *drb-ToAddModList*:

3> reconfigure the SCG or split DRB by *drb-ToAddModList* as specified in 5.3.10.12;

2> stop timer T313, if running;

2> stop timer T307, if running;

1> else:

2> if *scg-ConfigPartMCG* is received and includes the *scg-Counter*:

3> update the S-KeNB key based on the KeNB key and using the received *scg-Counter* value, as specified in TS 33.401 [32];

3> derive the KUPenc key associated with the *cipheringAlgorithmSCG* included in *mobilityControlInfoSCG* within the received *scg-ConfigPartSCG*, as specified in TS 33.401 [32];

3> configure lower layers to apply the ciphering algorithm and the KUPenc key;

2> if *scg-ConfigPartSCG* is received and includes the *radioResourceConfigDedicatedSCG*:

3> reconfigure the dedicated radio resource configuration for the SCG as specified in 5.3.10.11;

2> if the current UE configuration includes one or more split or SCG DRBs and the received *RRCConnectionReconfiguration* message includes *radioResourceConfigDedicated* including *drb-ToAddModList*:

3> reconfigure the SCG or split DRB by *drb-ToAddModList* as specified in 5.3.10.12;

2> if *scg-ConfigPartSCG* is received and includes *measConfigSN*:

3> for *measConfigSN* perform the actions as specified in 5.5.2 for *measConfig* unless explicitly stated otherwise;

2> if *scg-ConfigPartSCG* is received and includes the *sCellToReleaseListSCG*:

3> perform SCell release for the SCG as specified in 5.3.10.3a;

2> if *scg-ConfigPartSCG* is received and includes the *pSCellToAddMod*:

3> perform PSCell addition or modification as specified in 5.3.10.3c;

NOTE 0: This procedure is also used to release the PSCell e.g. PSCell change, SI change for the PSCell.

2> if *scg-ConfigPartSCG* is received and includes the *sCellToAddModListSCG*:

3> perform SCell addition or modification as specified in 5.3.10.3b;

2> configure lower layers in accordance with mobilityControlInfoSCG, if received;

2> if *rach-SkipSCG* is configured:

3> configure lower layers to apply the *rach-SkipSCG* for the target SCG, as specified in TS 36.213 [23] and TS 36.321 [6];

2> if *scg-ConfigPartSCG* is received and includes the *mobilityControlInfoSCG* (i.e. SCG change):

3> resume all SCG DRBs and resume SCG transmission for split DRBs, if suspended;

3> stop timer T313, if running;

3> start timer T307 with the timer value set to *t307,* as included in the *mobilityControlInfoSCG*, if *makeBeforeBreakSCG* is not configured;

3> start synchronising to the DL of the target PSCell;

3> initiate the random access procedure on the PSCell, as specified in TS 36.321 [6], if *rach-SkipSCG* is not configured:

NOTE 1: The UE is not required to determine the SFN of the target PSCell by acquiring system information from that cell before performing RACH access in the target PSCell.

3> the procedure ends, except that the following actions are performed when MAC successfully completes the random access procedure on the PSCell or when MAC indicates the successful reception of a PDCCH transmission addressed to C-RNTI and if *rach-skipSCG* is configured:

4> stop timer T307;

4> release *rach-SkipSCG*;

4> apply the parts of the CQI reporting configuration, the scheduling request configuration and the sounding RS configuration that do not require the UE to know the SFN of the target PSCell, if any;

4> apply the parts of the measurement and the radio resource configuration that require the UE to know the SFN of the target PSCell (e.g. periodic CQI reporting, scheduling request configuration, sounding RS configuration), if any, upon acquiring the SFN of the target PSCell;

NOTE 2: Whenever the UE shall setup or reconfigure a configuration in accordance with a field that is received it applies the new configuration, except for the cases addressed by the above statements.

#### 5.3.10.11 SCG dedicated resource configuration

The UE shall:

1> if the received *radioResourceConfigDedicatedSCG* includes the *srb-ToReleaseListSCG*:

2> for each *srb-Identity* value included in the *srb-ToReleaseListSCG* perform the SCG RLC bearer release as specified in 5.3.10.17;

1> if the received *radioResourceConfigDedicatedSCG* includes the *srb-ToAddModListSCG*:

2> for each *srb-Identity* value included in the *srb-ToAddModListSCG* perform the SCG RLC bearer addition or reconfiguration as specified in 5.3.10.1a;

1> if the received *radioResourceConfigDedicatedSCG* includes *drb-ToReleaseListSCG*:

2> perform the DRB release as specified in 5.3.10.2;

1> if the received *radioResourceConfigDedicatedSCG* includes the *drb-ToAddModListSCG*:

2> if the UE is configured with NE-DC:

3> for each *drb-Identity* value included in the *drb-ToAddModListSCG* perform the SCG RLC bearer addition or reconfiguration for DRBs in NE-DC as specified in 5.3.10.3a4;

2> else:

3> for each *drb-Identity* value included in the *drb-ToAddModListSCG* perform the DC specific DRB addition or reconfiguration as specified in 5.3.10.3a1;

1> if the received *radioResourceConfigDedicatedSCG* includes the *mac-MainConfigSCG*:

2> perform the SCG MAC main reconfiguration as specified in 5.3.10.4;

1> if the received *radioResourceConfigDedicatedSCG* includes the *rlf-TimersAndConstantsSCG*:

2> reconfigure the values of timers and constants as specified in 5.3.10.7;

#### 5.3.10.12 Reconfiguration SCG or split DRB by *drb-ToAddModList*

The UE shall:

1> for each split or SCG DRBs that is part of the current configuration:

2> if the corresponding *drb-Identity* value is included in the received *drb-ToAddModList*; and

2> if the corresponding *drb-Identity* value is not included in the received *drb-ToAddModListSCG* (i.e. reconfigure split, split to MCG or SCG to MCG):

3> perform the DC specific DRB addition or reconfiguration as specified in 5.3.10.3a1;

#### 5.3.10.13 Neighbour cell information reconfiguration

The UE shall:

1> if the received *naics-Info* is set to *release*:

2> instruct lower layer to release all the NAICS neighbour cell information for the concerned cell, if previously configured;

1> if the received *naics-Info* includes the *neighCellsToReleaseList-r12*:

2> for each *physCellId-r12* value included in the *neighCellsToReleaseList-r12* that is part of the current NAICS neighbour cell information of the concerned cell:

3> instruct lower layer to release the NAICS neighbour cell information for the concerned cell;

1> if the received *naics-Info* includes the *NeighCellsToAddModList-r12*:

2> for each *physCellId-r12* value included in the *neighCellsToAddModList-r12* that is not part of the current NAICS neighbour cell information of the concerned cell:

3> instruct lower layer to add the NAICS neighbour cell information for the concerned cell;

2> for each *physCellId-r12* value included in the *neighCellsToAddModList-r12* that is part of the current NAICS neighbour cell information of the concerned cell:

3> instruct lower layer to modify the NAICS neighbour cell information in accordance with the received *NeighCellsInfo* for the concerned cell;

#### 5.3.10.14 Void

#### 5.3.10.15 Sidelink dedicated configuration

The UE shall:

1> if the *RRCConnectionReconfiguration* message includes the *sl-CommConfig*:

2> if *commTxResources* is included and set to *setup*:

3> from the next SC period use the resources indicated by *commTxResources* for sidelink communication transmission, as specified in 5.10.4;

2> else if *commTxResources* is included and set to *release*:

3> from the next SC period, release the resources allocated for sidelink communication transmission previously configured by *commTxResources*;

1> if the *RRCConnectionReconfiguration* message includes the *sl-DiscConfig*:

2> if *discTxResources* is included and set to *setup*:

3> from the next discovery period, as defined by *discPeriod*, use the resources indicated by *discTxResources* for sidelink discovery announcement, as specified in 5.10.6;

2> else if *discTxResources* is included and set to *release*:

3> from the next discovery period, as defined by *discPeriod*, release the resources allocated for sidelink discovery announcement previously configured by *discTxResources*;

2> if *discTxResourcesPS* is included and set to *setup*:

3> from the next discovery period, as defined by *discPeriod*, use the resources indicated by *discTxResourcesPS* for sidelink discovery announcement, as specified in 5.10.6;

2> else if *discTxResourcesPS* is included and set to *release*:

3> from the next discovery period, as defined by *discPeriod*, release the resources allocated for sidelink discovery announcement previously configured by *discTxResourcesPS*;

2> if *discTxInterFreqInfo* is included and set to *setup*:

3> from the next discovery period, as defined by *discPeriod*, use the resources indicated by *discTxInterFreqInfo* for sidelink discovery announcement, as specified in 5.10.6;

2> else if *discTxInterFreqInfo* is included and set to *release*:

3> from the next discovery period, as defined by *discPeriod*, release the resources allocated for sidelink discovery announcement previously configured by *discTxInterFreqInfo*;

2> if *discRxGapConfig* is included and set to *setup*:

3> from the next gap period, as defined by *gapPeriod*, use the gaps indicated by *discRxGapConfig* for sidelink discovery monitoring, as specified in 5.10.5;

2> else if *discRxGapConfig* is included and set to *release*:

3> from the next gap period, as defined by *gapPeriod*, release the gaps configured for sidelink discovery monitoring previously configured by *discRxGapConfig*;

2> if *discTxGapConfig* is included and set to *setup*:

3> from the next gap period, as defined by *gapPeriod*, use the gaps indicated by *discTxGapConfig* for sidelink discovery announcement, as specified in 5.10.6;

2> else if *discTxGapConfig* is included and set to *release*:

3> from the next gap period, as defined by *gapPeriod*, release the gaps configured for sidelink discovery announcement previously configured by *discTxGapConfig*;

2> if *discSysInfoToReportConfig* is included and set to *setup*:

3> start timer T370 with the timer value set to 60s;

2> else if *discSysInfoToReportConfig* is included and set to *release*:

3> stop timer T370 and release *discSysInfoToReportConfig*;

#### 5.3.10.15a V2X sidelink Communication dedicated configuration

The UE shall:

1> if the *RRCConnectionReconfiguration* message includes the *sl-V2X-ConfigDedicated*:

2> if *commTxResources* is included and set to *setup*:

3> use the resources indicated by *commTxResources* for V2X sidelink communication transmission, as specified in 5.10.13;

3> perform CBR measurement on the transmission resource pool indicated in *commTxResources* for V2X sidelink communication transmission, as specified in 5.5.3;

2> else if *commTxResources* is included and set to *release*:

3> release the resources allocated for V2X sidelink communication transmission previously configured by *commTxResources*;

2> if *v2x-InterFreqInfoList* is included:

3> use the synchronization configuration and resource configuration parameters for V2X sidelink communication on frequencies included in *v2x-InterFreqInfoList*, as specified in 5.10.13;

3> perform CBR measurement on the transmission resource pool indicated in *v2x-InterFreqInfoList* for V2X sidelink communication transmission, as specified in 5.5.3;

1> if the *RRCConnectionReconfiguration* message includes the *mobilityControlInfoV2X*:

2> if *v2x-CommRxPool* is included:

3> use the resources indicated by *v2x-CommRxPool* for V2X sidelink communication reception, as specified in 5.10.12;

2> if *v2x-CommTxPoolExceptional* is included:

3> use the resources indicated by *v2x-CommTxPoolExceptional* for V2X sidelink communication transmission, as specified in 5.10.13;

3> perform CBR measurement on the transmission resource pool indicated by *v2x-CommTxPoolExceptional* for V2X sidelink communication transmission, as specified in 5.5.3;

#### 5.3.10.16 T370 expiry

The UE shall:

1> if T370 expires:

2> release *discSysInfoToReportConfig*;

#### 5.3.10.17 SRB release

The UE shall:

1> for each *srb-Identity* value included in *srb-ToReleaseList* or in *srb-ToReleaseListSCG* that is part of the current UE configuration:

2> if the SRB configuration does not include an E-UTRA PDCP entity (release the SCG RLC bearer configuration):

3> re-establish the RLC entity as specified in TS 36.322 [7] for this SRB;

3> configure the E-UTRA PDCP entity to deactivate duplication;

2> release the RLC entity or entities;

2> release the DCCH logical channel;

2> if *srb-Identity* value is set to 4, release the PDCP entity;

#### 5.3.10.18 Scheduling Request Configuration for NB-IoT

The UE shall:

1> apply *sr-WithHARQ-ACK-Config*, if included;

1> apply *sr-WithoutHARQ-ACK-Config*, if included;

1> if *sr-SPS-BSR-Config* is included:

2> instruct lower layers to clear existing configured uplink grants for BSR (if any);

2> apply *sr-SPS-BSR-Config*.

#### 5.3.10.19 NE-DC release

The UE shall:

1> if NE-DC release is triggered by NR:

2> reset SCG MAC, if configured;

2> for each RLC bearer that is part of the SCG configuration:

3> perform RLC bearer release procedure as specified in 5.3.10.17 (SRBs) and in 5.3.10.2 (DRBs);

2> release the measurement configuration;

2> release the SCG configuration i.e. release the MAC and physical configuration for each cell that is part of the SCG configuration;

2> stop timer T313 for the corresponding PSCell, if running;

2> stop timer T307 for the corresponding PSCell, if running.

NOTE: Upon NE-DC release the UE releases all fields configured by the *RRCConnectionReconfiguration* message.

### 5.3.11 Radio link failure related actions

#### 5.3.11.1 Detection of physical layer problems in RRC\_CONNECTED

The UE shall:

1> if any DAPS bearer is configured, upon receiving N310 consecutive "out-of-sync" indications for the source PCell from lower layers and T304 is running:

2> start timer T310 for the source PCell;

1> upon receiving N310 consecutive "out-of-sync" indications for the PCell from lower layers while neither T300, T301, T304, T311, nor T316 is running:

2> start timer T310;

1> upon receiving N313 consecutive "out-of-sync" indications for the PSCell from lower layers while T307 is not running:

2> start T313;

NOTE: Physical layer monitoring and related autonomous actions do not apply to SCells except for the PSCell.

#### 5.3.11.1a Early detection of physical layer problems in RRC\_CONNECTED

The UE shall:

1> upon receiving N310 consecutive "early-out-of-sync" indications for the PCell from lower layers:

2> start timer T314 with the timer value set to the value of T310;

#### 5.3.11.1b Detection of physical layer improvements in RRC\_CONNECTED

The UE shall:

1> upon receiving N311 consecutive "early-in-sync" indications for the PCell from lower layers:

2> start timer T315 with the timer value set to the value of T310;

#### 5.3.11.2 Recovery of physical layer problems

Upon receiving N311 consecutive "in-sync" indications for the PCell from lower layers while T310 is running, the UE shall:

1> stop timer T310;

1> stop timer T312, if running;

NOTE 1: In this case, the UE maintains the RRC connection without explicit signalling, i.e. the UE maintains the entire radio resource configuration.

NOTE 2: Periods in time where neither "in-sync" nor "out-of-sync" is reported by layer 1 do not affect the evaluation of the number of consecutive "in-sync" or "out-of-sync" indications.

Upon receiving N314 consecutive "in-sync" indications for the PSCell from lower layers while T313 is running, the UE shall:

1> stop timer T313;

#### 5.3.11.2a Recovery of early detection of physical layer problems

Upon receiving N311 consecutive "in-sync" indications for the PCell from lower layers while T314 is running, the UE shall:

1> stop timer T314;

#### 5.3.11.2b Cancellation of physical layer improvements in RRC\_CONNECTED

Upon receiving N311 consecutive "in-sync" indications for the PCell from lower layers while T315 is running, the UE shall:

1> stop timer T315;

#### 5.3.11.3 Detection of radio link failure

The UE shall:

1> in case any DAPS bearer is configured, only the target PCell is considered in the following;

1> upon T310 expiry; or

1> upon T312 expiry; or

1> upon T318 expiry and *SystemInformationBlockType31* (*SystemInformationBlockType31-NB* in NB-IoT) not acquired; or

1> upon reaching *t-Service* if *t-Service* is broadcast; or

1> upon random access problem indication from MCG MAC while neither T300, T301, T304 nor T311 is running; or

1> upon indication from MCG RLC, which is allowed to be send on PCell, that the maximum number of retransmissions has been reached for an SRB or DRB:

2> consider radio link failure to be detected for the MCG i.e. RLF;

2> discard any segments of segmented RRC messages received;

2> if the last *RRCConnectionReconfiguration* message including the *mobilityControlInfo* concerned a handover to E-UTRA from NR and if the UE supports successful handover report for Handover from NR to E-UTRA as defined in TS 38.306 [87] and if the UE has successful handover related information available in *VarSuccessHO-Report* of TS 38.331 [82]:

3> set the *eutra-C-RNTI* in the *successHO-Report* in *VarSuccessHO-Report* of TS 38.331 [82] to the C-RNTI used in the PCell;

2> store the following radio link failure information in the *VarRLF-Report* (*VarRLF-Report-NB* in NB-IoT) by setting its fields as follows:

3> clear the information included in *VarRLF-Report* (*VarRLF-Report-NB* in NB-IoT), if any;

3> set the *plmn-IdentityList* to include the list of EPLMNs stored by the UE (i.e. includes the RPLMN);

3> set the *measResultLastServCell* to include the RSRP and RSRQ, if available, of the PCell based on measurements collected up to the moment the UE detected radio link failure;

3> except for NB-IoT, set the *measResultNeighCells* to include the best measured cells, other than the PCell, ordered such that the best cell is listed first, and based on measurements collected up to the moment the UE detected radio link failure, and set its fields as follows;

4> if the UE was configured to perform measurements for one or more EUTRA frequencies, include the *measResultListEUTRA*;

4> if the UE was configured to perform measurement reporting for one or more neighbouring UTRA frequencies, include the *measResultListUTRA*;

4> if the UE was configured to perform measurement reporting for one or more neighbouring GERAN frequencies, include the *measResultListGERAN*;

4> if the UE was configured to perform measurement reporting for one or more neighbouring CDMA2000 frequencies, include the *measResultsCDMA2000*;

4> if the UE was configured to perform measurement reporting, not related to NR sidelink communication, for one or more neighbouring NR frequencies, include the *measResultListNR*;

4> for each neighbour cell included, include the optional fields that are available;

NOTE 1: The measured quantities are filtered by the L3 filter as configured in the mobility measurement configuration. The measurements are based on the time domain measurement resource restriction, if configured. Exclude-listed cells are not required to be reported.

3> except for NB-IoT, if available, set the *logMeasResultListWLAN* to include the WLAN measurement results, in order of decreasing RSSI for WLAN APs;

3> except for NB-IoT, if available, set the *logMeasResultListBT* to include the Bluetooth measurement results, in order of decreasing RSSI for Bluetooth beacons;

3> if detailed location information is available, set the content of the *locationInfo* as follows:

4> include the *locationCoordinates*;

4> include the *horizontalVelocity*, if available;

3> set the *failedPCellId* to the global cell identity, if available, and otherwise , except for NB-IoT, to the physical cell identity and carrier frequency of the PCell where radio link failure is detected;

3> except for NB-IoT, set the *tac-FailedPCell* to the tracking area code, if available, of the PCell where radio link failure is detected;

3> except for NB-IoT, if an *RRCConnectionReconfiguration* message including the *mobilityControlInfo* was received before the connection failure:

4> if the last *RRCConnectionReconfiguration* message including the *mobilityControlInfo* concerned an intra E-UTRA handover:

5> include the *previousPCellId* and set it to the global cell identity of the PCell where the last *RRCConnectionReconfiguration* message including *mobilityControlInfo* was received;

5> set the *timeConnFailure* to the elapsed time since reception of the last *RRCConnectionReconfiguration* message including the *mobilityControlInfo*;

4> if the last *RRCConnectionReconfiguration* message including the *mobilityControlInfo* concerned a handover to E-UTRA from UTRA and if the UE supports Radio Link Failure Report for Inter-RAT MRO:

5> include the *previousUTRA-CellId* and set it to the physical cell identity, the carrier frequency and the global cell identity, if available, of the UTRA Cell in which the last *RRCConnectionReconfiguration* message including *mobilityControlInfo* was received;

5> set the *timeConnFailure* to the elapsed time since reception of the last *RRCConnectionReconfiguration* message including the *mobilityControlInfo*;

4> if the last *RRCConnectionReconfiguration* message including the *mobilityControlInfo* concerned a handover to E-UTRA from NR and if the UE supports Radio Link Failure Report for Inter-RAT MRO NR:

5> include the *previousNR-PCellId* and set it to the global cell identity of the PCell where the last *RRCConnectionReconfiguration* message including *mobilityControlInfo* was received embedded in NR RRC message *MobilityFromNRCommand* message as specified in TS 38.331 [82] clause 5.4.3.3;

5> set the *timeConnFailure* to the elapsed time since reception of the last *RRCConnectionReconfiguration* message including the *mobilityControlInfo* embedded in NR RRC message *MobilityFromNRCommand* message as specified in TS 38.331 [82] clause 5.4.3.3.

5> if the UE supports RLF Report for Inter-system HO for Voice Fallback as defined in TS 38.306 [87], and *voiceFallbackIndication* is included in the *MobilityFromNRCommand*:

6> include the *voiceFallbackHO*;

3> except for NB-IoT, if the UE supports QCI1 indication in Radio Link Failure Report and has a DRB for which QCI is 1:

4> include the *drb-EstablishedWithQCI-1*;

3> except for NB-IoT, set the *connectionFailureType* to *rlf*;

3> except for NB-IoT, set the *c-RNTI* to the C-RNTI used in the PCell;

3> except for NB-IoT, set the *rlf-Cause* to the trigger for detecting radio link failure;

2> if the UE is configured with (NG)EN-DC; and

2> if T316 is configured; and

2> if SCG transmission is not suspended; and

2> if the SCG is not deactivated; and

2> if neither NR PSCell change nor NR PSCell addition is ongoing (i.e. T304 for the NR PSCell is not running as specified in TS 38.331 [82], clause 5.3.5.5.2, in (NG)EN-DC):

3> initiate the MCG failure information procedure as specified in 5.6.26 to report MCG radio link failure;

2> else:

3> if AS security has not been activated:

4> if the UE is a NB-IoT UE:

5> if the UE is connected to EPC and the UE supports RRC connection re-establishment for the Control Plane CIoT EPS optimisation; or

5> if the UE is connected to 5GC, the UE supports RRC connection re-establishment for the Control Plane CIoT 5GS optimisation and the UE is configured with a truncated 5G-S-TMSI:

6> initiate the RRC connection re-establishment procedure as specified in 5.3.7;

5> else:

6> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'RRC connection failure';

4> else:

5> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'other';

3> else:

4> initiate the connection re-establishment procedure as specified in 5.3.7;

NOTE 2: BL UEs or UEs in CE or NB-IoT UEs that are connected to NTN may perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'other' if the UE determines by implementation there is not enough time to finish the procedure of reestablishment due to the discontinuous coverage.

In case of DC or NE-DC, the UE shall:

1> upon T313 expiry; or

1> upon random access problem indication from SCG MAC; or

1> upon indication from SCG RLC, which is allowed to be sent on PSCell, that the maximum number of retransmissions has been reached for an SCG, for a split DRB or for a split SRB:

2> consider radio link failure to be detected for the SCG i.e. SCG-RLF;

2> if the UE is configured with DC; or

2> if the UE is configured with NE-DC and MCG transmission is not suspended:

3> initiate the SCG failure information procedure as specified in 5.6.13 to report SCG radio link failure;

2> else:

3> initiate the connection re-establishment procedure as specified in TS 38.331 [82], clause 5.3.7.

In case of CA PDCP duplication, the UE shall:

1> upon indication from an RLC entity, which is restricted to be sent on SCell only, that the maximum number of retransmissions has been reached:

2> initiate the failure information procedure as specified in 5.6.21 to report RLC failure of type duplication;

If any DAPS bearer is configured and T304 is running, the UE shall:

1> upon T310 expiry for the source PCell; or

1> upon random access problem indication from source MCG MAC; or

1> upon indication from source MCG RLC, which is allowed to be sent on source PCell, that the maximum number of retransmissions has been reached for an DRB:

2> consider radio link failure to be detected for the source MCG;

2> suspend the transmission of all DRBs in the source MCG;

2> reset MAC for the source MCG;

2> release the source connection;

The UE may discard the radio link failure information, i.e. release the UE variable *VarRLF-Report* (*VarRLF-Report-NB* in NB-IoT), 48 hours after the radio link failure is detected, upon power off or upon detach, and for NB-IoT, upon entering another RAT.

#### 5.3.11.3a Detection of early-out-of-sync event

The UE shall:

1> upon T314 expiry;

2> consider "early-out-of-sync" event to be detected and initiate transmission of the *UEAssistanceInformation* message in accordance with 5.6.10;

#### 5.3.11.3b Detection of early-in-sync event

The UE shall:

1> upon T315 expiry;

2> consider "early-in-sync" event to be detected and initiate transmission of the *UEAssistanceInformation* message in accordance with 5.6.10;

### 5.3.12 UE actions upon leaving RRC\_CONNECTED or RRC\_INACTIVE

Upon leaving RRC\_CONNECTED or RRC\_INACTIVE, the UE shall:

1> reset MAC;

1> if leaving RRC\_INACTIVE was not triggered by the reception of *RRCConnectionRelease* including *idleModeMobilityControlInfo* or *altFreqPriorities*:

2> stop the timer T320 and T323, if running;

2> if stored, discard the cell reselection priority information provided by the *idleModeMobilityControlInfo*;

2> if stored, discard the *altFreqPriorities* provided by the *RRCConnectionRelease*;

1> if entering RRC\_IDLE was triggered by reception of the *RRCConnectionRelease* message including a *waitTime*:

2> start timer T302, with the timer value set according to the *waitTime*;

2> inform the upper layer that access barring is applicable for all access categories except categories '0' and '2';

1> else if T302 is running:

2> stop timer T302;

2> if the UE is connected to 5GC:

3> perform the actions as specified in 5.3.16.4;

1> if T309 is running:

2> stop timer T309 for all access categories;

2> perform the actions as specified in 5.3.16.4.

1> stop all timers that are running except T302, T320, T322, T323, T325, T330, T331;

1> release *crs-ChEstMPDCCH-ConfigDedicated*, if configured;

1> if leaving RRC\_CONNECTED was triggered by suspension of the RRC:

2> re-establish RLC entities for all SRBs and DRBs, including RBs configured with NR PDCP;

2> remove all entries within *VarConditionalReconfiguration*, if any;

2> for each *measId*, that is part of the current UE configuration in *VarMeasConfig,* if the associated *reportConfig* has *condReconfigurationTriggerEUTRA/condReconfigurationTriggerNR* configured:

3> remove the entry with the matching *reportConfigId* from the *reportConfigList* within the *VarMeasConfig*;

3> if the associated *measObjectId* is only associated with *condReconfigurationTriggerEUTRA/condReconfigurationTriggerNR*:

4> remove the entry with the matching *measObjectId* from the *measObjectList* within the *VarMeasConfig*;

3> remove the entry with the matching *measId* from the *measIdList* within the *VarMeasConfig*;

2> store the UE AS Context including the current RRC configuration, the current security context, the PDCP state including ROHC state, C-RNTI used in the source PCell, the *cellIdentity* and the physical cell identity of the source PCell, and the *spCellConfigCommon* within *ReconfigurationWithSync* of the PSCell (if configured);

2> store the following information provided by E-UTRAN:

3> if the UE connected to 5GC is a BL UE or UE in CE:

4> the *fullI-RNTI*, if present;

4> the *shortI-RNTI*, if present;

3> else:

4> the *resumeIdentity*;

3> the *nextHopChainingCount*, if present. Otherwise discard any stored *nextHopChainingCount* that does not correspond to stored key KRRCint;

3> the *drb-ContinueROHC*, if present. Otherwise discard any stored *drb-ContinueROHC*;

2> suspend all SRB(s) and DRB(s), including RBs configured with NR PDCP, except SRB0;

2> if the UE connected to 5GC is a BL UE or UE in CE, indicate PDCP suspend to lower layers of all DRBs;

2> if the UE is connected to 5GC:

3> indicate the idle suspension of the RRC connection to upper layers;

2> else:

3> indicate the suspension of the RRC connection to upper layers;

2> configure lower layers to suspend integrity protection and ciphering;

NOTE 1: Except when resuming an RRC connection after early security reactivation in accordance with conditions in 5.3.3.18, ciphering is not applied for the subsequent *RRCConnectionResume* message used to resume the connection and an integrity check is performed by lower layers, but merely upon request from RRC.

1> else:

2> upon leaving RRC\_INACTIVE:

3> discard the UE Inactive AS context;

3> discard the KeNB, the KRRCenc key, the KRRCint and the KUPenc key;

2> release *rrc-InactiveConfig*, if configured;

2> remove all entries within *VarConditionalReconfiguration*, if any;

2> for each *measId*, that is part of the current UE configuration in *VarMeasConfig,* if the associated *reportConfig* has *condReconfigurationTriggerEUTRA/condReconfigurationTriggerNR* configured:

3> remove the entry with the matching *reportConfigId* from the *reportConfigList* within the *VarMeasConfig*;

3> if the associated *measObjectId* is only associated with *condReconfigurationTriggerEUTRA/condReconfigurationTriggerNR*:

4> remove the entry with the matching *measObjectId* from the *measObjectList* within the *VarMeasConfig*;

3> remove the entry with the matching *measId* from the *measIdList* within the *VarMeasConfig*;

2> release all radio resources, including release of the MAC configuration, the RLC entity and the associated PDCP entity and SDAP (if any) for all established RBs, except for the following:

- *pur-Config*, if stored;

2> indicate the release of the RRC connection to upper layers together with the release cause;

1> release the stored *serviceType*, if any;

1> inform upper layers to clear the stored application layer measurement configuration;

1> discard received application layer measurement report information from upper layers, if any;

1> consider itself not to be configured to send application layer measurement report;

1> if leaving RRC\_CONNECTED was triggered neither by reception of the *MobilityFromEUTRACommand* message nor by selecting an inter-RAT cell while T311 was running; or

1> if leaving RRC\_INACTIVE was not triggered by the inter-RAT cell reselection:

2> if timer T350 is configured:

3> start timer T350;

3> apply *rclwi-Configuration* if configured, otherwise apply the *wlan-Id-List* corresponding to the RPLMN included in *SystemInformationBlockType17*;

2> else:

3> release the *wlan-OffloadConfigDedicated*, if received;

3> if the *wlan-OffloadConfigCommon* corresponding to the RPLMN is broadcast by the cell:

4> apply the *wlan-OffloadConfigCommon* corresponding to the RPLMN included in *SystemInformationBlockType17*;

4> apply *steerToWLAN* if configured, otherwise apply the *wlan-Id-List* corresponding to the RPLMN included in *SystemInformationBlockType17*;

2> enter RRC\_IDLE and perform procedures as specified in TS 36.304 [4], clause 5.2.7;

1> else:

2> release the *wlan-OffloadConfigDedicated*, if received;

NOTE 2: BL UEs or UEs in CE verifies validity of SI when released to RRC\_IDLE.

1> discard any segments of segmented RRC messages received;

1> release the LWA configuration, if configured, as described in 5.6.14.3;

1> release the LWIP configuration, if configured, as described in 5.6.17.3;

### 5.3.13 UE actions upon PUCCH/ SPUCCH/ SRS release request

Upon receiving a PUCCH release request from lower layers, for an indicated serving cell the UE shall:

1> apply the default physical channel configuration for *cqi-ReportConfig* for the indicated serving cell as specified in 9.2.4 and release *cqi-ReportConfigSCell*, for each SCell that sends HARQ feedback on the indicated serving cell, if any;

1> apply the default physical channel configuration for *schedulingRequestConfig* as specified in 9.2.4, for the concerned CG;

Upon receiving a sPUCCH release request from lower layers, the UE shall:

1> for each serving cell in the UE configuration:

2> apply the value *release* to the field *schedulingRequest-SPUCCH*;

Upon receiving an SRS release request from lower layers, for an indicated serving cell the UE shall:

1> apply the default physical channel configuration for *soundingRS-UL-ConfigDedicated,* as specified in 9.2.4;

NOTE: Upon PUCCH/ SRS release request, the UE does not modify the *soundingRS-UL-ConfigDedicatedAperiodic* i.e. it does not apply the default for this field (release).

### 5.3.13a UE actions upon SR release request for NB-IoT

Upon receiving a SR release request from lower layers, the UE shall:

1> apply the value *FALSE* for *sr-WithHARQ-ACK-Config* and release *sr-WithHARQ-ACK-Config*, if configured;

1> apply the value *release* for *sr-WithoutHARQ-ACK-Config* and release *sr-WithoutHARQ-ACK-Config*, if configured;

1> apply the value *release* for *sr-SPS-BSR-Config* and release *sr-SPS-BSR-Config*, if configured;

### 5.3.13b UE actions upon PUR release request

Upon receiving a PUR release request from lower layers, the UE shall:

1> release *pur-Config*, if configured;

1> discard previously stored *pur-Config*, if any.

### 5.3.14 Proximity indication

#### 5.3.14.1 General



Figure 5.3.14.1-1: Proximity indication

The purpose of this procedure is to indicate that the UE is entering or leaving the proximity of one or more CSG member cells. The detection of proximity is based on an autonomous search function as defined in TS 36.304 [4].

#### 5.3.14.2 Initiation

A UE in RRC\_CONNECTED shall:

1> if the UE enters the proximity of one or more CSG member cell(s) on an E-UTRA frequency while proximity indication is enabled for such E-UTRA cells; or

1> if the UE enters the proximity of one or more CSG member cell(s) on an UTRA frequency while proximity indication is enabled for such UTRA cells; or

1> if the UE leaves the proximity of all CSG member cell(s) on an E-UTRA frequency while proximity indication is enabled for such E-UTRA cells; or

1> if the UE leaves the proximity of all CSG member cell(s) on an UTRA frequency while proximity indication is enabled for such UTRA cells:

2> if the UE has previously not transmitted a *ProximityIndication* for the RAT and frequency during the current RRC connection, or if more than 5 s has elapsed since the UE has last transmitted a *ProximityIndication* (either entering or leaving) for the RAT and frequency:

3> initiate transmission of the *ProximityIndication* message in accordance with 5.3.14.3;

NOTE: In the conditions above, "if the UE enters the proximity of one or more CSG member cell(s)" includes the case of already being in the proximity of such cell(s) at the time proximity indication for the corresponding RAT is enabled.

#### 5.3.14.3 Actions related to transmission of *ProximityIndication* message

The UE shall set the contents of *ProximityIndication* message as follows:

1> if the UE applies the procedure to report entering the proximity of CSG member cell(s):

2> set *type* to *entering*;

1> else if the UE applies the procedure to report leaving the proximity of CSG member cell(s):

2> set *type* to *leaving*;

1> if the proximity indication was triggered for one or more CSG member cell(s) on an E-UTRA frequency:

2> set the *carrierFreq* to *eutra* with the value set to the E-ARFCN value of the E-UTRA cell(s) for which proximity indication was triggered;

1> else if the proximity indication was triggered for one or more CSG member cell(s) on a UTRA frequency:

2> set the *carrierFreq* to *utra* with the value set to the ARFCN value of the UTRA cell(s) for which proximity indication was triggered;

The UE shall submit the *ProximityIndication* message to lower layers for transmission.

### 5.3.15 Void

### 5.3.16 Unified Access Control

#### 5.3.16.1 General

The purpose of this procedure is to perform access barring check for an access attempt associated with a given Access Category and one or more Access Identities upon request from upper layers according to TS 24.501 [95] or the RRC layer.

BL UE or UE in CE in RRC\_CONNECTED uses *SystemInformationBlockType25,* if broadcasted,acquired when entering RRC\_CONNECTED or acquired while T311 is running.

Except for BL UE and UE in CE, after a handover resulting in change of PCell in RRC\_CONNECTED the UE shall defer access barring checks until it has obtained valid UAC information (from *SystemInformationBlockType25*) from the target cell if the *SystemInformationBlockType25* is broadcasted. For BL UE or UE in CE after a handover resulting in change of PCell, the UE shall consider sy*stemInformationBlockType25* is not broadcast in the target cell until the UE leaves RRC\_CONNECTED.

In NB-IoT, in RRC\_CONNECTED, the UE uses *MasterInformationBlock-NB* */ MasterInformationBlock-TDD-NB* and *SystemInformationBlockType14-NB,* if broadcasted,acquired when entering RRC\_CONNECTED or acquired while T311 is running.

#### 5.3.16.2 Initiation

Except for NB-IoT, upon initiation of the procedure, the UE shall:

1> if T309 is running for the Access Category:

2> consider the access attempt as barred;

1> else if timer T302 is running and the Access Category is neither '2' nor '0':

2> consider the access attempt as barred;

1> else:

2> if the Access Category is '0':

3> consider the access attempt as allowed;

2> else if *SystemInformationBlockType25* is not broadcasted:

3> consider the access attempt as allowed;

2> else if *ab-PerRSRP* is included:

3> if the *establishmentCause* received from higher layers is set to a value other than *emergency*:

4> if *ab-PerRSRP* is set to *thresh0*:

5> consider access to the cell as barred when in enhanced coverage as specified in TS 36.304 [4];

4> else if *ab-PerRSRP* is set to *thresh1*:

5> if the measured RSRP is less than the first entry in *rsrp-ThresholdsPrachInfoList*:

6> consider access to the cell as barred;

5> else:

6> consider that only the resources indicated for the first CE level are configured;

4> else if *ab-PerRSRP* is set to *thresh2*:

5> if the measured RSRP is less than the second entry in *rsrp-ThresholdsPrachInfoList*:

6> consider access to the cell as barred;

5> else:

6> consider that only the resources indicated for the first and second CE levels are configured;

4> else if *ab-PerRSRP* is set to *thresh3*:

5> if the measured RSRP is less than the third entry in *rsrp-ThresholdsPrachInfoList*:

6> consider access to the cell as barred;

5> else:

6> consider that only the resources indicated for the first, second, and third CE levels are configured;

2> if the Access Category is not '0', and *SystemInformationBlockType25* is broadcasted, and access to the cell is not barred due to *ab-PerRSRP*:

3> if *SystemInformationBlockType25* includes *uac-BarringPerPLMN-List* and the *uac-BarringPerPLMN-List* contains an *UAC-BarringPerPLMN* entry with the *plmn-IdentityIndex* corresponding to the PLMN selected by upper layers (see TS 24.501 [95]):

4> select the *UAC-BarringPerPLMN* entry with the *plmn-IdentityIndex* corresponding to the PLMN selected by upper layers;

4> in the remainder of this procedure, use the selected *UAC-BarringPerPLMN* entry (i.e. presence or absence of access barring parameters in this entry) irrespective of the *uac-BarringForCommon* included in *SystemInformationBlockType25;*

3> else if *SystemInformationBlockType25* includes *uac-BarringForCommon*:

4> in the remainder of this procedure use the *uac-BarringForCommon* (i.e. presence or absence of these parameters) included in *SystemInformationBlockType25*;

3> else:

4> consider the access attempt as allowed;

3> if *uac-BarringForCommon* is applicable or the *uac-AC-BarringListType* indicated that *uac-ExplicitAC-BarringList* is used:

4> if the corresponding *UAC-BarringPerCatList* contains a *UAC-BarringPerCat* entry corresponding to the Access Category:

5> select the *UAC-BarringPerCat* entry;

5> if the uac-BarringInfoSetList contain a *UAC-BarringInfoSet* entry corresponding to the *uac-barringInfoSetIndex* in the *UAC-BarringPerCat*:

6> select the *UAC-BarringInfoSet* entry;

6> perform access barring check for the Access Category as specified in 5.3.16.5, using the *UAC-BarringInfoSet* as "UAC barring parameter";

5> else:

6> consider the access attempt as allowed;

4> else:

5> consider the access attempt as allowed;

3> else if the *uac-AC-BarringListType* indicated that *uac-ImplicitAC-BarringList* is indicated:

4> select the *uac-BarringInfoSetIndex* corresponding to the Access Category in the *uac-ImplicitACBarringList;*

4> if the *uac-BarringInfoSetList* contain the *UAC-BarringInfoSet* entry corresponding to the selected *uac-BarringInfoSetIndex*:

5> select the *UAC-BarringInfoSet* entry;

5> perform access barring check for the Access Category as specified in 5.3.16.5, using the *UAC-BarringInfoSet* as "UAC barring parameter";

4> else:

5> consider the access attempt as allowed;

3> else:

4> consider the access attempt as allowed;

1> if the access barring check was requested by upper layers:

2> if the access attempt is considered as barred:

3> if timer T302 is running:

4> if timer T309 is running for Access Category '2':

5> inform the upper layer that access barring is applicable for all access categories except categories '0', upon which the procedure ends;

4> else:

5> inform the upper layer that access barring is applicable for all access categories except categories '0' and '2', upon which the procedure ends;

3> else:

4> inform upper layers that the access attempt for the Access Category is barred, upon which the procedure ends;

2> else:

3> inform upper layers that the access attempt for the Access Category is allowed, upon which the procedure ends;

1> else:

2> the procedure ends;

For NB-IoT, upon initiation of the procedure, the UE shall:

1> if T309 is running for the Access Category:

2> consider the access attempt as barred;

1> else:

2> if the Access Category is '0':

3> consider the access attempt as allowed;

2> else if *ab-Barring-5GC* in *MasterInformationBlock-NB* / *MasterInformationBlock-TDD-NB* is set to *FALSE*:

3> consider the access attempt as allowed;

2> else:

3> if *SystemInformationBlockType14-NB* includes *uac-BarringCommon*:

4> in the remainder of this procedure, use the *UAC-BarringCommon* as *UAC-Barring*;

3> else if *SystemInformationBlockType14-NB* includes *uac-BarringPerPLMN-List* and the *uac-BarringPerPLMN-List* contains an *UAC-Barring* entry with the *plmn-IdentityIndex* corresponding to the PLMN selected by upper layers (see TS 24.501 [95]):

4> select the *UAC-Barring* entry with the *plmn-IdentityIndex* corresponding to the PLMN selected by upper layers;

4> in the remainder of this procedure, use the selected *UAC-Barring* entry as *UAC-Barring*;

3> else:

4> consider the access attempt as allowed;

3> if *UAC-Barring* is applicable:

4> if one or more Access Identities are indicated according to TS 24.501 [95]; and

4> if for at least one of these Access Identities the corresponding bit in the *uac-BarringForAccessIdentity* is set to zero:

5> consider the access attempt as allowed;

4> else if the *UAC-BarringPerCatList* contains a *UAC-BarringPerCat* entry corresponding to the Access Category:

5> select the *UAC-BarringPerCat* entry;

6> perform access barring check for the Access Category as specified in 5.3.16.5, using the *uac-BarringForAccessIdentity* and the *UAC-BarringPetCat* entry as "UAC barring parameter";

5> else:

6> consider the access attempt as allowed;

1> if the access barring check was requested by upper layers:

2> if the access attempt is considered as barred:

3> inform upper layers that the access attempt for the Access Category is barred, upon which the procedure ends;

2> else:

3> inform upper layers that the access attempt for the Access Category is allowed, upon which the procedure ends;

1> else:

2> the procedure ends;

#### 5.3.16.3 Void

#### 5.3.16.4 T302, T309 expiry or stop (Barring alleviation)

Except for NB-IoT, if the UE is connected to 5GC, the UE shall:

1> if timer T302 expires or is stopped:

2> for each Access Category for which T309 is not running:

3> consider the barring for this Access Category to be alleviated:

1> else if timer T309 corresponding to an Access Category other than '2' expires or is stopped, and if timer T302 is not running:

2> consider the barring for this Access Category to be alleviated;

1> else if timer T309 corresponding to the Access Category '2' expires or is stopped:

2> consider the barring for this Access Category to be alleviated;

1> When barring for an access category is considered being alleviated:

2> if the Access Category was informed to upper layers as barred:

3> inform upper layers about barring alleviation for the Access Category;

2> if barring is alleviated for Access Category '8'; or

2> if barring is alleviated for Access Category '2':

3> perform actions specified in 5.3.17;

For NB-IoT, if the UE is connected to 5GC, the UE shall:

1> if timer T309 expires or is stopped for one Access Category:

2> consider the barring for this Access Category to be alleviated;

2> if the Access Category was informed to upper layers as barred:

3> inform upper layers about barring alleviation for the Access Category;

#### 5.3.16.5 Access barring check

The UE shall:

1> if one or more Access Identities equal to 1, 2, 11, 12, 13, 14, or 15 are indicated according to TS 24.501 [95], and

1> if for at least one of these Access Identities the corresponding bit in the *uac-BarringForAccessIdentity* contained in "UAC barring parameter" is set to *zero*:

2> consider the access attempt as allowed;

1> else:

2> if the establishment of the RRC connection is the result of relase with redirect with *mpsPriorityIndication* (either in NR or E-UTRAN); and

2> if the bit corresponding to Access Identity 1 in the *uac-BarringForAccessIdentity* contained in the "UAC barring parameter" is set to *zero*:

3> consider the access attempt as allowed;

2> else if Access Identity 3 is indicated:

3> draw a random number '*rand*' uniformly distributed in the range: 0 ≤ rand < 1;

3> if '*rand*' is lower than the value indicated by *uac-BarringFactorForAI3* included in "UAC barring parameter":

4> consider the access attempt as allowed;

3> else:

4> consider the access attempt as barred;

2> else:

3> draw a random number '*rand*' uniformly distributed in the range: 0 ≤ *rand* < 1;

3> if '*rand*' is lower than the value indicated by *uac-BarringFactor* included in "UAC barring parameter":

4> consider the access attempt as allowed;

3> else:

4> consider the access attempt as barred;

1> if the access attempt is considered as barred:

2> draw a random number '*rand*' that is uniformly distributed in the range 0 ≤ *rand* < 1;

2> start timer T309 for the Access Category with the timer value calculated as follows, using the *uac-BarringTime* included in"UAC barring parameter":

"Tbarring" = (0.7+ 0.6 \* *rand*) \* *uac-BarringTime*;

### 5.3.17 RAN notification area update

#### 5.3.17.1 General

The purpose of this procedure is:

- to notify the network that a UE in RRC\_INACTIVE has re-selected to a cell not belonging to the configured RAN notification area; or

- to periodically notify the network by a UE in RRC\_INACTIVE;

#### 5.3.17.2 Initiation

When in RRC\_INACTIVE state, the UE shall:

1> if T380 expires, or:

1> if RNA Update is triggered at reception of *SystemInformationBlockType1*, as specified in 5.2.2.7:

2> initiate RRC connection resume procedure in 5.3.3 with cause value set to 'rna-Update';

1> if barring is alleviated for Access Category '8' or Access Category '2', as specified in 5.3.16.4:

2> if upper layers do not request RRC the resumption of an RRC connection, and

2> if the variable *pendingRnaUpdate* is set to 'TRUE':

3> initiate RRC connection resume procedure in 5.3.3 with cause value set to 'rna-Update';

If the UE in RRC\_INACTIVE state fails to find a suitable cell and camps on the acceptable cell to obtain limited service as defined in TS 36.304 [4], the UE shall:

1> perform the actions upon leaving RRC\_INACTIVE as specified in 5.3.12 with release cause 'other'.

#### 5.3.17.3 Inter RAT cell reselection or CN type change

Upon reselecting to an inter-RAT cell or to another CN type, the UE shall:

1> perform the actions upon leaving RRC\_INACTIVE as specified in 5.3.12, with release cause 'other'.

### 5.3.18 T317 expiry

The UE in RRC\_CONNECTED shall:

1> if T317 expires and the UE is not performing GNSS measurement; or

1> if indication is received that new GNSS position becomes valid and T317 has expired during the GNSS measurement; or

1> if indication is received that new GNSS position becomes valid, and T317 has expired before the GNSS measurement, and timer T318 has been stopped upon the GNSS measurement:

2> inform lower layers that the UL synchronisation is lost;

2> start timer T318;

2> acquire *SystemInformationBlockType31* (*SystemInformationBlockType31-NB* in NB-IoT) as specified in 5.2.2;

2> if the UE acquires *SystemInformationBlockType33* (*SystemInformationBlockType33-NB* in NB-IoT) as specified in 5.2.2:

3> inform lower layers when UL synchronisation is restored upon successful acquisition of *SystemInformationBlockType31* (*SystemInformationBlockType31-NB* in NB-IoT);

3> stop timer T318 when both *SystemInformationBlockType31* (*SystemInformationBlockType31-NB* in NB-IoT) and *SystemInformationBlockType33* (*SystemInformationBlockType33-NB* in NB-IoT) are acquired;

2> else:

3> upon successful acquisition of *SystemInformationBlockType31* (*SystemInformationBlockType31-NB* in NB-IoT):

4> stop timer T318;

4> inform lower layers when UL synchronisation is restored.

NOTE 1: *SystemInformationBlockType31* (*SystemInformationBlockType31-NB* in NB-IoT) and *SystemInformationBlockType33* (*SystemInformationBlockType33-NB* in NB-IoT) may be broadcast on a different narrowband or different NB-IoT carrier than the one configured to the UE.

NOTE 2: The exact time when UL synchronisation is restored (after *SystemInformationBlockType31* or *SystemInformationBlockType31-NB* in NB-IoT is acquired) is left to UE implementation, which can be from the subframe indicated by *epochTime* and optionally before the subframe indicated by *epochTime*.

NOTE 3: For UEs not capable of performing system information acquisition and GNSS measurement at the same time, if the UE cannot complete acquisition of *SystemInformationBlockType31* (*SystemInformationBlockType31-NB*) before the start of GNSS measurement gap, acquisition of *SystemInformationBlockType31* (*SystemInformationBlockType31-NB*) may be postponed until GNSS measurement is completed, and T318 is restarted after GNSS measurement is completed.

## 5.4 Inter-RAT mobility

### 5.4.1 Introduction

The general principles of connected mode mobility are described in 5.3.1.3. The general principles of the security handling upon connected mode mobility are described in 5.3.1.2.

For the (network controlled) inter RAT mobility from E-UTRA for a UE in RRC\_CONNECTED, a single procedure is defined that supports both handover, cell change order with optional network assistance (NACC) and enhanced CS fallback to CDMA2000 1xRTT. The same procedure also supports inter-system handover between E-UTRA/EPC and E-UTRA/5GC. In case of mobility to CDMA2000, the eNB decides when to move to the other RAT while the target RAT determines to which cell the UE shall move.

### 5.4.2 Handover to E-UTRA

#### 5.4.2.1 General



Figure 5.4.2.1-1: Handover to E-UTRA, successful

The purpose of this procedure is to, under the control of the network, transfer a connection between the UE and another Radio Access Network (e.g. GERAN, UTRAN or NR) to E-UTRAN, or transfer a connection between the UE and the E-UTRAN with one type of CN to the E-UTRAN with a different type of CN.

The handover to E-UTRA procedure applies when SRBs, possibly in combination with DRBs, are established in another RAT or in E-UTRA connected to another type of CN. Handover from UTRAN to E-UTRAN applies only after integrity has been activated in UTRAN. Handover to E-UTRA connected to a different type of CN applies only after integrity has been activated in E-UTRAN. Handover from NR to E-UTRAN applies only after integrity has been activated in NR.

#### 5.4.2.2 Initiation

The RAN using another RAT or the E-UTRA connected to a different type of CN initiates the handover to E-UTRA procedure, in accordance with the specifications applicable for the other RAT or for the E-UTRA connected to a different type of CN, by sending the *RRCConnectionReconfiguration* message via the radio access technology from which the inter-RAT handover is performed.

E-UTRAN applies the procedure as follows:

- to activate ciphering, possibly using NULL algorithm, if not yet activated in the other RAT or in the E-UTRA connected to a different type of CN;

- to establish SRB1, SRB2 and one or more DRBs, i.e. at least the DRB associated with the default EPS bearer is established if the target CN is EPC and at least one DRB is established if the target CN is 5GC.

#### 5.4.2.3 Reception of the *RRCConnectionReconfiguration* by the UE

If the UE is able to comply with the configuration included in the *RRCConnectionReconfiguration* message, the UE shall:

1> if the *RRCConnectionReconfiguration* message does not include the *fullConfig* and the UE is connected to 5GC (i.e., delta signalling during intra 5GC handover):

2> re-use the source SDAP and PDCP configurations (i.e., current SDAP/PDCP configurations for all RBs from source RAT prior to the reception of the inter-RAT handover *RRCConnectionReconfiguration* message);

1> if the *RRCConnectionReconfiguration* message includes the *fullConfig* and the source RAT was E-UTRA (i.e., intra-RAT inter-system handover):

2> except the MCG C-RNTI, release/ clear all current dedicated radio resources and configurations, including all SDAP (if configured), PDCP, RLC, logical channel configurations for the DRBs and the logged measurement configuration (if configured);

2> release/ clear all current common radio configurations;

2> for each *srb-Identity* value included in the *srb-ToAddModList* (SRB reconfiguration):

3> apply the specified configuration defined in 9.1.2 for the corresponding SRB;

3> apply the corresponding default RLC configuration for the SRB specified in 9.2.1.1 for SRB1 or in 9.2.1.2 for SRB2;

3> apply the corresponding default logical channel configuration for the SRB as specified in 9.2.1.1 for SRB1 or in 9.2.1.2 for SRB2;

3> if the *handoverType* in *securityConfigHO* is set to *fivegc-ToEPC* (i.e, the UE is connecting to EPC):

4> release the PDCP entity and establish it with an E-UTRA PDCP entity;

3> else if the *handoverType* in *securityConfigHO* is set to *epc-To5GC* (i.e., the UE is connecting to 5GC):

4> release the PDCP entity and establish it with an NR PDCP and apply the corresponding default PDCP configuration for the SRB as specified in TS 38.331 [82], clause 9.2.1;

3> associate the RLC bearer of this SRB with the established PDCP entity;

1> apply the default physical channel configuration as specified in 9.2.4;

1> apply the default semi-persistent scheduling configuration as specified in 9.2.3;

1> apply the default MAC main configuration as specified in 9.2.2;

1> start timer T304 with the timer value set to *t304,* as included in the *mobilityControlInfo*;

1> consider the target PCell to be one on the frequency indicated by the *carrierFreq* with a physical cell identity indicated by the *targetPhysCellId*;

1> start synchronising to the DL of the target PCell;

1> set the C-RNTI to the value of the *newUE-Identity*;

1> for the target PCell, apply the downlink bandwidth indicated by the *dl-Bandwidth;*

1> for the target PCell, apply the uplink bandwidth indicated by (the absence or presence of) the *ul-Bandwidth;*

1> configure lower layers in accordance with the received *radioResourceConfigCommon*;

1> configure lower layers in accordance with any additional fields, not covered in the previous, if included in the received *mobilityControlInfo*;

1> perform the radio resource configuration procedure as specified in 5.3.10.0;

1> if the *handoverType* in *securityConfigHO* is set to *fivegc-ToEPC*:

2> indicate to higher layer that the CN has changed from 5GC to EPC;

2> derive the key KeNB based on the mapped KASME key as specified for interworking between EPS and 5GS in TS 33.501 [86];

2> store the *nextHopChainingCount-r15* value;

1> else if the *handoverType* in *securityConfigHO* is set to *intra5GC*:

2> if the *keyChangeIndicator-r15* received in the *securityConfigHO* is set to *TRUE*:

3> forward *nas-Container* to the upper layers, if included;

3> update the KeNB key based on the KAMF key, as specified in TS 33.501 [86];

2> else:

3> update the KeNB key based on the current KgNB or the NH, using the *nextHopChainingCount-r15* value indicated in the *SecurityConfigHO*, as specified in TS 33.501 [86];

2> store the *nextHopChainingCount-r15* value;

1> else if the *handoverType* in *securityConfigHO* is set to *epc-To5GC*:

2> forward the *nas-Container* to the upper layers;

2> derive the KeNB key, as specified in TS 33.501 [86];

1> else:

2> forward the *nas-SecurityParamToEUTRA* to the upper layers;

2> derive the KeNB key, as specified in TS 33.401 [32];

1> derive the KRRCint key associated with the *integrityProtAlgorithm*, as specified in TS 33.401 [32];

1> derive the KRRCenc key and the KUPenc key associated with the *cipheringAlgorithm*, as specified in TS 33.401 [32];

1> if capable of user plane integrity protection:

2> derive the KUPint key associated with the *integrityProtAlgorithm*, as specified in TS 33.401 [32];

1> if the received *RRCConnectionReconfiguration* includes the *sk-Counter*:

2> perform key update procedure as specified in in TS 38.331 [82], clause 5.3.5.7;

1> if the received *RRCConnectionReconfiguration* includes the *nr-SecondaryCellGroupConfig*:

2> perform NR RRC Reconfiguration as specified in TS 38.331 [82], clause 5.3.5.3;

1> if the received *RRCConnectionReconfiguration* includes the *nr-RadioBearerConfig1*:

2> perform radio bearer configuration as specified in TS 38.331 [82], clause 5.3.5.6;

1> if the received *RRCConnectionReconfiguration* includes the *nr-RadioBearerConfig2*:

2> perform radio bearer configuration as specified in TS 38.331 [82], clause 5.3.5.6;

1> if the *handoverType* in *securityConfigHO* is set to *fivegc-ToEPC* orif the *handoverType-v1530* is not present:

2> configure lower layers to apply the indicated integrity protection algorithm and the KRRCint key immediately, i.e. the indicated integrity protection configuration shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;

2> configure lower layers to apply the indicated ciphering algorithm, the KRRCenc key and the KUPenc key immediately, i.e. the indicated ciphering configuration shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;

1> if the received *RRCConnectionReconfiguration* includes the s*CellToAddModList*:

2> perform SCell addition as specified in 5.3.10.3b;

1> if the *RRCConnectionReconfiguration* message includes the *measConfig*:

2> perform the measurement configuration procedure as specified in 5.5.2;

1> perform the measurement identity autonomous removal as specified in 5.5.2.2a;

1> if the *RRCConnectionReconfiguration* message includes the *otherConfig*:

2> perform the other configuration procedure as specified in 5.3.10.9;

1> if the *RRCConnectionReconfiguration* message includes *wlan-OffloadInfo*:

2> perform the dedicated WLAN offload configuration procedure as specified in 5.6.12.2;

1> if the *RRCConnectionReconfiguration* message includes *rclwi-Configuration*:

2> perform the WLAN traffic steering command procedure as specified in 5.6.16.2;

1> if the *RRCConnectionReconfiguration* message includes *lwa-Configuration*:

2> perform the LWA configuration procedure as specified in 5.6.14.2;

1> if the *RRCConnectionReconfiguration* message includes *lwip-Configuration*:

2> perform the LWIP reconfiguration procedure as specified in 5.6.17.2;

1> set the content of *RRCConnectionReconfigurationComplete* message as follows:

2> if the UE has radio link failure or handover failure information available in *VarRLF-Report* and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report*:

3> include *rlf-InfoAvailable*;

2> if the UE has MBSFN logged measurements available for E-UTRA and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport* and if T330 is not running:

3> include *logMeasAvailableMBSFN*;

2> else if the UE has logged measurements available for E-UTRA and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:

3> include the *logMeasAvailable*;

3> if Bluetooth measurement results are included in the logged measurements the UE has available:

4> include the *logMeasAvailableBT*;

3> if WLAN measurement results are included in the logged measurements the UE has available:

4> include the *logMeasAvailableWLAN*;

2> if the UE has connection establishment failure information available in *VarConnEstFailReport* and if the RPLMN is equal to *plmn-Identity* stored in *VarConnEstFailReport*:

3> include *connEstFailInfoAvailable*;

2> if the received *RRCConnectionReconfiguration* message included *nr-SecondaryCellGroupConfig*:

3> include *scg-ConfigResponseNR* in accordance with TS 38.331 [82], clause 5.3.5.3;

1> submit the *RRCConnectionReconfigurationComplete* message to lower layers for transmission using the new configuration;

1> if the *RRCConnectionReconfiguration* message does not include *rlf-TimersAndConstants* set to *setup*:

2> use the default values specified in 9.2.5 for timer T310, T311 and constant N310, N311;

1> if MAC successfully completes the random access procedure:

2> stop timer T304;

2> apply the parts of the CQI reporting configuration, the scheduling request configuration and the sounding RS configuration that do not require the UE to know the SFN of the target PCell, if any;

2> apply the parts of the measurement and the radio resource configuration that require the UE to know the SFN of the target PCell (e.g. measurement gaps, periodic CQI reporting, scheduling request configuration, sounding RS configuration), if any, upon acquiring the SFN of the target PCell;

NOTE 1: Whenever the UE shall setup or reconfigure a configuration in accordance with a field that is received it applies the new configuration, except for the cases addressed by the above statements.

2> enter E-UTRA RRC\_CONNECTED, upon which the procedure ends;

NOTE 2: The UE is not required to determine the SFN of the target PCell by acquiring system information from that cell before performing RACH access in the target PCell.

NOTE 3: If the handover is from NR and target CN is 5GC, the delta configuration on PDCP and SDAP can be used for intra-system inter-RAT handover. For other cases, source RAT configuration is not considered when the UE applies the reconfiguration message of target RAT.

#### 5.4.2.4 Reconfiguration failure

The UE shall:

1> if the UE is unable to comply with (part of) the configuration included in the *RRCConnectionReconfiguration* message or if the upper layers indicate that the *nas-Container* is invalid:

2> if the source RAT is E-UTRA*:*

3> perform the actions as specified in 5.3.5.5;

2> else*:*

3> perform the actions defined for this failure case as defined in the specifications applicable for the other RAT;

NOTE 1: The UE may apply above failure handling also in case the *RRCConnectionReconfiguration* message causes a protocol error for which the generic error handling as defined in 5.7 specifies that the UE shall ignore the message.

NOTE 2: If the UE is unable to comply with part of the configuration, it does not apply any part of the configuration, i.e. there is no partial success/ failure.

#### 5.4.2.5 T304 expiry (handover to E-UTRA failure)

The UE shall:

1> upon T304 expiry (handover to E-UTRA failure):

2> if the source RAT is E-UTRA:

3> perform the actions as specified in 5.3.5.6;

2> else:

3> reset MAC;

3> perform the actions defined for this failure case as defined in the specifications applicable for the other RAT;

### 5.4.3 Mobility from E-UTRA

#### 5.4.3.1 General



Figure 5.4.3.1-1: Mobility from E-UTRA, successful



Figure 5.4.3.1-2: Mobility from E-UTRA, failure

The purpose of this procedure is to move a UE in RRC\_CONNECTED to a cell using another Radio Access Technology (RAT), e.g. GERAN, UTRA, CDMA2000 systems, NR, or handover a UE to an E-UTRA cell connected to another type of CN. The mobility from E-UTRA procedure covers the following type of mobility:

- handover, i.e. the *MobilityFromEUTRACommand* message includes radio resources that have been allocated for the UE in the target cell;

- cell change order, i.e. the *MobilityFromEUTRACommand* message may include information facilitating access of and/ or connection establishment in the target cell, e.g. system information. Cell change order is applicable only to GERAN; and

- enhanced CS fallback to CDMA2000 1xRTT, i.e. the *MobilityFromEUTRACommand* message includes radio resources that have been allocated for the UE in the target cell. The enhanced CS fallback to CDMA2000 1xRTT may be combined with concurrent handover or redirection to CDMA2000 HRPD.

NOTE: For the case of dual receiver/transmitter enhanced CS fallback to CDMA2000 1xRTT, the *DLInformationTransfer* message is used instead of the *MobilityFromEUTRACommand* message (see TS 36.300 [9]).

#### 5.4.3.2 Initiation

E-UTRAN initiates the mobility from E-UTRA procedure to a UE in RRC\_CONNECTED, possibly in response to a *MeasurementReport* message, in response to reception of CS fallback indication for the UE from MME, or in response to an *MCGFailureInformation* message by sending a *MobilityFromEUTRACommand* message. E-UTRAN applies the procedure as follows:

- the procedure is initiated only when AS-security has been activated, and SRB2 with at least one DRB are setup and not suspended;

- the procedure is not initiated if any DAPS bearer is configured;

#### 5.4.3.3 Reception of the *MobilityFromEUTRACommand* by the UE

The UE shall be able to receive a *MobilityFromEUTRACommand* message and perform a cell change order to GERAN, even if no prior UE measurements have been performed on the target cell.

The UE shall:

1> stop timer T310, if running;

1> stop timer T312, if running;

1> if timer T316 is running:

2> stop timer T316;

2> clear the information included in *VarRLF-Report*, if any;

1> if T309 is running:

2> stop timer T309 for all access categories;

2> perform the actions as specified in 5.3.16.4.

1> if the *MobilityFromEUTRACommand* message includes the *purpose* set to *handover*:

2> if the *targetRAT-Type* is set to *utra* or *geran*:

3> consider inter-RAT mobility as initiated towards the RAT indicated by the *targetRAT-Type* included in the *MobilityFromEUTRACommand* message;

3> forward the *nas-SecurityParamFromEUTRA* to the upper layers;

3> access the target cell indicated in the inter-RAT message in accordance with the specifications of the target RAT;

3> if the *targetRAT-Type* is set to *geran*:

4> use the contents of *systemInformation*, if provided for PS Handover, as the system information to begin access on the target GERAN cell;

NOTE 1: If there are DRBs for which no radio bearers are established in the target RAT as indicated in the *targetRAT-MessageContainer* in the message, the E-UTRA RRC part of the UE does not indicate the release of the concerned DRBs to the upper layers. Upper layers may derive which bearers are not established from information received from the AS of the target RAT.

NOTE 2: In case of SR-VCC, the DRB to be replaced is specified in TS 23.216 [61].

2> else if the *targetRAT-Type* is set to *eutra*:

3> consider inter-system mobility as initiated towards E-UTRA;

3> forward the *nas-SecurityParamFromEUTRA* to the upper layers, if included;

3> access the target cell indicated in the inter-RAT message in accordance with clause 5.4.2.3;

2> else if the *targetRAT-Type* is set to *nr*:

3> consider inter-RAT mobility as initiated towards NR;

3> access the target cell indicated in the inter-RAT message in accordance with the specifications in TS 38.331 [82];

2> else if the *targetRAT-Type* is set to *cdma2000-1XRTT* or *cdma2000-HRPD*:

3> forward the *targetRAT-Type* and the *targetRAT-MessageContainer* to the CDMA2000 upper layers for the UE to access the cell(s) indicated in the inter-RAT message in accordance with the specifications of the CDMA2000 target-RAT;

1> else if the *MobilityFromEUTRACommand* message includes the *purpose* set to *cellChangeOrder*:

2> start timer T304 with the timer value set to *t304,* as included in the *MobilityFromEUTRACommand* message;

2> if the *targetRAT-Type* is set to *geran*:

3> if *networkControlOrder* is included in the *MobilityFromEUTRACommand* message:

4> apply the value as specified in TS 44.060 [36];

3> else:

4> acquire *networkControlOrder* and apply the value as specified in TS 44.060 [36];

3> use the contents of *systemInformation*, if provided, as the system information to begin access on the target GERAN cell;

2> establish the connection to the target cell indicated in the *CellChangeOrder*;

NOTE 3: The criteria for success or failure of the cell change order to GERAN are specified in TS 44.060 [36].

1> if the *MobilityFromEUTRACommand* message includes the *purpose* set to *e-CSFB*:

2> if *messageContCDMA2000-1XRTT* is present:

3> forward the *messageContCDMA2000-1XRTT* to the CDMA2000 upper layers for the UE to access the cell(s) indicated in the inter-RAT message in accordance with the specification of the target RAT;

2> if *mobilityCDMA2000-HRPD* is present and is set to *handover*:

3> forward the *messageContCDMA2000-HRPD* to the CDMA2000 upper layers for the UE to access the cell(s) indicated in the inter-RAT message in accordance with the specification of the target RAT;

2> if *mobilityCDMA2000-HRPD* is present and is set to *redirection*:

3> forward the *redirectCarrierCDMA2000-HRPD* to the CDMA2000 upper layers;

NOTE 4: When the CDMA2000 upper layers in the UE receive both the *messageContCDMA2000-1XRTT* and *messageContCDMA2000-HRPD* the UE performs concurrent access to both CDMA2000 1xRTT and CDMA2000 HRPD RAT.

NOTE 5: The UE should perform the handover, the cell change order or enhanced 1xRTT CS fallback as soon as possible following the reception of the RRC message *MobilityFromEUTRACommand*, which could be before confirming successful reception (HARQ and ARQ) of this message.

#### 5.4.3.4 Successful completion of the mobility from E-UTRA

Upon successfully completing the handover, the cell change order or enhanced 1xRTT CS fallback, the UE shall:

1> if the *targetRAT-Type* in the received *MobilityFromEUTRACommand* is set to *eutra* (intra-E-UTRA inter-system HO):

2> indicate to the upper layers associated to the source system the release of the RRC connection together with the release cause 'other';

2> the procedure ends;

1> else if the UE was connected to 5GC prior to the reception of the *MobilityFromEUTRACommand* and the *targetRAT-Type* in the received *MobilityFromEUTRACommand* is set to *nr*:

2> reset MAC;

2> stop all timers that are running except T325, T330;

2> release *ran-NotificationAreaInfo*, if stored;

2> release the AS security context including the KRRCenc key, the KRRCint, the KUPint key and the KUPenc key, if stored;

2> release all radio resources, including release of the RLC entity, the MAC configuration and the associated PDCP entity and SDAP entity for all established RBs;

NOTE 1: PDCP and SDAP configured by the source configurations RAT prior to the handover that are reconfigured and re-used by target RAT when delta signalling (i.e., during inter-RAT intra-system handover when *fullConfig* is not present) is used, are not released as part of this procedure.

2> if a *serviceType* is stored in the current UE configuration:

3> release the stored *serviceType*;

3> inform upper layers to clear the stored application layer measurement configuration;

3> discard received application layer measurement report information from upper layers;

3> consider itself not to be configured to send application layer measurement report;

1> else:

2> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'other';

NOTE 2: If the UE performs enhanced 1xRTT CS fallback along with concurrent mobility to CDMA2000 HRPD and the connection to either CDMA2000 1xRTT or CDMA2000 HRPD succeeds, then the mobility from E-UTRA is considered successful.

#### 5.4.3.5 Mobility from E-UTRA failure

The UE shall:

1> if T304 configured in the *MobilityFromEUTRACommand* message expires (mobility from E-UTRA failure); or

1> if the UE does not succeed in establishing the connection to the target radio access technology; or

1> if the UE is unable to comply with (part of) the configuration included in the *MobilityFromEUTRACommand* message; or

1> if there is a protocol error in the inter RAT information included in the *MobilityFromEUTRACommand* message, causing the UE to fail the procedure according to the specifications applicable for the target RAT (i.e. according to clause 5.3.5.6 if the *targetRAT-Type* in the received *MobilityFromEUTRACommand* is set to *eutra*):

2> stop T304, if running;

2> if the *cs-FallbackIndicator* in the *MobilityFromEUTRACommand* message was set to *TRUE* or *e-CSFB* was present:

*3>* indicate to upper layers that the CS fallback procedure has failed;

2> revert back to the configuration used in the source PCell, excluding the configuration configured by the *physicalConfigDedicated*, *mac-MainConfig* and *sps-Config*;

2> if *MobilityFromEUTRACommand* concerned a failed inter-RAT handover from E-UTRA to NR and if the UE supports Radio Link Failure Report for Inter-RAT MRO NR:

3> store handover failure information in *VarRLF-Report* according to 5.3.5.6;

2> initiate the connection re-establishment procedure as specified in 5.3.7;

NOTE: For enhanced CS fallback to CDMA2000 1xRTT, the above UE behavior applies only when the UE is attempting the enhanced 1xRTT CS fallback and connection to the target radio access technology fails or if the UE is attempting enhanced 1xRTT CS fallback along with concurrent mobility to CDMA2000 HRPD and connection to both the target radio access technologies fails.

### 5.4.4 Handover from E-UTRA preparation request (CDMA2000)

#### 5.4.4.1 General



Figure 5.4.4.1-1: Handover from E-UTRA preparation request

The purpose of this procedure is to trigger the UE to prepare for handover or enhanced 1xRTT CS fallback to CDMA2000 by requesting a connection with this network. The UE may use this procedure to concurrently prepare for handover to CDMA2000 HRPD along with preparation for enhanced CS fallback to CDMA2000 1xRTT. This procedure applies to CDMA2000 capable UEs only.

This procedure is also used to trigger the UE which supports dual Rx/Tx enhanced 1xCSFB to redirect its second radio to CDMA2000 1xRTT.

The handover from E-UTRA preparation request procedure applies when signalling radio bearers are established.

#### 5.4.4.2 Initiation

E-UTRAN initiates the handover from E-UTRA preparation request procedure to a UE in RRC\_CONNECTED, possibly in response to a *MeasurementReport* message or CS fallback indication for the UE, by sending a *HandoverFromEUTRAPreparationRequest* message. E-UTRA initiates the procedure only when AS security has been activated.

#### 5.4.4.3 Reception of the *HandoverFromEUTRAPreparationRequest* by the UE

Upon reception of the *HandoverFromEUTRAPreparationRequest* message, the UE shall:

1> if *dualRxTxRedirectIndicator* is present in the received message:

2> forward *dualRxTxRedirectIndicator* to the CDMA2000 upper layers;

2> forward *redirectCarrierCDMA2000-1XRTT* to the CDMA2000 upper layers, if included;

1> else:

2> indicate the request to prepare handover or enhanced 1xRTT CS fallback and forward the *cdma2000-Type* to the CDMA2000 upper layers;

2> if *cdma2000-Type* is set to *type1XRTT*:

3> forward the *rand* and the *mobilityParameters* to the CDMA2000 upper layers;

2> if *concurrPrepCDMA2000-HRPD* is present in the received message:

3> forward *concurrPrepCDMA2000-HRPD* to the CDMA2000 upper layers;

2> else:

3> forward *concurrPrepCDMA2000-HRPD*, with its value set to *FALSE*, to the CDMA2000 upper layers;

### 5.4.5 UL handover preparation transfer (CDMA2000)

#### 5.4.5.1 General



Figure 5.4.5.1-1: UL handover preparation transfer

The purpose of this procedure is to tunnel the handover related CDMA2000 dedicated information or enhanced 1xRTT CS fallback related CDMA2000 dedicated information from UE to E-UTRAN when requested by the higher layers. The procedure is triggered by the higher layers on receipt of *HandoverFromEUTRAPreparationRequest* message. If preparing for enhanced CS fallback to CDMA2000 1xRTT and handover to CDMA2000 HRPD, the UE sends two consecutive *ULHandoverPreparationTransfer* messages to E-UTRAN, one per addressed CDMA2000 RAT Type. This procedure applies to CDMA2000 capable UEs only.

#### 5.4.5.2 Initiation

A UE in RRC\_CONNECTED initiates the UL handover preparation transfer procedure whenever there is a need to transfer handover or enhanced 1xRTT CS fallback related non-3GPP dedicated information. The UE initiates the UL handover preparation transfer procedure by sending the *ULHandoverPreparationTransfer* message.

#### 5.4.5.3 Actions related to transmission of the *ULHandoverPreparationTransfer* message

The UE shall set the contents of the *ULHandoverPreparationTransfer* message as follows:

1> include the *cdma2000-Type* and the *dedicatedInfo*;

1> if the *cdma2000-Type* is set to *type1XRTT*:

2> include the *meid* and set it to the value received from the CDMA2000 upper layers;

1> submit the *ULHandoverPreparationTransfer* message to lower layers for transmission, upon which the procedure ends;

#### 5.4.5.4 Failure to deliver the *ULHandoverPreparationTransfer* message

The UE shall:

1> if the UE is unable to guarantee successful delivery of *ULHandoverPreparationTransfer* messages:

2> inform upper layers about the possible failure to deliver the information contained in the concerned *ULHandoverPreparationTransfer* message;

### 5.4.6 Inter-RAT cell change order to E-UTRAN

#### 5.4.6.1 General

The purpose of the inter-RAT cell change order to E-UTRAN procedure is to transfer, under the control of the source radio access technology, a connection between the UE and another radio access technology (e.g. GSM/ GPRS) to E-UTRAN.

#### 5.4.6.2 Initiation

The procedure is initiated when a radio access technology other than E-UTRAN, e.g. GSM/GPRS, using procedures specific for that RAT, orders the UE to change to an E-UTRAN cell. In response, upper layers request the establishment of an RRC connection as specified in clause 5.3.3.

NOTE: Within the message used to order the UE to change to an E-UTRAN cell, the source RAT should specify the identity of the target E-UTRAN cell as specified in the specifications for that RAT.

The UE shall:

1> upon receiving an *RRCConnectionSetup* message:

2> consider the inter-RAT cell change order procedure to have completed successfully;

#### 5.4.6.3 UE fails to complete an inter-RAT cell change order

If the inter-RAT cell change order fails the UE shall return to the other radio access technology and proceed as specified in the appropriate specifications for that RAT.

The UE shall:

1> upon failure to establish the RRC connection as specified in clause 5.3.3:

2> consider the inter-RAT cell change order procedure to have failed;

NOTE: The cell change was network ordered. Therefore, failure to change to the target PCell should not cause the UE to move to UE-controlled cell selection.

## 5.5 Measurements

### 5.5.1 Introduction

For NB-IoT in RRC\_CONNECTED state measurements see clause 5.5.8.

For BL UEs or UEs in CE or NB-IoT UEs that are connected to NTN, GNSS measurement triggering and reporting related procedures are defined in 5.5.9.

The UE reports measurement information in accordance with the measurement configuration and performs conditional reconfiguration evaluation in accordance with conditional reconfiguration as provided by E-UTRAN. E-UTRAN provides the measurement configuration or the conditional reconfiguration applicable for a UE in RRC\_CONNECTED by means of dedicated signalling, i.e. using the *RRCConnectionReconfiguration* or *RRCConnectionResume* message.

The UE can be requested to perform the following types of measurements:

- Intra-frequency measurements: measurements at the downlink carrier frequency(ies) of the serving cell(s).

- Inter-frequency measurements: measurements at frequencies that differ from any of the downlink carrier frequency(ies) of the serving cell(s).

- Inter-RAT measurements of NR frequencies.

- Inter-RAT measurements of UTRA frequencies.

- Inter-RAT measurements of GERAN frequencies.

- Inter-RAT measurements of CDMA2000 HRPD or CDMA2000 1xRTT or WLAN frequencies.

- CBR measurements for V2X sidelink communication.

- Sensing measurements for V2X sidelink communication.

The measurement configuration includes the following parameters:

1. **Measurement objects:** The objects on which the UE shall perform the measurements.

- For intra-frequency and inter-frequency measurements a measurement object is a single E-UTRA carrier frequency. Associated with this carrier frequency, E-UTRAN can configure a list of cell specific offsets, a list of 'exclude-listed' cells and a list of 'allow-listed' cells. Exclude-listed cells are not considered in event evaluation or measurement reporting.

- For inter-RAT NR measurements a measurement object is a single NR carrier frequency. Associated with this carrier frequency, E-UTRAN can configure a list of 'exclude-listed' cells. Exclude-listed cells are not considered in event evaluation or measurement reporting.

- For inter-RAT UTRA measurements a measurement object is a set of cells on a single UTRA carrier frequency.

- For inter-RAT GERAN measurements a measurement object is a set of GERAN carrier frequencies.

- For inter-RAT CDMA2000 measurements a measurement object is a set of cells on a single (HRPD or 1xRTT) carrier frequency.

- For inter-RAT WLAN measurements a measurement object is a set of WLAN identifiers and optionally a set of WLAN frequencies.

- For CBR measurements and sensing measurements a measurement object is a set of transmission resource pools for V2X sidelink communication.

NOTE 1: Some measurements using the above mentioned measurement objects, only concern a single cell, e.g. measurements used to report neighbouring cell system information, PCell UE Rx-Tx time difference, or a pair of cells, e.g. SSTD measurements between the PCell and the PSCell.

2. **Reporting configurations**: A list of measurement reporting configurations where each measurement reporting configuration consists of the following:

- Reporting criterion: The criterion that triggers the UE to send a measurement report. This can either be periodical or a single event description.

- Reporting format: The quantities that the UE includes in the measurement report and associated information (e.g. number of cells to report).

In case of conditional handover, conditional PSCell addition or MN initiated inter-SN conditional PSCell change triggering configuration, each configuration consists of the following:

- Execution criteria: The criteria that triggers the UE to perform conditional handover, conditional PSCell addition or MN initiated inter-SN conditional PSCell change.

3. **Measurement identities**: For measurement reporting, a list of measurement identities where each measurement identity links one measurement object with one measurement reporting configuration. By configuring multiple measurement identities it is possible to link more than one measurement object to the same reporting configuration, as well as to link more than one reporting configuration to the same measurement object. The measurement identity is used as a reference number in the measurement report. For conditional reconfiguration triggering, one measurement identity links to exactly one conditional reconfiguration trigger configuration. And up to two measurement identities can be linked to one conditional reconfiguration execution condition.

4. **Quantity configurations:** One quantity configuration is configured per RAT type. The quantity configuration defines the measurement quantities and associated filtering used for all event evaluation and related reporting of that measurement type. One filter can be configured per measurement quantity, except for NR where the network may configure up to 2 sets of quantity configurations each comprising per measurement quantity seperate filters for cell and RS index measurement results. The quantity configuration set that applies for a given measurement is indicated within the NR measurement object.

5. **Measurement gaps:** Periods that the UE may use to perform measurements, i.e. no (UL, DL) transmissions are scheduled.

E-UTRAN only configures a single measurement object for a given frequency (except for WLAN and except for CBR measurements), i.e. it is not possible to configure two or more measurement objects for the same frequency with different associated parameters, e.g. different offsets and/ or exclude-lists. E-UTRAN may configure multiple instances of the same event e.g. by configuring two reporting configurations with different thresholds.

The UE maintains a single measurement object list, a single reporting configuration list, and a single measurement identities list. The measurement object list includes measurement objects, that are specified per RAT type, possibly including intra-frequency object(s) (i.e. the object(s) corresponding to the serving frequency(ies)), inter-frequency object(s) and inter-RAT objects. Similarly, the reporting configuration list includes E-UTRA and inter-RAT reporting configurations. Any measurement object can be linked to any reporting configuration of the same RAT type. Some reporting configurations may not be linked to a measurement object. Likewise, some measurement objects may not be linked to a reporting configuration.

The measurement procedures distinguish the following types of cells:

1. The serving cell(s) - these are the PCell and one or more SCells, if configured for a UE supporting CA or DC. Likewise, NR serving cell(s) are the NR PCell, NR PSCell and NR SCells, if the UE is configured with MR-DC.

2. Listed cells - these are cells listed within the measurement object(s) or, for inter-RAT WLAN, the WLANs matching the WLAN identifiers configured in the measurement object or the WLAN the UE is connected to.

3. Detected cells - these are cells that are not listed within the measurement object(s) but are detected by the UE on the carrier frequency(ies) indicated by the measurement object(s) or, for inter-RAT WLAN, the WLANs not included in the *measObjectWLAN* but meeting the triggering requirements.

For E-UTRA, the UE measures and reports on the serving cell(s), listed cells, detected cells, transmission resource pools for V2X sidelink communication, and, for RSSI and channel occupancy measurements, the UE measures and reports on any reception on the indicated frequency. For inter-RAT NR, the UE measures and reports on detected cells and, if configured with MR-DC, on NR serving cell(s) and, for RSSI and channel occupancy measurements, the UE measures and reports on the indicated frequency. For inter-RAT UTRA, the UE measures and reports on listed cells and optionally on cells that are within a range for which reporting is allowed by E-UTRAN. For inter-RAT GERAN, the UE measures and reports on detected cells. For inter-RAT CDMA2000, the UE measures and reports on listed cells. For inter-RAT WLAN, the UE measures and reports on listed cells.

NOTE 2: For inter-RAT UTRA and CDMA2000, the UE measures and reports also on detected cells for the purpose of SON.

NOTE 3: This specification is based on the assumption that typically CSG cells of home deployment type are not indicated within the neighbour list. Furthermore, the assumption is that for non-home deployments, the physical cell identity is unique within the area of a large macro cell (i.e. as for UTRAN).

Whenever the procedural specification, other than contained in clause 5.5.2, refers to a field it concerns a field included in the *VarMeasConfig* unless explicitly stated otherwise i.e. only the measurement configuration procedure covers the direct UE action related to the received *measConfig*.

### 5.5.2 Measurement configuration

#### 5.5.2.1 General

E-UTRAN applies the procedure as follows:

- to ensure that, whenever the UE has a *measConfig*, it includes a *measObject* for each LTE serving frequency;

- to configure at most one measurement identity using a reporting configuration with the *purpose* set to *reportCGI*;

- for E-UTRA serving frequencies, set the EARFCN within the corresponding *measObject* according to the band as used for reception/ transmission;

- to configure at most one measurement identity using a reporting configuration with *ul-DelayConfig*;

- to configure at most one measurement identity using a reporting configuration with *ul-DelayValueConfig*;

- to configure at most one measurement identity using a reporting configuration with *reportSFTD-Meas*;

- to configure at most one *MeasObjectNR* with the same *carrierFreq*;

The UE shall:

1> if the received *measConfig* includes the *measObjectToRemoveList*:

2> perform the measurement object removal procedure as specified in 5.5.2.4;

1> if the received *measConfig* includes the *measObjectToAddModList*:

2> perform the measurement object addition/ modification procedure as specified in 5.5.2.5;

1> if the received *measConfig* includes the *reportConfigToRemoveList*:

2> perform the reporting configuration removal procedure as specified in 5.5.2.6;

1> if the received *measConfig* includes the *reportConfigToAddModList*:

2> perform the reporting configuration addition/ modification procedure as specified in 5.5.2.7;

1> if the received *measConfig* includes the *quantityConfig*:

2> perform the quantity configuration procedure as specified in 5.5.2.8;

1> if the received *measConfig* includes the *measIdToRemoveList*:

2> perform the measurement identity removal procedure as specified in 5.5.2.2;

1> if the received *measConfig* includes the *measIdToAddModList*:

2> perform the measurement identity addition/ modification procedure as specified in 5.5.2.3;

1> if the received *measConfig* includes the *measGapConfig* or *measGapConfigPerCC-List*:

2> perform the measurement gap configuration procedure as specified in 5.5.2.9;

1> if the received *measConfig* includes the *measGapConfigDensePRS*:

2> perform the measurement gap configuration procedure for RSTD measurements with dense PRS configuration as specified in 5.5.2.9a;

1> if the received *measConfig* includes the *measGapSharingConfig*:

2> perform the measurement gap sharing configuration procedure as specified in 5.5.2.12;

1> if the received *measConfig* includes the *s-Measure*:

2> set the parameter *s-Measure* within *VarMeasConfig* to the lowest value of the RSRP ranges indicated by the received value of *s-Measure*;

1> if the received *measConfig* includes the *preRegistrationInfoHRPD*:

2> forward the *preRegistrationInfoHRPD* to CDMA2000 upper layers;

1> if the received *measConfig* includes the *speedStatePars*:

2> set the parameter *speedStatePars* within *VarMeasConfig* to the received value of *speedStatePars*;

1> if the received *measConfig* includes the *allowInterruptions*:

2> set the parameter *allowInterruptions* within *VarMeasConfig* to the received value of *allowInterruptions*;

#### 5.5.2.2 Measurement identity removal

The UE shall:

1> for each *measId* included in the received *measIdToRemoveList* that is part of the current UE configuration in *VarMeasConfig*:

2> remove the entry with the matching *measId* from the *measIdList* within the *VarMeasConfig*;

2> remove the measurement reporting entry for this *measId* from the *VarMeasReportList*, if included;

2> stop the periodical reporting timer or timer T321, whichever one is running, and reset the associated information (e.g. *timeToTrigger*) for this *measId*;

NOTE: The UE does not consider the message as erroneous if the *measIdToRemoveList* includes any *measId* value that is not part of the current UE configuration.

#### 5.5.2.2a Measurement identity autonomous removal

The UE shall:

1> for each *measId* included in the *measIdList* within *VarMeasConfig*:

2> if the associated *reportConfig* concerns an event involving a serving cell while the concerned serving cell is not configured; or

2> if the associated *reportConfig* concerns an event involving a WLAN mobility set while the concerned WLAN mobility set is not configured; or

2> if the associated *reportConfig* concerns an event involving a transmission resource pool for V2X sidelink communication while the concerned resource pool is not configured; or

2> if the associated *reportConfig* concerns an event involving *reportSFTD-Meas* set to *pSCell* while the *nr-Config* is not configured:

3> remove the *measId* from the *measIdList* within the *VarMeasConfig*;

3> remove the measurement reporting entry for this *measId* from the *VarMeasReportList*, if included;

3> stop the periodical reporting timer if running, and reset the associated information (e.g. *timeToTrigger*) for this *measId*;

NOTE 1: The above UE autonomous removal of *measId*'s applies only for measurement events A1, A2, A6, and also applies for events A3 and A5 if configured for PSCell and W2 and W3 and V1 and V2 and event involving *reportSFTD-Meas* set to *pSCell*, if configured.

NOTE 2: When performed during re-establishment, the UE is only configured with a primary frequency (i.e. the SCell(s) and WLAN mobility set are released, if configured).

#### 5.5.2.3 Measurement identity addition/ modification

E-UTRAN applies the procedure as follows:

- configure a *measId* only if the corresponding measurement object, the corresponding reporting configuration and the corresponding quantity configuration, are configured;

The UE shall:

1> for each *measId* included in the received *measIdToAddModList*:

2> if an entry with the matching *measId* exists in the *measIdList* within the *VarMeasConfig*:

3> replace the entry with the value received for this *measId*;

2> else:

3> add a new entry for this *measId* within the *VarMeasConfig*;

2> remove the measurement reporting entry for this *measId* from the *VarMeasReportList*, if included;

2> stop the periodical reporting timer or timer T321, whichever one is running, and reset the associated information (e.g. *timeToTrigger*) for this *measId*;

NOTE: If the *measId* associated with *reportConfig* for conditional reconfiguration is modified, the conditions need to be set to non-fulfilled as specified in 5.3.5.9.4.

2> if the *triggerType* is set to *periodical* and the *purpose* is set to *reportCGI* in the *reportConfig* associated with this *measId*:

3> if the *measObject* associated with this *measId* concerns E-UTRA:

4> if the *si-RequestForHO* is included in the *reportConfig* associated with this *measId*:

5> if the UE is a category 0 UE according to TS 36.306 [5]:

6> start timer T321 with the timer value set to 190 ms for this *measId*;

5> else:

6> start timer T321 with the timer value set to 150 ms for this *measId*;

4> else:

5> start timer T321 with the timer value set to 1 second for this *measId*;

3> else if the *measObject* associated with this *measId* concerns UTRA:

4> if the *si-RequestForHO* is included in the *reportConfig* associated with this *measId*:

5> for UTRA FDD, start timer T321 with the timer value set to 2 seconds for this *measId*;

5> for UTRA TDD, start timer T321 with the timer value set to [1 second] for this *measId*;

4> else:

5> start timer T321 with the timer value set to 8 seconds for this *measId*;

3> else if the *measObject* associated with this *measId* concerns NR:

4> if the *measObject* associated with this *measId* concerns FR1:

5> start timer T321 with the timer value set to 2 seconds for this *measId;*

4> if the *measObject* associated with this *measId* concerns FR2:

5> if the *useAutonomousGapsNR* is included in the *reportConfig* associated with this *measId*:

6> start timer T321 with the timer value set to 5 seconds for this *measId*;

5> else:

6> start timer T321 with the timer value set to 16 seconds for this *measId;*

3> else:

4> start timer T321 with the timer value set to 8 seconds for this *measId*;

#### 5.5.2.4 Measurement object removal

The UE shall:

1> for each *measObjectId* included in the received *measObjectToRemoveList* that is part of the current UE configuration in *VarMeasConfig*:

2> remove the entry with the matching *measObjectId* from the *measObjectList* within the *VarMeasConfig*;

2> remove all *measId* associated with this *measObjectId* from the *measIdList* within the *VarMeasConfig,* if any;

2> if a *measId* is removed from the *measIdList:*

3> remove the measurement reporting entry for this *measId* from the *VarMeasReportList*, if included;

3> stop the periodical reporting timer or timer T321, whichever one is running, and reset the associated information (e.g. *timeToTrigger*) for this *measId*;

NOTE: The UE does not consider the message as erroneous if the *measObjectToRemoveList* includes any *measObjectId* value that is not part of the current UE configuration.

#### 5.5.2.5 Measurement object addition/ modification

The UE shall:

1> for each *measObjectId* included in the received *measObjectToAddModList*:

2> if an entry with the matching *measObjectId* exists in the *measObjectList* within the *VarMeasConfig*, for this entry:

3> reconfigure the entry with the value received for this *measObject*, except for the fields *cellsToAddModList*, *excludedCellsToAddModList*, *allowedCellsToAddModList, altTTT-CellsToAddModList, cellsToRemoveList,* *excludedCellsToRemoveList, allowedCellsToRemoveList, altTTT-CellsToRemoveList*, *measSubframePatternConfigNeigh,* *measDS-Config,* *wlan-ToAddModList,* *wlan-ToRemoveList, tx-ResourcePoolToRemoveList*, *tx-ResourcePoolToAddList*, *ssb-PositionQCL-CellsToAddModListNR*, and *ssb-PositionQCL-CellsToRemoveListNR*;

3> if the received *measObject* includes the *cellsToRemoveList*:

4> for each *cellIndex* included in the *cellsToRemoveList*:

5> remove the entry with the matching *cellIndex* from the *cellsToAddModList*;

3> if the received *measObject* includes the *cellsToAddModList*:

4> for each *cellIndex* value included in the *cellsToAddModList*:

5> if an entry with the matching *cellIndex* exists in the *cellsToAddModList*:

6> replace the entry with the value received for this *cellIndex*;

5> else:

6> add a new entry for the received *cellIndex* to the *cellsToAddModList*;

3> if the received *measObject* includes the *excludedCellsToRemoveList*:

4> for each *cellIndex* included in the *excludedCellsToRemoveList*:

5> remove the entry with the matching *cellIndex* from the *excludedCellsToAddModList*;

NOTE 1: For each *cellIndex* included in the *excludedCellsToRemoveList* that concerns overlapping ranges of cells, a cell is removed from the exclude-listed cells only if all cell indexes containing it are removed.

3> if the received *measObject* includes the *excludedCellsToAddModList*:

4> for each *cellIndex* included in the *excludedCellsToAddModList*:

5> if an entry with the matching *cellIndex* is included in the *excludedCellsToAddModList*:

6> replace the entry with the value received for this *cellIndex*;

5> else:

6> add a new entry for the received *cellIndex* to the *excludedCellsToAddModList*;

3> if the received *measObject* includes the *allowedCellsToRemoveList*:

4> for each *cellIndex* included in the *allowedCellsToRemoveList*:

5> remove the entry with the matching *cellIndex* from the *allowedCellsToAddModList*;

NOTE 2: For each *cellIndex* included in the *allowedCellsToRemoveList* that concerns overlapping ranges of cells, a cell is removed from the allow-listed cells only if all cell indexes containing it are removed.

3> if the received *measObject* includes the *allowedCellsToAddModList*:

4> for each *cellIndex* included in the *allowedCellsToAddModList*:

5> if an entry with the matching *cellIndex* is included in the *allowedCellsToAddModList*:

6> replace the entry with the value received for this *cellIndex*;

5> else:

6> add a new entry for the received *cellIndex* to the *allowedCellsToAddModList*;

3> if the received *measObject* includes the *altTTT-CellsToRemoveList*:

4> for each *cellIndex* included in the *altTTT-CellsToRemoveList*:

5> remove the entry with the matching *cellIndex* from the *altTTT-CellsToAddModList*;

NOTE 3: For each *cellIndex* included in the *altTTT-CellsToRemoveList* that concerns overlapping ranges of cells, a cell is removed from the list of cells only if all cell indexes containing it are removed.

3> if the received *measObject* includes the *altTTT-CellsToAddModList*:

4> for each *cellIndex* value included in the *altTTT-CellsToAddModList*:

5> if an entry with the matching *cellIndex* exists in the *altTTT-CellsToAddModList*:

6> replace the entry with the value received for this *cellIndex*;

5> else:

6> add a new entry for the received *cellIndex* to the *altTTT-CellsToAddModList*;

3> if the received *measObject* includes *measSubframePatternConfigNeigh*:

4> set *measSubframePatternConfigNeigh* within the *VarMeasConfig* to the value of the received field

3> if the received *measObject* includes *measDS-Config*:

4> if *measDS-Config* is set to *setup*:

5> if the received *measDS-Config* includes the *measCSI-RS-ToRemoveList*:

6> for each *measCSI-RS-Id* included in the *measCSI-RS-ToRemoveList*:

7> remove the entry with the matching *measCSI-RS-Id* from the *measCSI-RS-ToAddModList*;

5> if the received *measDS-Config* includes the *measCSI-RS-ToAddModList*, for each *measCSI-RS-Id* value included in the *measCSI-RS-ToAddModList*:

6> if an entry with the matching *measCSI-RS-Id* exists in the *measCSI-RS-ToAddModList*:

7> replace the entry with the value received for this *measCSI-RS-Id*;

6> else:

7> add a new entry for the received *measCSI-RS-Id* to the *measCSI-RS-ToAddModList*;

5> set other fields of the *measDS-Config* within the *VarMeasConfig* to the value of the received fields;

5> perform the discovery signals measurement timing configuration procedure as specified in 5.5.2.10;

4> else:

5> release the discovery signals measurement configuration;

3> if the received *measObject* modifies fields other than *cellsForWhichToReportSFTD*:

4> for each *measId* associated with this *measObjectId* in the *measIdList* within the *VarMeasConfig*, if any:

5> remove the measurement reporting entry for this *measId* from the *VarMeasReportList*, if included;

5> stop the periodical reporting timer or timer T321, whichever one is running, and reset the associated information (e.g. *timeToTrigger*) for this *measId*;

3> if the received *measObject* includes the *wlan-ToRemoveList*:

4> for each *WLAN-Identifiers* included in the *wlan-ToRemoveList*:

5> remove the entry with the matching *WLAN-Identifiers* from the *wlan-ToAddModList*;

NOTE 3a: Matching of *WLAN-Identifiers* requires that all WLAN identifier fields should be same.

3> if the received *measObject* includes the *wlan-ToAddModList*:

4> for each *WLAN-Identifiers* included in the *wlan-ToAddModList*:

5> add a new entry for the received *WLAN-Identifiers* to the *wlan-ToAddModList*;

3> if the received *measObject* includes the *tx-ResourcePoolToRemoveList*:

4> for each transmission resource pool indicated in *tx-ResourcePoolToRemoveList*:

5> remove the entry with the matching identity of the transmission resource pool from the *tx-ResourcePoolToAddList*;

3> if the received *measObject* includes the *tx-ResourcePoolToAddList*:

4> for each transmission resource pool indicated in *tx-ResourcePoolToAddList*:

5> add a new entry for the received identity of the transmission resource pool to the *tx-ResourcePoolToAddList*;

3> if the received *measObject* includes the *ssb-PositionQCL-CellsToRemoveListNR*:

4> for each *physCellId* included in the *ssb-PositionQCL-CellsToRemoveListNR*:

5> remove the entry with the matching *physCellId* from the *ssb-PositionQCL-CellsToAddModListNR*;

3> if the received *measObject* includes the *ssb-PositionQCL-CellsToAddModListNR*:

4> for each *physCellId* included in the *ssb-PositionQCL-CellsToAddModListNR*:

5> if an entry with the matching *physCellId* exists in the *ssb-PositionQCL-CellsToAddModListNR*:

6> replace the entry with the value received for this *physCellId*;

5> else:

6> add a new entry for the received *physCellId* to the *ssb-PositionQCL-CellsToAddModListNR*;

2> else:

3> add a new entry for the received *measObject* to the *measObjectList* within *VarMeasConfig*;

NOTE 4: UE does not need to retain *cellForWhichToReportCGI* in the *measObject* after reporting *cgi-Info*.

#### 5.5.2.6 Reporting configuration removal

The UE shall:

1> for each *reportConfigId* included in the received *reportConfigToRemoveList* that is part of the current UE configuration in *VarMeasConfig*:

2> remove the entry with the matching *reportConfigId* from the *reportConfigList* within the *VarMeasConfig*;

2> remove all *measId* associated with the *reportConfigId* from the *measIdList* within the *VarMeasConfig*, if any;

2> if a *measId* is removed from the *measIdList*:

3> remove the measurement reporting entry for this *measId* from the *VarMeasReportList*, if included;

3> stop the periodical reporting timer or timer T321, whichever one is running, and reset the associated information (e.g. *timeToTrigger*) for this *measId*;

NOTE: The UE does not consider the message as erroneous if the *reportConfigToRemoveList* includes any *reportConfigId* value that is not part of the current UE configuration.

#### 5.5.2.7 Reporting configuration addition/ modification

The UE shall:

1> for each *reportConfigId* included in the received *reportConfigToAddModList*:

2> if an entry with the matching *reportConfigId* exists in the *reportConfigList* within the *VarMeasConfig*, for this entry:

3> reconfigure the entry with the value received for this *reportConfig*;

3> for each *measId* associated with this *reportConfigId* included in the *measIdList* within the *VarMeasConfig*, if any:

4> remove the measurement reporting entry for this *measId* from in *VarMeasReportList*, if included;

4> stop the periodical reporting timer or timer T321, whichever one is running, and reset the associated information (e.g. *timeToTrigger*) for this *measId*;

2> else:

3> add a new entry for the received *reportConfig* to the *reportConfigList* within the *VarMeasConfig*;

#### 5.5.2.8 Quantity configuration

The UE shall:

1> for each RAT for which the received *quantityConfig* includes parameter(s):

2> set the corresponding parameter(s) in *quantityConfig* within *VarMeasConfig* to the value of the received *quantityConfig* parameter(s);

1> for each *measId* included in the *measIdList* within *VarMeasConfig*:

2> remove the measurement reporting entry for this *measId* from the *VarMeasReportList*, if included;

2> stop the periodical reporting timer or timer T321, whichever one is running, and reset the associated information (e.g. *timeToTrigger*) for this *measId*;

#### 5.5.2.9 Measurement gap configuration

The UE shall:

1> if *measGapConfig* is set to *setup*:

2> if a measurement gap configuration *measGapConfig* or *measGapConfigPerCC-List* is already setup, release the measurement gap configuration;

2> if the *gapOffset* in *measGapConfig* indicates a non-uniform gap pattern:

3> setup the measurement gap configuration indicated by the *measGapConfig* in accordance with the received *gapOffset*, i.e., the first subframe of the first gap of each non-uniform gap pattern occurs at an SFN and subframe meeting the following condition (SFN and subframe of MCG cells):

SFN mod *T* = FLOOR(*gapOffset*/10);

subframe = *gapOffset* mod 10;

with *T* = LMGRP/10 as defined in TS 36.133 [16];

2> else:

3> setup the measurement gap configuration indicated by the *measGapConfig* in accordance with the received *gapOffset*, i.e., the first subframe of each gap occurs at an SFN and subframe meeting the following condition (SFN and subframe of MCG cells):

SFN mod *T* = FLOOR(*gapOffset*/10);

subframe = *gapOffset* mod 10;

with *T* = MGRP/10 as defined in TS 36.133 [16];

2> if (NG)EN-DC is configured:

3> if the UE is configured with *fr1-Gap* set to *TRUE*:

4> apply the gap configuration for LTE serving cells and for NR serving cells on FR1;

3> else:

4> apply the gap configuration for all LTE and NR serving cells;

2> if *mgta* is set to *TRUE*, apply a timing advance value of 0.5ms to the gap occurrences calculated above according to TS 38.133 [84];

NOTE 1: The UE applies a single gap, which timing is relative to the MCG cells, even when configured with DC. In case of (NG)EN-DC, the UE may either be configured with a single (common) gap or with two separate gaps i.e. a first one for FR1 (configured by E-UTRA RRC) and a second one for FR2 (configured by NR RRC).

1> else if *measGapConfig* is set to *release*:

2> release the measurement gap configuration *measGapConfig*;

1> if *measGapConfigPerCC-List* is set to *setup*:

2> if a measurement gap configuration *measGapConfig* is already setup, release *measGapConfig*;

2> if *measGapConfigToRemoveList* is included:

3> for each *ServCellIndex* included in the *measGapConfigToRemoveList*:

4> release *measGapConfigCC* for the serving cell indicated by *servCellId*;

2> if *measGapConfigToAddModList* is included:

3> for each *ServCellIndex* included in the *measGapConfigToAddModList*:

4> store *measGapConfigCC* for the serving cell indicated by *servCellId*;

2> for each serving cell with stored *measGapConfigCC* indicating a non-uniform gap pattern*,* setup the measurement gap configuration indicated by the *measGapConfigCC* in accordance with the received *gapOffset*, i.e., the first subframe of the first gap of each non-uniform gap pattern occurs at an SFN and subframe meeting the following condition (SFN and subframe of MCG cells):

SFN mod *T* = FLOOR(*gapOffset*/10);

subframe = *gapOffset* mod 10;

with *T* = LMGRP/10 as defined in TS 36.133 [16];

2> for each serving cell with stored *measGapConfigCC* not indicating a non-uniform gap pattern*,* setup the measurement gap configuration indicated by the *measGapConfigCC* in accordance with the received *gapOffset*, i.e., the first subframe of each gap occurs at an SFN and subframe meeting the following condition (SFN and subframe of MCG cells):

SFN mod *T* = FLOOR(*gapOffset*/10);

subframe = *gapOffset* mod 10;

with *T* = MGRP/10 as defined in TS 36.133 [16];

NOTE 2: The UE applies gap timing relative to the MCG cells, even when configured with DC.

1> else (*measGapConfigPerCC-List* is set to *release)*:

2> release the measurement gap configuration *measGapConfigPerCC-List*;

NOTE 3: When a SCell is released, the UE is not required to apply a per CC measurement gap configuration associated to the SCell.

#### 5.5.2.9a Measurement gap configuration for RSTD measurements with dense PRS configuration

The UE shall:

1> if *measGapConfigDensePRS* is set to *setup*:

2> setup the measurement gap configuration indicated by the *measGapConfigDensePRS* in accordance with the received *gapOffsetDensePRS*, i.e., the first subframe of each gap occurs at an SFN and subframe meeting the following condition:

SFN mod *T* = FLOOR(*gapOffsetDensePRS*/10);

subframe = *gapOffsetDensePRS* mod 10;

with *T* = MGRP/10 as defined in TS 36.133 [16];

#### 5.5.2.10 Discovery signals measurement timing configuration

The UE shall setup the discovery signals measurement timing configuration (DMTC) in accordance with the received *dmtc-PeriodOffset*, i.e., the first subframe of each DMTC occasion occurs at an SFN and subframe of the PCell meeting the following condition:

SFN mod *T* = FLOOR(*dmtc-Offset*/10);

subframe = *dmtc-Offset* mod 10;

with *T* = *dmtc-Periodicity*/10;

On the concerned frequency, the UE shall not consider discovery signals transmission in subframes outside the DMTC occasion for measurements including RRM measurements.

#### 5.5.2.11 RSSI measurement timing configuration

The UE shall setup the RSSI measurement timing configuraton (RMTC) in accordance with the received *rmtc-Period*, *rmtc-SubframeOffset* if configured otherwise determined by the UE randomly, i.e. the first symbol of each RMTC occasion occurs at first symbol of an SFN and subframe of the PCell meeting the following condition:

SFN mod *T* = FLOOR(*rmtc-SubframeOffset*/10);

subframe = *rmtc-SubframeOffset* mod 10;

with *T* = *rmtc-Period*/10;

On the concerned frequency, the UE shall not consider RSSI measurements outside the configured RMTC occasion which lasts for *measDuration* for RSSI and channel occupancy measurements.

For inter-RAT NR measurements, the UE shall setup the RMTC in accordance with the received *rmtc-PeriodicityNR*, and, if configured, with *rmtc-SubframeOffsetNR*, i.e. the first symbol of each RMTC occasion occurs at first symbol of an SFN and subframe of the PCell meeting the following condition:

SFN mod *T* = FLOOR(*rmtc-SubframeOffsetNR*/10);

subframe = *rmtc-SubframeOffsetNR* mod 10;

with *T* = *rmtc-PeriodicityNR*/10;

The UE derives the RSSI measurement duration from a combination of *measDurationNR* and *refSCS-CP-NR*. On the frequency configured by *rmtc-FrequencyNR*, the UE shall not consider RSSI measurements outside the configured RMTC occasion which lasts for *measDurationNR* for RSSI and channel occupancy measurements.

#### 5.5.2.12 Measurement gap sharing configuration

The UE shall:

1> if *measGapSharingConfig* is set to *setup*:

2> if a measurement gap sharing configuration is already setup, release the measurement gap sharing configuration;

2> setup the measurement gap sharing configuration indicated by the *measGapSharingConfig* in accordance with the received *measGapSharingScheme* as defined in TS 36.133 [16];

NOTE: In case of (NG)EN-DC, the UE may either be configured with a single (common) gap sharing or with two separate gap sharing configurations, i.e. a first one for FR1 (configured by E-UTRA RRC) and a second one for FR2 (configured by NR RRC). For the case of per FR gap configuration, the gap sharing configured here (i.e. E-UTRA RRC) is applicable only for FR1 gap.

1> else:

2> release the measurement gap sharing configuration;

#### 5.5.2.13 NR measurement timing configuration

The UE shall setup the first SS/PBCH block measurement timing configuration (SMTC) in accordance with the received *periodicityAndOffset* (providing *Periodicity* and *Offset* value for the following condition) in the *MTC-SSB-NR* configuration i.e., the first subframe of each SMTC occasion occurs at an SFN and subframe of the PCell meeting the following condition:

SFN mod *T* = FLOOR(*Offset*/10);

if the *Periodicity* is larger than *sf5*:

subframe = *Offset* mod 10;

else:

subframe = *Offset* or (*Offset* +5);

with *T* = CEIL(*Periodicity*/10).

On the concerned frequency, the UE shall not consider SS/PBCH block transmission in subframes outside the SMTC occasion which lasts for *ssb-Duration* for measurements including RRM measurements except for SFTD measurement (see TS 36.133 [16], clause 8.1.2.4.25.2 and 8.1.2.4.26.1).

If *smtc2-LP* is present, for cells indicated in the *pci-List* parameter in *smtc2-LP* for inter-RAT cell reselection, the UE shall setup an additional SS/PBCH block measurement timing configuration (SMTC) in accordance with the received *periodicity* parameter in the *smtc2-LP* configuration and use the *Offset* (derived from parameter *periodicityAndOffset*) and *ssb-Duration* parameter from the *measTimingConfig* configuration for that frequency. The first subframe of each SMTC occasion occurs at an SFN and subframe of the NR SpCell or serving cell (for cell reselection) meeting the above condition.

### 5.5.3 Performing measurements

#### 5.5.3.1 General

For all measurements, except for UE Rx–Tx time difference measurements, RSSI, UL PDCP Packet Delay per QCI measurement, UL PDCP Packet Delay Value per DRB measurement, channel occupancy measurements, CBR measurement, sensing measurement and except for WLAN measurements of Band, Carrier Info, Available Admission Capacity, Backhaul Bandwidth, Channel Utilization, and Station Count, the UE applies the layer 3 filtering as specified in 5.5.3.2, before using the measured results for evaluation of reporting criteria, for measurement reporting or for evaluation of fulfilment of the criteria to trigger conditional reconfiguration execution. When performing measurements on NR carriers, the UE derives the cell quality as specified in 5.5.3.3 and the beam quality as specified in 5.5.3.4.

The UE shall:

1> whenever the UE has a *measConfig*, perform RSRP and RSRQ measurements for each serving cell as follows:

2> for the PCell, apply the time domain measurement resource restriction in accordance with *measSubframePatternPCell,* if configured;

2> if the UE supports CRS based discovery signals measurement:

3> for each SCell in deactivated state, apply the discovery signals measurement timing configuration in accordance with *measDS-Config*, if configured within the *measObject* corresponding to the frequency of the SCell;

1> if the UE has a *measConfig* with *rs-sinr-Config* configured, perform RS-SINR (as indicated in the associated *reportConfig*) measurements as follows:

2> perform the corresponding measurements on the frequency indicated in the associated *measObject* using available idle periods or using autonomous gaps as necessary;

1> for each *measId* included in the *measIdList* within *VarMeasConfig*:

2> if the *purpose* for the associated *reportConfig* is set to *reportCGI*:

3> if the RAT indicated in the associated *measObject* is not NR:

4> if *si-RequestForHO* is configured for the associated *reportConfig*:

5> perform the corresponding measurements on the frequency and RAT indicated in the associated *measObject* using autonomous gaps as necessary;

4> else:

5> perform the corresponding measurements on the frequency and RAT indicated in the associated *measObject* using available idle periods or using autonomous gaps as necessary;

3> else:

4> if *useAutonomousGapsNR* is configured for the associated *reportConfig*:

5> perform the corresponding measurements on the NR frequency indicated in the associated *measObject* using autonomous gaps as necessary;

4> else:

5> perform the corresponding measurements on the NR frequency indicated in the associated *measObject* using available idle periods;

NOTE 1: If autonomous gaps are used to perform measurements, the UE is allowed to temporarily abort communication with all serving cell(s), i.e. create autonomous gaps to perform the corresponding measurements within the limits specified in TS 36.133 [16]. Otherwise, the UE only supports the measurements with the purpose set to *reportCGI* only if E-UTRAN has provided sufficient idle periods.

3> try to acquire the global cell identity of the cell indicated by the *cellForWhichToReportCGI* in the associated *measObject* by acquiring the relevant system information from the concerned cell;

3> if an entry in the *cellAccessRelatedInfoList* includes the selected PLMN, acquire the relevant system information from the concerned cell;

3> if the cell indicated by the *cellForWhichToReportCGI* included in the associated *measObject* is an E-UTRAN cell:

4> try to acquire the CSG identity, if the CSG identity is broadcast in the concerned cell;

4> try to acquire the *trackingAreaCode* in the concerned cell;

4> try to acquire the list of additional PLMN Identities, as included in the *plmn-IdentityList*, if multiple PLMN identities are broadcast in the concerned cell;

4> if *cellAccessRelatedInfoList* is included, use *trackingAreaCode* and *plmn-IdentityList* from the entry of *cellAccessRelatedInfoList* containing the selected PLMN;

4> if the *includeMultiBandInfo* is configured:

5> try to acquire the *freqBandIndicator* in the *SystemInformationBlockType1*of the concerned cell;

5> try to acquire the list of additional frequency band indicators, as included in the *multiBandInfoList*, if multiple frequency band indicators are included in the *SystemInformationBlockType1*of the concerned cell;

5> try to acquire the *freqBandIndicatorPriority*, if the *freqBandIndicatorPriority* is included in the *SystemInformationBlockType1*of the concerned cell;

4> if *cellAccessRelatedInfoList-5GC* is broadcast in the concerned cell and the UE is E-UTRA/5GC capable:

5> try to acquire the *cellAccessRelatedInfoList-5GC*;

NOTE 2: The 'primary' PLMN is part of the global cell identity.

3> if the cell indicated by the *cellForWhichToReportCGI* included in the associated *measObject* is a UTRAN cell:

4> try to acquire the LAC, the RAC and the list of additional PLMN Identities, if multiple PLMN identities are broadcast in the concerned cell;

4> try to acquire the CSG identity, if the CSG identity is broadcast in the concerned cell;

3> if the cell indicated by the *cellForWhichToReportCGI* included in the associated *measObject* is a GERAN cell:

4> try to acquire the RAC in the concerned cell;

3> if the cell indicated by the *cellForWhichToReportCGI* included in the associated *measObject* is a CDMA2000 cell and the *cdma2000-Type* included in the *measObject* is *typeHRPD*:

4> try to acquire the Sector ID in the concerned cell;

3> if the cell indicated by the *cellForWhichToReportCGI* included in the associated *measObject* is a CDMA2000 cell and the *cdma2000-Type* included in the *measObject* is *type1XRTT*:

4> try to acquire the BASE ID, SID and NID in the concerned cell;

3> if the cell indicated by the *cellForWhichToReportCGI* included in the associated *MeasObject* is an NR cell:

4> if the indicated cell is broadcasting *SIB1* (see TS 38.213 [88], clause 13):

5> try to acquire the plmn-IdentityInfoList including plmn-IdentityList, trackingAreaCode (if available), ran-AreaCode (if available) and cellIdentity for each entry of the plmn-IdentityInfoList;

5> try to acquire the frequencyBandList, if multiple frequency bands are broadcasted in the concerned cell;

2> if the *ul-DelayConfig* is configured for the associated *reportConfig*:

3> ignore the *measObject*;

3> configure the PDCP layer to perform UL PDCP Packet Delay per QCI measurement;

2> if the *ul-DelayValueConfig* is configured for the associated *reportConfig*:

3> ignore the *measObject*;

3> configure the PDCP layer to perform UL PDCP Packet Delay value per DRB measurement;

2> else:

3> if a measurement gap configuration is setup; or

3> if the UE does not require measurement gaps to perform the concerned measurements:

4> if *s-Measure* is not configured; or

4> if the UE is not in NE-DC and the PCell RSRP, after layer 3 filtering, is lower than *s-Measure*; or

4> if the UE is in NE-DC and the PSCell RSRP, after layer 3 filtering, is lower than *s-Measure*; or

4> if the associated *measObject* concerns NR; or

4> if *timeMeasConfig* is configured and *t-Service* is configured in *SystemInformationBlockType3*; or

4> if *locationMeasConfig* is configured and *fixedReferenceLocation* and *distanceThresh* are present in *SystemInformationBlockType31*, and the distance between UE and serving cell *fixedReferenceLocation* is above *distanceThresh*; or

4> if *locationMeasConfig* is configured and *movingReferenceLocation* and *distanceThresh* are present in *SystemInformationBlockType31*, and the distance between UE and moving reference location of serving cell is above *distanceThresh* (where the moving reference location is determined based on *movingReferenceLocation*, serving cell ephemeris information, and the corresponding epoch time broadcast in *SystemInformationBlockType31*); or

4> if *measDS-Config* is configured in the associated *measObject*:

5> if the UE supports CSI-RS based discovery signals measurement; and

5> if the *eventId* in the associated *reportConfig* is set to *eventC1* or *eventC2*, or if *reportStrongestCSI-RSs* is set to *true* in the associated *reportConfig*:

6> perform the corresponding measurements of CSI-RS resources on the frequency indicated in the concerned *measObject*, applying the discovery signals measurement timing configuration in accordance with *measDS-Config* in the concerned *measObject*;

6> if *reportCRS-Meas* is set to *true* in the associated *reportConfig,* perform the corresponding measurements of neighbouring cells on the frequencies indicated in the concerned *measObject* as follows:

7> for neighbouring cells on the primary frequency, apply the time domain measurement resource restriction in accordance with *measSubframePatternConfigNeigh,* if configured in the concerned *measObject*;

7> apply the discovery signals measurement timing configuration in accordance with *measDS-Config* in the concerned *measObject*;

5> else:

6> perform the corresponding measurements of neighbouring cells on the frequencies and RATs indicated in the concerned *measObject* as follows:

7> for neighbouring cells on the primary frequency, apply the time domain measurement resource restriction in accordance with *measSubframePatternConfigNeigh,* if configured in the concerned *measObject*;

7> if the UE supports CRS based discovery signals measurement, apply the discovery signals measurement timing configuration in accordance with *measDS-Config*, if configured in the concerned *measObject*;

NOTE 2A: If *timeMeasConfig* is configured and *t-Service* is configured in *SystemInformationBlockType3*, the exact time to start measurements before *t-Service* is left up to UE implementation and *t-ServiceStartNeigh* may be used to decide when to start measurements.

4> if the *ue-RxTxTimeDiffPeriodical* is configured in the associated *reportConfig*:

5> perform the UE Rx–Tx time difference measurements on the PCell;

4> if the *reportSSTD-Meas* is set to *true* or *pSCell* in the associated *reportConfig*:

5> perform SSTD measurements between the PCell and the PSCell;

4> if the *reportSFTD-Meas* is set to *pSCell* in the associated *reportConfig*:

5> perform SFTD measurements between the PCell and the NR PSCell;

4> if the *reportSFTD-Meas* is set to *neighborCells* in the associated *reportConfig*:

5> perform SFTD measurements between the PCell and NR cell(s) on the frequency indicated in the associated *measObject*;

4> if the *measRSSI-ReportConfig* is configured in the associated *reportConfig*:

5> perform the RSSI and channel occupancy measurements on the frequency indicated in the associated *measObject*;

2> perform the evaluation of reporting criteria as specified in 5.5.4, except if *reportConfig* is *condReconfigurationTriggerEUTRA* or *condReconfigurationTriggerNR*;

NOTE 2c: The evaluation of conditional reconfiguration execution criteria is specified in 5.3.5.9.4.

The UE capable of CBR measurement when configured to transmit non-P2X related V2X sidelink communication shall:

1> if in coverage on the frequency used for V2X sidelink communication transmission as defined in TS 36.304 [4], clause 11.4; or

1> if the concerned frequency is included in *v2x-InterFreqInfoList* in *RRCConnectionReconfiguration* or in *v2x-InterFreqInfoList* within *SystemInformationBlockType21* or *SystemInformationBlockType26*:

2> if the UE is in RRC\_IDLE:

3> if the concerned frequency is the camped frequency:

4> perform CBR measurement on the pools in *v2x-CommTxPoolNormalCommon* and *v2x-CommTxPoolExceptional* if included in *SystemInformationBlockType21*;

3> else if *v2x-CommTxPoolNormal* or *v2x-CommTxPoolExceptional* is included in *v2x-InterFreqInfoList* forthe concerned frequency within *SystemInformationBlockType21* or *SystemInformationBlockType26*:

4> perform CBR measurement on pools in *v2x-CommTxPoolNormal* and *v2x-CommTxPoolExceptional* in *v2x-InterFreqInfoList* for the concerned frequency in *SystemInformationBlockType21* or *SystemInformationBlockType26*;

3> else if the concerned frequency broadcasts *SystemInformationBlockType21*:

4> perform CBR measurement on pools in *v2x-CommTxPoolNormalCommon* and *v2x-CommTxPoolExceptional* if included in *SystemInformationBlockType21* broadcast on the concerned frequency;

2> if the UE is in RRC\_CONNECTED:

3> if *tx-ResourcePoolToAddList* is included in *VarMeasConfig*:

4> perform CBR measurements on each resource pool indicated in *tx-ResourcePoolToAddList*;

3> if the concerned frequency is the PCell's frequency:

4> perform CBR measurement on the pools in *v2x-CommTxPoolNormalDedicated* or *v2x-SchedulingPool* if included in *RRCConnectionReconfiguration*, *v2x-CommTxPoolExceptional* if included in *SystemInformationBlockType21* for the concerned frequency and *v2x-CommTxPoolExceptional* if included in *mobilityControlInfoV2X*;

3> else if *v2x-CommTxPoolNormal*, *v2x-SchedulingPool* or *v2x-CommTxPoolExceptional* is included in *v2x-InterFreqInfoList* forthe concerned frequency within *RRCConnectionReconfiguration*:

4> perform CBR measurement on pools in *v2x-CommTxPoolNormal, v2x-SchedulingPool,* and *v2x-CommTxPoolExceptional* if included in *v2x-InterFreqInfoList* for the concerned frequency in *RRCConnectionReconfiguration*;

3> else if the concerned frequency broadcasts *SystemInformationBlockType21*:

4> perform CBR measurement on pools in *v2x-CommTxPoolNormalCommon* and *v2x-CommTxPoolExceptional* if included in *SystemInformationBlockType21* for the concerned frequency;

1> else:

2> perform CBR measurement on pools in *v2x-CommTxPoolList* in *SL-V2X-Preconfiguration* for the concerned frequency;

The UE capable of sensing measurement, with *commTxResources* set to *scheduled*, shall:

1> for each *measId* included in the *measIdList* within *VarMeasConfig*:

2> if *measSensing-Config* is configured in the associated *measObject*

3> perform the sensing measurement in accordance with TS 36.213 [23] on the pools of *v2x-SchedulingPool* and also indicated in *tx-ResourcePoolToAddList* in the associated *measObject*, using *sensingSubchannelNumber*, *sensingPeriodicity*, *sensingReselectionCounter* and *sensingPriority*.

If a UE that is configured by upper layers to transmit NR sidelink communication is configured by EUTRA with transmission resource pool(s) in *SystemInformationBlockType28* or by *sl-ConfigDedicatedForNR* and the measurements concerning NR sidelink communication (i.e. by *sl-ConfigDedicatedForNR*), it shall perform CBR measurement as specified in clause 5.5.3 of TS 38.331 [82], based on the transmission resource pool(s) in *SystemInformationBlockType28* or *sl-ConfigDedicatedForNR*.

NOTE 2a: *SIB12* specified in clause 5.5.3 of TS 38.331 [82] is provided in *SystemInformationBlockType28*.

NOTE 2b: For NR sidelink communication, each of the CBR measurement results is associated with a resource pool, as indicated by the *sl-poolReportIdentity* (see TS 38.331 [82]), that refers to a pool as included in *sl-ConfigDedicatedForNR* or *SystemInformationBlockType28*.

NOTE 3: The *s-Measure* defines when the UE is required to perform measurements. The UE is however allowed to perform measurements also when the PCell RSRP (or PSCell RSRP, if the UE is in NE-DC) exceeds *s-Measure*, e.g., to measure cells broadcasting a CSG identity following use of the autonomous search function as defined in TS 36.304 [4].

NOTE 4: The UE may not perform the WLAN measurements it is configured with e.g. due to connection to another WLAN based on user preferences as specified in TS 23.402 [75] or due to turning off WLAN.

NOTE 5: In case the configurations for V2X sidelink communication are acquired from NR, the configurations for V2X sidelink communication in *SystemInformationBlockType21,* *SystemInformationBlockType26, SL-V2X-ConfigDedicated* within *RRCConnectionReconfiguration* used in this clause can be provided by *SIB13*, *SIB14,* *sl-ConfigDedicatedEUTRA* within *RRCReconfiguration* as specified in TS 38.331 [82], respectively.

#### 5.5.3.2 Layer 3 filtering

The UE shall:

1> for each measurement quantity that the UE performs measurements according to 5.5.3.1:

NOTE 1: This does not include quantities configured solely for UE Rx-Tx time difference, SSTD measurements and RSSI, channel occupancy measurements, WLAN measurements of Band, Carrier Info, Available Admission Capacity, Backhaul Bandwidth, Channel Utilization, and Station Count, CBR measurement, sensing measurement, UL PDCP Packet Delay per QCI measurement and UL PDCP Packet Delay Value per DRB measurement i.e. for those types of measurements the UE ignores the *triggerQuantity* and *reportQuantity*.

2> filter the measured result, before using for evaluation of reporting criteria or for measurement reporting, by the following formula:



where

***Mn*** is the latest received measurement result from the physical layer;

***Fn***is the updated filtered measurement result, that is used for evaluation of reporting criteria or for measurement reporting;

***Fn-1*** is the old filtered measurement result, where ***F0*** is set to ***M1*** when the first measurement result from the physical layer is received; and

except for NR, ***a*** = 1/2(***k***/4), where ***k*** is the *filterCoefficient* for the corresponding measurement quantity received by the *quantityConfig*; for NR, ***a*** = 1/2(***ki***/4), where ***ki*** is the *filterCoefficient* for the corresponding measurement quantity of the i:th *QuantityConfigNR* in *quantityConfigNRList*, and *i* is indicated by *quantityConfigSet* in *MeasObjectNR;*

2> adapt the filter such that the time characteristics of the filter are preserved at different input rates, observing that the *filterCoefficient* ***k*** assumes a sample rate equal to 200 ms;

NOTE 2: If ***k*** is set to 0, no layer 3 filtering is applicable.

NOTE 3: The filtering is performed in the same domain as used for evaluation of reporting criteria or for measurement reporting, i.e., logarithmic filtering for logarithmic measurements.

NOTE 4: The filter input rate is implementation dependent, to fulfil the performance requirements set in TS 36.133 [16]. For further details about the physical layer measurements, see TS 36.133 [16].

#### 5.5.3.3 Derivation of NR cell quality

The UE shall:

1> if the associated *measObject*, in RRC\_CONNECTED, or the associated entry in *measIdleCarrierListNR* within *VarMeasIdleConfig*, for measurements performed according to 5.6.20.2 in RRC\_IDLE or RRC\_INACTIVE, includes *maxRS-IndexCellQual*; and

1> if there are multiple detected NR-SS beams associated to the cell; and

1> if *threshRS-Index* is configured and if for more than one of the NR-SS beams the measured result exceeds this threshold:

2> consider the cell quality to be the linear average of the power values of the, up to *maxRS-IndexCellQual*, best of the detected NR-SS beams exceeding *threshRS-Index*;

1> else:

2> consider the cell quality to be the measurement result of the detected NR-SS beam, associated to the cell, with the highest measurement result;

#### 5.5.3.4 Derivation of NR beam quality

The UE shall:

1> consider the beam quality to be the value resulting after layer 3 filtering, as specified in 5.5.3.2, of the measurement results of the concerned beam, where each result is averaged as described in TS 38.215 [89];

### 5.5.4 Measurement report triggering

#### 5.5.4.1 General

If security has been activated successfully, the UE shall:

1> for each *measId* included in the *measIdList* within *VarMeasConfig*:

2> if the corresponding *reportConfig* includes a purpose set to *reportStrongestCellsForSON*:

3> consider any neighbouring cell detected on the associated frequency to be applicable;

2> else if the corresponding *reportConfig* includes a purpose set to *reportCGI*:

3> consider any neighbouring cell detected on the associated frequency/ set of frequencies (GERAN) which has a physical cell identity matching the value of the *cellForWhichToReportCGI* included in the corresponding *measObject* within the *VarMeasConfig* to be applicable;

2> else:

3> if the corresponding *measObject* concerns E-UTRA:

4> if the *ue-RxTxTimeDiffPeriodical* is configured in the corresponding *reportConfig*:

5> consider only the PCell to be applicable;

4> else if the *reportSSTD-Meas* is set to *true* in the corresponding *reportConfig*:

5> consider the PSCell to be applicable;

4> else if the *eventA1* or *eventA2* is configured in the corresponding *reportConfig*:

5> consider only the serving cell to be applicable;

4> else if *eventC1* or *eventC2* is configured in the corresponding *reportConfig*; or if *reportStrongestCSI-RSs* is set to *true* in the corresponding *reportConfig*:

5> consider a CSI-RS resource on the associated frequency to be applicable when the concerned CSI-RS resource is included in the *measCSI-RS-ToAddModList* defined within the *VarMeasConfig* for this *measId*;

4> else if *measRSSI-ReportConfig* is configured in the corresponding *reportConfig*:

5> consider the resource indicated by the *rmtc-Config* on the associated frequency to be applicable;

4> else if the corresponding *reportConfig* includes *reportType* set to *periodical* or the *eventId* is set to measurement events other than *eventD1* and *eventD2*:

5> if *useAllowedCellList* is set to *TRUE*:

6> consider any neighbouring cell detected on the associated frequency to be applicable when the concerned cell is included in the *allowedCellsToAddModList* defined within the *VarMeasConfig* for this *measId*;

5> else:

6> consider any neighbouring cell detected on the associated frequency to be applicable when the concerned cell is not included in the *excludedCellsToAddModList* defined within the *VarMeasConfig* for this *measId*;

5> for events involving a serving cell on one frequency and neighbours on another frequency, consider the serving cell on the other frequency as a neighbouring cell;

4> if the corresponding *reportConfig* includes *alternativeTimeToTrigger* and if the UE supports *alternativeTimeToTrigger*:

5> use the value of *alternativeTimeToTrigger* as the time to trigger instead of the value of *timeToTrigger* in the corresponding *reportConfig* for cells included in the *altTTT-CellsToAddModList* of the corresponding *measObject*;

3> else if the corresponding *measObject* concerns UTRA or CDMA2000:

4> consider a neighbouring cell on the associated frequency to be applicable when the concerned cell is included in the *cellsToAddModList* defined within the *VarMeasConfig* for this *measId* (i.e. the cell is included in the allow-list);

NOTE 0: The UE may also consider a neighbouring cell on the associated UTRA frequency to be applicable when the concerned cell is included in the *csg-allowedReportingCells* within the *VarMeasConfig* for this *measId*, if configured in the corresponding *measObjectUTRA* (i.e. the cell is included in the range of physical cell identities for which reporting is allowed).

3> else if the corresponding *measObject* concerns GERAN:

4> consider a neighbouring cell on the associated set of frequencies to be applicable when the concerned cell matches the *ncc-Permitted* defined within the *VarMeasConfig* for this *measId*;

3> else if the corresponding *measObject* concerns WLAN:

4> consider a WLAN on the associated set of frequencies, as indicated by *carrierFreq* or on all WLAN frequencies when *carrierFreq* is not present, to be applicable if the WLAN matches all WLAN identifiers of at least one entry within *wlan-Id-List* for this *measId*;

3> else if the corresponding *measObject* concerns NR:

4> if the *reportSFTD-Meas* is set to *pSCell* in the corresponding *reportConfigInterRAT*:

5> consider the PSCell to be applicable;

4> else if the *reportSFTD-Meas* is set to *neighborCells* in the corresponding *reportConfigInterRAT*:

5> if *cellsForWhichToReportSFTD* is configured in the corresponding *measObjectNR*:

6> consider any neighbouring NR cell on the associated frequency that is included in *cellsForWhichToReportSFTD* to be applicable;

5> else:

6> consider up to 3 strongest neighbouring NR cells detected on the associated frequency to be applicable when the concerned cells are not included in the *excludedCellsToAddModList* defined within the *VarMeasConfig* for this measId;

4> else if *measRSSI-ReportConfigNR* is configured in the corresponding *reportConfigInterRAT*:

5> consider the resource indicated by the *rmtc-ConfigNR* on the associated frequency to be applicable;

4> else:

5> if the *eventB1* or *eventB2* is configured in the corresponding *reportConfig*:

6> consider a serving cell, if any, on the associated NR frequency as neighbouring cell;

5> consider any neighbouring cell detected on the associated frequency to be applicable when the concerned cell is not included in the *excludedCellsToAddModList* defined within the *VarMeasConfig* for this *measId*;

2> if *tx-ResourcePoolToAddList* is configured in the *measObject*, and if the corresponding *reportConfig* includes a purpose set to *sidelink* or includes *eventV1* or *eventV2*:

3> consider the transmission resource pools indicated by the *tx-ResourcePoolToAddList* defined within the *VarMeasConfig* for this *measId* to be applicable;

2> if the corresponding *reportConfig* includes a purpose set to *reportLocation*:

3> consider only the PCell to be applicable;

2> if the *triggerType* is set to *event,* and if the corresponding *reportConfig* does not include *numberOfTriggeringCells,* and if the entry condition applicable for this event, i.e. the event corresponding with the *eventId* of the corresponding *reportConfig* within *VarMeasConfig*, is fulfilled for one or more applicable cells for all measurements after layer 3 filtering taken during *timeToTrigger* defined for this event within the *VarMeasConfig*, while the *VarMeasReportList* does not include a measurement reporting entry for this *measId* (a first cell triggers the event):

3> include a measurement reporting entry within the *VarMeasReportList* for this *measId*;

3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;

3> include the concerned cell(s) in the *cellsTriggeredList* defined within the *VarMeasReportList* for this *measId*;

3> if the UE supports T312 and if *useT312* is set to *true* for this event and if T310 is running:

4> if T312 is not running:

5> start timer T312 with the value configured in the corresponding *measObject*;

3> initiate the measurement reporting procedure, as specified in 5.5.5;

2> if the *triggerType* is set to *event,* and if the corresponding *reportConfig* does not include *numberOfTriggeringCells,* and if the entry condition applicable for this event, i.e. the event corresponding with the *eventId* of the corresponding *reportConfig* within *VarMeasConfig*, is fulfilled for one or more applicable cells not included in the *cellsTriggeredList* for all measurements after layer 3 filtering taken during *timeToTrigger* defined for this event within the *VarMeasConfig* (a subsequent cell triggers the event):

3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;

3> include the concerned cell(s) in the *cellsTriggeredList* defined within the *VarMeasReportList* for this *measId*;

3> if the UE supports T312 and if *useT312* is set to *true* for this event and if T310 is running:

4> if T312 is not running:

5> start timer T312 with the value configured in the corresponding *measObject*;

3> initiate the measurement reporting procedure, as specified in 5.5.5;

2> if the *triggerType* is set to *event* and if the corresponding *reportConfig* includes *numberOfTriggeringCells,* and if the entry condition applicable for this event, i.e. the event corresponding with the *eventId* of the corresponding *reportConfig* within *VarMeasConfig*, is fulfilled for one or more applicable cells for all measurements after layer 3 filtering taken during *timeToTrigger* defined for this event within the *VarMeasConfig*:

3> If the *VarMeasReportList* does not include a measurement reporting entry for this *measId* (a first cell triggers the event):

4> include a measurement reporting entry within the *VarMeasReportList* for this *measId*;

3> If the number of cell(s) in the *cellsTriggeredList* is larger than or equal to *numberOfTriggeringCells*:

4> include the concerned cell(s) in the *cellsTriggeredList* defined within the *VarMeasReportList* for this *measId*;

3> else:

4> include the concerned cell(s) in the *cellsTriggeredList* defined within the *VarMeasReportList* for this *measId*;

4> If the number of cell(s) in the *cellsTriggeredList* is larger than or equal to *numberOfTriggeringCells*:

5> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;

5> initiate the measurement reporting procedure, as specified in 5.5.5;

2> if the *triggerType* is set to *event* and if the leaving condition applicable for this event is fulfilled for one or more of the cells included in the *cellsTriggeredList* defined within the *VarMeasReportList* for this *measId* for all measurements after layer 3 filtering taken during *timeToTrigger* defined within the *VarMeasConfig* for this event:

3> remove the concerned cell(s) in the *cellsTriggeredList* defined within the *VarMeasReportList* for this *measId*;

3> if *reportOnLeave* is set to *TRUE* for the corresponding reporting configuration or if *a6-ReportOnLeave* is set to *TRUE* or if *a4-a5-ReportOnLeave* is set to TRUE for the corresponding reporting configuration:

4> initiate the measurement reporting procedure, as specified in 5.5.5;

3> if the *cellsTriggeredList* defined within the *VarMeasReportList* for this *measId* is empty:

4> remove the measurement reporting entry within the *VarMeasReportList* for this *measId*;

4> stop the periodical reporting timer for this *measId*, if running;

2> if the *triggerType* is set to *event* and if the entry condition applicable for this event, i.e. the event corresponding with the *eventId* of the corresponding *reportConfig* within *VarMeasConfig*, is fulfilled for one or more applicable CSI-RS resources for all measurements after layer 3 filtering taken during *timeToTrigger* defined for this event within the *VarMeasConfig*, while the *VarMeasReportList* does not include a measurement reporting entry for this *measId* (i.e. a first CSI-RS resource triggers the event):

3> include a measurement reporting entry within the *VarMeasReportList* for this *measId*;

3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;

3> include the concerned CSI-RS resource(s) in the *csi-RS-TriggeredList* defined within the *VarMeasReportList* for this *measId*;

3> initiate the measurement reporting procedure, as specified in 5.5.5;

2> if the *triggerType* is set to *event* and if the entry condition applicable for this event, i.e. the event corresponding with the *eventId* of the corresponding *reportConfig* within *VarMeasConfig*, is fulfilled for one or more applicable CSI-RS resources not included in the *csi-RS-TriggeredList* for all measurements after layer 3 filtering taken during *timeToTrigger* defined for this event within the *VarMeasConfig* (i.e. a subsequent CSI-RS resource triggers the event):

3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;

3> include the concerned CSI-RS resource(s) in the *csi-RS-TriggeredList* defined within the *VarMeasReportList* for this *measId*;

3> initiate the measurement reporting procedure, as specified in 5.5.5;

2> if the *triggerType* is set to *event* and if the leaving condition applicable for this event is fulfilled for one or more of the CSI-RS resources included in the *csi-RS-TriggeredList* defined within the *VarMeasReportList* for this *measId* for all measurements after layer 3 filtering taken during *timeToTrigger* defined within the *VarMeasConfig* for this event:

3> remove the concerned CSI-RS resource(s) in the *csi-RS-TriggeredList* defined within the *VarMeasReportList* for this *measId*;

3> if *c1-ReportOnLeave* is set to *TRUE* for the corresponding reporting configuration or if *c2-ReportOnLeave* is set to *TRUE* for the corresponding reporting configuration:

4> initiate the measurement reporting procedure, as specified in 5.5.5;

3> if the *csi-RS-TriggeredList* defined within the *VarMeasReportList* for this *measId* is empty:

4> remove the measurement reporting entry within the *VarMeasReportList* for this *measId*;

4> stop the periodical reporting timer for this *measId*, if running;

2> if the *triggerType* is set to *event* and if the entry condition applicable for this event, i.e. the event corresponding with the *eventId* of the corresponding *reportConfig* within *VarMeasConfig*, is fulfilled for one or more applicable transmission resource pools for all measurements taken during *timeToTrigger* defined for this event within the *VarMeasConfig*, while the *VarMeasReportList* does not include a measurement reporting entry for this *measId* (a first transmission resource pool triggers the event):

3> include a measurement reporting entry within the *VarMeasReportList* for this *measId*;

3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;

3> include the concerned transmission resource pool(s) in the *poolsTriggeredList* defined within the *VarMeasReportList* for this *measId*;

3> initiate the measurement reporting procedure, as specified in 5.5.5;

2> if the *triggerType* is set to *event* and if the entry condition applicable for this event, i.e. the event corresponding with the *eventId* of the corresponding *reportConfig* within *VarMeasConfig*, is fulfilled for one or more applicable transmission resource pools not included in the *poolsTriggeredList* for all measurements taken during *timeToTrigger* defined for this event within the *VarMeasConfig* (a subsequent transmission resource pool triggers the event):

3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;

3> include the concerned transmission resource pool(s) in the *poolsTriggeredList* defined within the *VarMeasReportList* for this *measId*;

3> initiate the measurement reporting procedure, as specified in 5.5.5;

2> if the *triggerType* is set to *event* and if the leaving condition applicable for this event is fulfilled for one or more applicable transmission resource pools included in the *poolsTriggeredList* defined within the *VarMeasReportList* for this *measId* for all measurements taken during *timeToTrigger* defined within the *VarMeasConfig* for this event:

3> remove the concerned transmission resource pool(s) from the *poolsTriggeredList*defined within the *VarMeasReportList* for this *measId*;

3> if the *poolsTriggeredList* defined within the *VarMeasReportList* for this *measId* is empty:

4> remove the measurement reporting entry within the *VarMeasReportList* for this *measId*;

4> stop the periodical reporting timer for this *measId*, if running;

NOTE 1: Void.

2> if the *triggerType* is set to *event* and if the *eventId* is set to *eventD1* or *eventD2* or *eventH1* or *eventH2* and if the entering condition applicable for this event, i.e. the event corresponding with the *eventId* of the corresponding *reportConfig* within *VarMeasConfig*, is fulfilled during *timeToTrigger* defined within the *VarMeasConfig* for this event, while the *VarMeasReportList* does not include a measurement reporting entry for this *measId*:

3> include a measurement reporting entry within the *VarMeasReportList* for this *measId*;

3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;

3> initiate the measurement reporting procedure, as specified in 5.5.5;

2> if the *triggerType* is set to *event* and if the *eventId* is set to *eventD1* or *eventD2* or *eventH1* or *eventH2* and if the leaving condition applicable for this event, i.e. the event corresponding with the *eventId* of the corresponding *reportConfig* within *VarMeasConfig*, is fulfilled during *timeToTrigger* defined within the *VarMeasConfig* for this event:

3> if the *eventId* is set to *eventD1* or *eventD2* and *reportOnLeave* is set to *TRUE* for the corresponding reporting configuration:

4> initiate the measurement reporting procedure, as specified in 5.5.5;

3> remove the measurement reporting entry within the *VarMeasReportList* for this *measId*;

3> stop the periodical reporting timer for this *measId*, if running;

2> if *measRSSI-ReportConfig* is included and if a (first) measurement result is available:

3> include a measurement reporting entry within the *VarMeasReportList* for this *measId*;

3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;

3> initiate the measurement reporting procedure as specified in 5.5.5 immediately when RSSI sample values are reported by the physical layer after the first L1 measurement duration;

2> if *measRSSI-ReportConfigNR* is included and if a (first) measurement result is available:

3> include a measurement reporting entry within the *VarMeasReportList* for this *measId*;

3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;

3> initiate the measurement reporting procedure as specified in 5.5.5 immediately when RSSI sample values are reported by the physical layer after the first L1 measurement duration;

2> else if the *purpose* is included and set to *reportStrongestCells,* *reportStrongestCellsForSON*, *reportLocation sidelink* or *sensing* and if a (first) measurement result is available:

3> include a measurement reporting entry within the *VarMeasReportList* for this *measId*;

3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;

3> if the *purpose* is set to *reportStrongestCells* and *reportStrongestCSI-RSs* is set to *FALSE*:

4> if the *triggerType* is set to *periodical* and the corresponding *reportConfig* includes the *ul-DelayConfig*:

5> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after a first measurement result is provided by lower layers;

4> if the *triggerType* is set to *periodical* and the corresponding *reportConfig* includes the *ul-DelayValueConfig*:

5> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after a first measurement result is provided by lower layers of the associated DRB identity;

4> else if the corresponding measurement object concerns WLAN:

5> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after the quantity to be reported becomes available for the PCell and for the applicable WLAN(s);

4> else if the *reportAmount* exceeds 1:

5> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after the quantity to be reported becomes available for the PCell;

4> else (i.e. the *reportAmount* is equal to 1):

5> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after the quantity to be reported becomes available for the PCell and for the strongest cell among the applicable cells, or becomes available for the pair of PCell and the PSCell in case of SSTD measurements, or becomes available for each requested pair of PCell and NR cell or the maximal measurement reporting delay as specified in TS 36.133 [16], clause 8.17.2.3 in case of SFTD measurements;

3> if the *purpose* is set to *reportLocation*, *sidelink* or *sensing*:

4> if the *purpose* is set to *reportLocation*:

5> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after both the quantity to be reported for the PCell and the location information become available;

4> else if the *purpose* is set to *sidelink*:

5> initiate the measurement reporting procedure as specified in 5.5.5 immediately after both the quantity to be reported for the PCell and the CBR measurement result become available;

4> else if the *purpose* is set to *sensing*:

5> initiate the measurement reporting procedure as specified in 5.5.5 immediately after both the quantity to be reported for the PCell and the sensing measurement result become available;

3> else if the *purpose* is not set to *reportStrongestCells* or *reportStrongestCSI-RSs* is set to *true*:

4> initiate the measurement reporting procedure, as specified in 5.5.5, when it has determined the strongest cells on the associated frequency;

2> upon expiry of the periodical reporting timer for this *measId*:

3> initiate the measurement reporting procedure, as specified in 5.5.5;

2> if the *purpose* is included and set to *reportCGI*:

3> if the UE acquired the information needed to set all fields of *cgi-Info* for the requested cell; or

3> if the UE detects that the requested NR cell is not transmitting *SIB1:*

4> include a measurement reporting entry within the *VarMeasReportList* for this *measId*;

4> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;

4> stop timer T321;

4> initiate the measurement reporting procedure, as specified in 5.5.5;

2> upon expiry of the T321 for this *measId*:

3> include a measurement reporting entry within the *VarMeasReportList* for this *measId*;

3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;

3> initiate the measurement reporting procedure, as specified in 5.5.5;

NOTE 2: The UE does not stop the periodical reporting with *triggerType* set to *event* or to *periodical* while the corresponding measurement is not performed due to the PCell RSRP (or PSCell RSRP, if the UE is in NE-DC) being equal to or better than *s-Measure* or due to the measurement gap not being setup.

NOTE 3: If the UE is configured with DRX, the UE may delay the measurement reporting for event triggered and periodical triggered measurements until the Active Time, which is defined in TS 36.321 [6].

#### 5.5.4.2 Event A1 (Serving becomes better than threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition A1-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition A1-2, as specified below, is fulfilled;

1> for this measurement, consider the primary or secondary cell that is configured on the frequency indicated in the associated *measObjectEUTRA* to be the serving cell;

Inequality A1-1 (Entering condition)



Inequality A1-2 (Leaving condition)



The variables in the formula are defined as follows:

***Ms*** is the measurement result of the serving cell, not taking into account any offsets.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigEUTRA* for this event).

***Thresh*** is the threshold parameter for this event (i.e. *a1-Threshold* as defined within *reportConfigEUTRA* for this event).

***Ms*** is expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

***Hys*** is expressed in dB.

***Thresh*** is expressed in the same unit as ***Ms***.

#### 5.5.4.3 Event A2 (Serving becomes worse than threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition A2-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition A2-2, as specified below, is fulfilled;

1> for this measurement, consider the primary or secondary cell that is configured on the frequency indicated in the associated *measObjectEUTRA* to be the serving cell;

Inequality A2-1 (Entering condition)



Inequality A2-2 (Leaving condition)



The variables in the formula are defined as follows:

***Ms*** is the measurement result of the serving cell, not taking into account any offsets.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigEUTRA* for this event).

***Thresh*** is the threshold parameter for this event (i.e. *a2-Threshold* as defined within *reportConfigEUTRA* for this event).

***Ms*** is expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

***Hys*** is expressed in dB.

***Thresh*** is expressed in the same unit as ***Ms***.

#### 5.5.4.4 Event A3 (Neighbour becomes offset better than PCell/ PSCell)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition A3-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition A3-2, as specified below, is fulfilled;

1> if *usePSCell* of the corresponding *reportConfig* is set to *true*:

2> use the PSCell for *Mp*, *Ofp and Ocp*;

1> else:

2> use the PCell for *Mp*, *Ofp and Ocp*;

NOTE 1: The cell(s) that triggers the event is on the frequency indicated in the associated *measObject* which may be different from the frequency used by the PCell/ PSCell.

Inequality A3-1 (Entering condition)



Inequality A3-2 (Leaving condition)



The variables in the formula are defined as follows:

***Mn*** is the measurement result of the neighbouring cell, not taking into account any offsets.

***Ofn*** is the frequency specific offset of the frequency of the neighbour cell (i.e. *offsetFreq* as defined within *measObjectEUTRA* corresponding to the frequency of the neighbour cell).

***Ocn*** is the cell specific offset of the neighbour cell (i.e. *cellIndividualOffset* as defined within *measObjectEUTRA* corresponding to the frequency of the neighbour cell), and set to zero if not configured for the neighbour cell.

***Mp*** is the measurement result of the PCell/ PSCell, not taking into account any offsets.

***Ofp*** is the frequency specific offset of the frequency of the PCell/ PSCell (i.e. *offsetFreq* as defined within *measObjectEUTRA* corresponding to the frequency of the PCell/ PSCell).

***Ocp*** is the cell specific offset of the PCell/ PSCell (i.e. *cellIndividualOffset* as defined within *measObjectEUTRA* corresponding to the frequency of the PCell/ PSCell), and is set to zero if not configured for the PCell/ PSCell.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigEUTRA* for this event).

***Off*** is the offset parameter for this event (i.e. *a3-Offset* as defined within *reportConfigEUTRA* for this event).

***Mn, Mp*** are expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

***Ofn***, ***Ocn***, ***Ofp***, ***Ocp***, ***Hys***, ***Off*** are expressed in dB.

NOTE 2: The definition of Event A3 also applies to CondEvent A3.

#### 5.5.4.5 Event A4 (Neighbour becomes better than threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition A4-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition A4-2, as specified below, is fulfilled;

Inequality A4-1 (Entering condition)



Inequality A4-2 (Leaving condition)



The variables in the formula are defined as follows:

***Mn*** is the measurement result of the neighbouring cell, not taking into account any offsets.

***Ofn*** is the frequency specific offset of the frequency of the neighbour cell (i.e. *offsetFreq* as defined within *measObjectEUTRA* corresponding to the frequency of the neighbour cell).

***Ocn*** is the cell specific offset of the neighbour cell (i.e. *cellIndividualOffset* as defined within *measObjectEUTRA* corresponding to the frequency of the neighbour cell), and set to zero if not configured for the neighbour cell.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigEUTRA* for this event).

***Thresh*** is the threshold parameter for this event (i.e. *a4-Threshold* as defined within *reportConfigEUTRA* for this event).

***Mn*** is expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

***Ofn, Ocn, Hys*** are expressed in dB.

***Thresh*** is expressed in the same unit as ***Mn***.

NOTE : The definition of Event A4 also applies to CondEvent A4.

#### 5.5.4.6 Event A5 (PCell/ PSCell becomes worse than threshold1 and neighbour becomes better than threshold2)

The UE shall:

1> consider the entering condition for this event to be satisfied when both condition A5-1 and condition A5-2, as specified below, are fulfilled;

1> consider the leaving condition for this event to be satisfied when condition A5-3 or condition A5-4, i.e. at least one of the two, as specified below, is fulfilled;

1> if *usePSCell* of the corresponding *reportConfig* is set to *true*:

2> use the PSCell for *Mp*;

1> else:

2> use the PCell for *Mp*;

NOTE 1: The cell(s) that triggers the event is on the frequency indicated in the associated *measObject* which may be different from the frequency used by the PCell/ PSCell.

Inequality A5-1 (Entering condition 1)



Inequality A5-2 (Entering condition 2)



Inequality A5-3 (Leaving condition 1)



Inequality A5-4 (Leaving condition 2)



The variables in the formula are defined as follows:

***Mp*** is the measurement result of the PCell/ PSCell, not taking into account any offsets.

***Mn*** is the measurement result of the neighbouring cell, not taking into account any offsets.

***Ofn*** is the frequency specific offset of the frequency of the neighbour cell (i.e. *offsetFreq* as defined within *measObjectEUTRA* corresponding to the frequency of the neighbour cell).

***Ocn*** is the cell specific offset of the neighbour cell (i.e. *cellIndividualOffset* as defined within *measObjectEUTRA* corresponding to the frequency of the neighbour cell), and set to zero if not configured for the neighbour cell.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigEUTRA* for this event).

***Thresh1*** is the threshold parameter for this event (i.e. *a5-Threshold1* as defined within *reportConfigEUTRA* for this event).

***Thresh2*** is the threshold parameter for this event (i.e. *a5-Threshold2* as defined within *reportConfigEUTRA* for this event).

***Mn, Mp*** are expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

***Ofn, Ocn, Hys*** are expressed in dB.

***Thresh1*** is expressed in the same unit as ***Mp***.

***Thresh2*** is expressed in the same unit as ***Mn***.

NOTE 2: The definition of Event A5 also applies to CondEvent A5.

#### 5.5.4.6a Event A6 (Neighbour becomes offset better than SCell)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition A6-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition A6-2, as specified below, is fulfilled;

1> for this measurement, consider the (secondary) cell that is configured on the frequency indicated in the associated *measObjectEUTRA* to be the serving cell;

NOTE: The neighbour(s) is on the same frequency as the SCell i.e. both are on the frequency indicated in the associated *measObject*.

Inequality A6-1 (Entering condition)



Inequality A6-2 (Leaving condition)



The variables in the formula are defined as follows:

***Mn*** is the measurement result of the neighbouring cell, not taking into account any offsets.

***Ocn*** is the cell specific offset of the neighbour cell (i.e. *cellIndividualOffset* as defined within *measObjectEUTRA* corresponding to the frequency of the neighbour cell), and set to zero if not configured for the neighbour cell.

***Ms*** is the measurement result of the serving cell, not taking into account any offsets.

***Ocs*** is the cell specific offset of the serving cell (i.e. *cellIndividualOffset* as defined within *measObjectEUTRA* corresponding to the serving frequency), and is set to zero if not configured for the serving cell.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigEUTRA* for this event).

***Off*** is the offset parameter for this event (i.e. *a6-Offset* as defined within *reportConfigEUTRA* for this event).

***Mn, Ms*** are expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

***Ocn, Ocs, Hys, Off*** are expressed in dB.

#### 5.5.4.7 Event B1 (Inter RAT neighbour becomes better than threshold)

The UE shall:

1> for UTRA and CDMA2000, only trigger the event for cells included in the corresponding measurement object;

1> consider the entering condition for this event to be satisfied when condition B1-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition B1-2, as specified below, is fulfilled;

Inequality B1-1 (Entering condition)

Inequality B1-2 (Leaving condition)

The variables in the formula are defined as follows:

***Mn*** is the measurement result of the inter-RAT neighbour cell, not taking into account any offsets. For CDMA 2000 measurement result, *pilotStrength* is divided by -2.

***Ofn*** is the frequency specific offset of the frequency of the inter-RAT neighbour cell (i.e. *offsetFreq* as defined within the *measObject* corresponding to the frequency of the neighbour inter-RAT cell).

***Ocn*** is the cell specific offset of the inter-RAT NR neighbour cell (i.e. *cellIndividualOffset* as defined within the *measObjectNR* corresponding to the neighbour inter-RAT cell), and set to zero if not configured for the neighbour cell.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigInterRAT* for this event).

***Thresh*** is the threshold parameter for this event (i.e. *b1-Threshold* as defined within *reportConfigInterRAT* for this event). For CDMA2000, *b1-Threshold* is divided by -2.

***Mn*** is expressed in dBm or in dB, depending on the measurement quantity of the inter-RAT neighbour cell.

***Ofn, Ocn, Hys*** are expressed in dB.

***Thresh*** is expressed in the same unit as ***Mn***.

#### 5.5.4.8 Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2)

The UE shall:

1> for UTRA and CDMA2000, only trigger the event for cells included in the corresponding measurement object;

1> consider the entering condition for this event to be satisfied when both condition B2-1 and condition B2-2, as specified below, are fulfilled;

1> consider the leaving condition for this event to be satisfied when condition B2-3 or condition B2-4, i.e. at least one of the two, as specified below, is fulfilled;

Inequality B2-1 (Entering condition 1)



Inequality B2-2 (Entering condition 2)

Inequality B2-3 (Leaving condition 1)



Inequality B2-4 (Leaving condition 2)

The variables in the formula are defined as follows:

***Mp*** is the measurement result of the PCell, not taking into account any offsets.

***Mn*** is the measurement result of the inter-RAT neighbour cell, not taking into account any offsets. For CDMA2000 measurement result, *pilotStrength* is divided by -2.

***Ofn*** is the frequency specific offset of the frequency of the inter-RAT neighbour cell (i.e. *offsetFreq* as defined within the *measObject* corresponding to the frequency of the inter-RAT neighbour cell).

***Ocn*** is the cell specific offset of the inter-RAT NR neighbour cell (i.e. *cellIndividualOffset* as defined within the *measObjectNR* corresponding to the neighbour inter-RAT cell), and set to zero if not configured for the neighbour cell.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigInterRAT* for this event).

***Thresh1*** is the threshold parameter for this event (i.e. b2*-Threshold1* as defined within *reportConfigInterRAT* for this event).

***Thresh2*** is the threshold parameter for this event (i.e. *b2-Threshold2* as defined within *reportConfigInterRAT* for this event). For CDMA2000, *b2-Threshold2* is divided by -2.

***Mp*** is expressed in dBm in case of RSRP, or in dB in case of RSRQ.

***Mn*** is expressed in dBm or dB, depending on the measurement quantity of the inter-RAT neighbour cell.

***Ofn, Ocn, Hys*** are expressed in dB.

***Thresh1*** is expressed in the same unit as ***Mp***.

***Thresh2*** is expressed in the same unit as ***Mn***.

#### 5.5.4.9 Event C1 (CSI-RS resource becomes better than threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition C1-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition C1-2, as specified below, is fulfilled;

Inequality C1-1 (Entering condition)



Inequality C1-2 (Leaving condition)



The variables in the formula are defined as follows:

***Mcr*** is the measurement result of the CSI-RS resource, not taking into account any offsets.

***Ocr*** is the CSI-RS specific offset (i.e. *csi-RS-IndividualOffset* as defined within *measObjectEUTRA* corresponding to the frequency of the CSI-RS resource), and set to zero if not configured for the CSI-RS resource.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigEUTRA* for this event).

***Thresh*** is the threshold parameter for this event (i.e. *c1-Threshold* as defined within *reportConfigEUTRA* for this event).

***Mcr, Thresh*** are expressed in dBm.

***Ocr, Hys*** are expressed in dB.

#### 5.5.4.10 Event C2 (CSI-RS resource becomes offset better than reference CSI-RS resource)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition C2-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition C2-2, as specified below, is fulfilled;

NOTE: The CSI-RS resource(s) that triggers the event is on the same frequency as the reference CSI-RS resource, i.e. both are on the frequency indicated in the associated *measObject*.

Inequality C2-1 (Entering condition)



Inequality C2-2 (Leaving condition)



The variables in the formula are defined as follows:

***Mcr*** is the measurement result of the CSI-RS resource, not taking into account any offsets.

***Ocr*** is the CSI-RS specific offset of the CSI-RS resource (i.e. *csi-RS-IndividualOffset* as defined within *measObjectEUTRA* corresponding to the frequency of the CSI-RS resource), and set to zero if not configured for the CSI-RS resource.

***Mref*** is the measurement result of the reference CSI-RS resource (i.e. *c2-RefCSI-RS* as defined within *reportConfigEUTRA* for this event), not taking into account any offsets.

***Oref*** is the CSI-RS specific offset of the reference CSI-RS resource (i.e. *csi-RS-IndividualOffset* as defined within *measObjectEUTRA* corresponding to the frequency of the reference CSI-RS resource), and is set to zero if not configured for the reference CSI-RS resource.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigEUTRA* for this event).

***Off*** is the offset parameter for this event (i.e. *c2-Offset* as defined within *reportConfigEUTRA* for this event).

***Mcr, Mref*** are expressed in dBm.

***Ocr, Oref, Hys, Off*** are expressed in dB.

#### 5.5.4.11 Event W1 (WLAN becomes better than a threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when *wlan-MobilitySet* within *VarWLAN-MobilityConfig* does not contain any entries and condition W1-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition W1-2, as specified below, is fulfilled;

Inequality W1-1 (Entering condition)



Inequality W1-2 (Leaving condition)



The variables in the formula are defined as follows:

***Mn*** is the measurement result of WLAN(s) configured in the measurement object, not taking into account any offsets.

***Hys*** is the hysteresis parameter for this event.

***Thresh*** is the threshold parameter for this event (i.e. *w1-Threshold* as defined within *reportConfigInterRAT* for this event).

***Mn*** is expressed in dBm.

***Hys is*** expressed in dB.

***Thresh*** is expressed in the same unit as ***Mn***.

#### 5.5.4.12 Event W2 (All WLAN inside WLAN mobility set becomes worse than threshold1 and a WLAN outside WLAN mobility set becomes better than threshold2)

The UE shall:

1> consider the entering condition for this event to be satisfied when both conditions W2-1 and W2-2 as specified below are fulfilled;

1> consider the leaving condition for this event to be satisfied when condition W2-3 orcondition W2-4, i.e. at least one of the two, as specified below is fulfilled;

Inequality W2-1 (Entering condition 1)



Inequality W2-2 (Entering condition 2)



Inequality W2-3 (Leaving condition 1)



Inequality W2-4 (Leaving condition 2)



The variables in the formula are defined as follows:

***Ms*** is the measurement result of WLAN(s) which matches all WLAN identifiers of at least one entry within *wlan-MobilitySet* in *VarWLAN-MobilityConfig*, not taking into account any offsets.

***Mn*** is the measurement result of WLAN(s) configured in the measurement object which does not match all WLAN identifiers of any entry within *wlan-MobilitySet* in *VarWLAN-MobilityConfig*, not taking into account any offsets.

***Hys*** is the hysteresis parameter for this event*.*

***Thresh1*** is the threshold parameter for this event (i.e. *w2-Threshold1* as defined within *reportConfigInterRAT* for this event).

***Thresh2*** is the threshold parameter for this event (i.e. *w2-Threshold2* as defined within *reportConfigInterRAT* for this event).

***Mn, Ms*** are expressed in dBm.

***Hys*** is expressed in dB.

***Thresh1*** is expressed in the same unit as ***Ms***.

***Thresh2*** is expressed in the same unit as ***Mn***.

#### 5.5.4.13 Event W3 (All WLAN inside WLAN mobility set becomes worse than a threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition W3-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition W3-2, as specified below, is fulfilled;

Inequality W3-1 (Entering condition)



Inequality W3-2 (Leaving condition)



The variables in the formula are defined as follows:

***Ms*** is the measurement result of WLAN(s) which matches all WLAN identifiers of at least one entry within *wlan-MobilitySet* in *VarWLAN-MobilityConfig*, not taking into account any offsets.

***Hys*** is the hysteresis parameter for this event.

***Thresh*** is the threshold parameter for this event (i.e. *w3-Threshold* as defined within *reportConfigInterRAT* for this event).

***Ms*** is expressed in dBm.

***Hys is*** expressed in dB.

***Thresh*** is expressed in the same unit as ***Ms***.

#### 5.5.4.14 Event V1 (The channel busy ratio is above a threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition V1-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition V1-2, as specified below, is fulfilled;

Inequality V1-1 (Entering condition)



Inequality V1-2 (Leaving condition)



The variables in the formula are defined as follows:

***Ms*** is the measurement result of channel busy ratio of the transmission resource pool, not taking into account any offsets.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigEUTRA* for this event).

***Thresh*** is the threshold parameter for this event (i.e. *v1-Threshold* as defined within *ReportConfigEUTRA*).

***Ms*** is expressed in decimal from 0 to 1 in steps of 0.01.

***Hys*** is expressed is in the same unit as ***Ms***.

***Thresh*** is expressed in the same unit as ***Ms***.

#### 5.5.4.15 Event V2 (The channel busy ratio is below a threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition V2-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition V2-2, as specified below, is fulfilled;

Inequality V2-1 (Entering condition)



Inequality V2-2 (Leaving condition)



The variables in the formula are defined as follows:

***Ms*** is the measurement result of channel busy ratio of the transmission resource pool, not taking into account any offsets.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigEUTRA* for this event).

***Thresh*** is the threshold parameter for this event (i.e. *v2-Threshold* as defined within *ReportConfigEUTRA*).

***Ms*** is expressed in decimal from 0 to 1 in steps of 0.01.

***Hys*** is expressed is in the same unit as ***Ms***.

***Thresh*** is expressed in the same unit as ***Ms***.

#### 5.5.4.16 Event H1 (The Aerial UE height is above a threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition H1-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition H1-2, as specified below, is fulfilled;

Inequality H1-1 (Entering condition)



Inequality H1-2 (Leaving condition)



The variables in the formula are defined as follows:

***Ms*** is the Aerial UE height, not taking into account any offsets.

***Hys*** is the hysteresis parameter (i.e. *h1-Hysteresis* as defined within *ReportConfigEUTRA*) for this event.

***Thresh*** is the reference threshold parameter for this event given in *MeasConfig*(i.e. *heightThreshRef* as defined within *MeasConfig*).

***Offset*** is the offset value to *heightThreshRef* to obtain the absolute threshold for this event. (i.e. *h1-ThresholdOffset* as defined within *ReportConfigEUTRA*)

***Ms*** is expressed in meters.

***Thresh*** is expressed in the same unit as ***Ms***.

#### 5.5.4.17 Event H2 (The Aerial UE height is below a threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition H2-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition H2-2, as specified below, is fulfilled;

Inequality H2-1 (Entering condition)



Inequality H2-2 (Leaving condition)



The variables in the formula are defined as follows:

***Ms*** is the Aerial UE height, not taking into account any offsets.

***Hys*** is the hysteresis parameter (i.e. *h2-Hysteresis* as defined within *ReportConfigEUTRA*) for this event.

***Thresh*** is the reference threshold parameter for this event given in MeasConfig(i.e. *heightThreshRef* as defined within *MeasConfig*).

***Offset*** is the offset value to *heightThreshRef* to obtain the absolute threshold for this event. (i.e. *h2-ThresholdOffset* as defined within *ReportConfigEUTRA*)

***Ms*** is expressed in meters.

***Thresh*** is expressed in the same unit as ***Ms***.

#### 5.5.4.18 Void

#### 5.5.4.19 Void

#### 5.5.4.20 Event D1 (Distance between UE and referenceLocation1 is above threshold1 and distance between UE and referenceLocation2 is below threshold2)

The UE shall:

1> consider the entering condition for this event to be satisfied when both condition D1-1 and condition D1-2, as specified below, are fulfilled;

1> consider the leaving condition for this event to be satisfied when condition D1-3 or condition D1-4, i.e. at least one of the two, as specified below, is fulfilled;

Inequality D1-1 (Entering condition 1)

Inequality D1-2 (Entering condition 2)

Inequality D1-3 (Leaving condition 1)

Inequality D1-4 (Leaving condition 2)

The variables in the formula are defined as follows:

***Ml1*** is the distance between UE and a reference location for this event (i.e. *referenceLocation1* as defined within *reportConfigEUTRA* for this event), not taking into account any offsets.

***Ml2*** is the distance between UE and a reference location for this event (i.e. *referenceLocation2* as defined within *reportConfigEUTRA* for this event), not taking into account any offsets.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresisLocation* as defined within *reportConfigEUTRA* for this event).

***Thresh1*** is the threshold for this event defined as a distance, configured with parameter *distanceThreshFromReference1,* from a reference location configured with parameter *referenceLocation1* within *reportConfigEUTRA* for this event.

***Thresh2*** is the threshold for this event defined as a distance, configured with parameter *distanceThreshFromReference2,* from a reference location configured with parameter *referenceLocation2* within *reportConfigEUTRA* for this event.

***Ml1*** is expressed in meters.

***Ml2, Hys, Thresh1, Thresh2*** are expressed in the same unit as ***Ml1***.

NOTE: The definition of Event D1 also applies to CondEvent D1.

#### 5.5.4.21 CondEvent T1 (Time measured at UE is within a duration from threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition T1-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition T1-2, as specified below, is fulfilled;

Inequality T1-1 (Entering condition)

Inequality T1-2 (Leaving condition)

The variables in the formula are defined as follows:

***Mt*** is the time measured at UE.

***Thresh1*** is the threshold parameter for this event (i.e. *t1-Threshold* as defined within *reportConfigEUTRA* for this event).

***Duration*** is the duration parameter for this event (i.e. *duration* as defined within *reportConfigEUTRA* for this event).

***Mt*** is expressed in *ms*.

***Thresh1, Duration*** are expressed in the same unit as ***Mt***.

#### 5.5.4.22 Event D2 (Distance between UE and serving cell moving reference location is above threshold1 and distance between UE and neighbour cell moving reference location is below threshold2)

The UE shall:

1> consider the entering condition for this event to be satisfied when both condition D2-1 and condition D2-2, as specified below, are fulfilled;

1> consider the leaving condition for this event to be satisfied when condition D2-3 or condition D2-4, i.e. at least one of the two, as specified below, is fulfilled;

Inequality D2-1 (Entering condition 1)

Inequality D2-2 (Entering condition 2)

Inequality D2-3 (Leaving condition 1)

Inequality D2-4 (Leaving condition 2)

The variables in the formula are defined as follows:

***Ml1*** is the distance between UE and a moving reference location of serving cell for this event, not taking into account any offsets. The moving reference location is determined based on *movingReferenceLocation*, serving cell ephemeris information, and the corresponding epoch time broadcast in *SystemInformationBlockType31*.

***Ml2*** is the distance between UE and a moving reference location of candidate target cell for this event, not taking into account any offsets. The moving reference location is determined based on *referenceLocation*, ephemeris information (provided in *ephemerisInfo* or indicated by *satelliteId*) and epoch time provided in the associated *measObjectEUTRA*.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresisLocation* as defined within *reportConfigEUTRA* for this event).

***Thresh1*** is the threshold for this event defined as a distance, configured with parameter *distanceThreshFromReference1,* from a moving reference location determined based on *movingReferenceLocation*, serving cell ephemeris information, and the corresponding epoch time broadcast in *SystemInformationBlockType31*.

***Thresh2*** is the threshold for this event defined as a distance, configured with parameter *distanceThreshFromReference2,* from a moving reference location determined based on *referenceLocation*, ephemeris information (provided in *ephemerisInfo* or indicated by *satelliteId*) and epoch time provided in the associated *measObjectEUTRA*.

***Ml1*** is expressed in meters.

***Ml2, Hys, Thresh1, Thresh2*** are expressed in the same unit as ***Ml1***.

NOTE: The definition of Event D2 also applies to CondEvent D2.

### 5.5.5 Measurement reporting

#### 5.5.5.1 General



Figure 5.5.5.1-1: Measurement reporting

The purpose of this procedure is to transfer measurement results from the UE to E-UTRAN. The UE shall initiate this procedure only after successful security activation.

For the *measId* for which the measurement reporting procedure was triggered, the UE shall set the *measResults* within the *MeasurementReport* message as follows:

1> set the *measId* to the measurement identity that triggered the measurement reporting;

1> set the *measResultPCell* to include the quantities of the PCell;

1> set the *measResultServFreqList* to include for each E-UTRA SCell that is configured, if any, within *measResultSCell* the quantities of the concerned SCell, if available according to performance requirements in TS 36.133 [16], except if *purpose* for the *reportConfig* associated with the *measId* that triggered the measurement reporting is set to *reportLocation*;

1> if the *reportConfig* associated with the *measId* that triggered the measurement reporting includes *reportAddNeighMeas*:

2> for each E-UTRA serving frequency for which *measObjectId* is referencedin the *measIdList*, other than the frequency corresponding with the *measId* that triggered the measurement reporting:

3> set the *measResultServFreqList* to include within *measResultBestNeighCell* the *physCellId* and the quantities of the best non-serving cell, based on RSRP, on the concerned serving frequency;

1> if the *triggerType* is set to *event*; and if the corresponding measObject concerns NR; and if *eventId* is set to *eventB1-NR* or *eventB2-NR*; or

1> if the *triggerType* is set to *event*; and if *eventId* is set to *eventA3* or *eventA4* or *eventA5*:

2> if (NG)EN-DC is configured, and if *purpose* for the *reportConfig* or *reportConfigInterRAT* associated with the *measId* that triggered the measurement reporting is set to a value other than *reportLocation* or if *purpose* is not configured:

3> set the *measResultServFreqListNR* to include for each NR serving frequency that the UE is configured to measure according to TS 38.331 [82], if any, the following:

4> set *measResultSCell* to include the available results of the NR serving cell, as specified in 5.5.5.2;

4> if the *reportConfig* associated with the *measId* that triggered the measurement reporting includes *reportAddNeighMeas* and if *eventId* is set to *eventA3* or *eventA4* or *eventA5*:

5> set *measResultBestNeighCell* to include the available results, as specified in 5.5.5.2, of the non-serving cell with the highest sorting quantity determined as specified in 5.5.5.3;

3> for each (serving or neighbouring) cell for which the UE reports results according to the previous, additionally include available beam results according to the following:

4> if *maxReportRS-Index* is configured, set *measResultRS-IndexList* to include available results, as specified in 5.5.5.2, of up to *maxReportRS-Index* beams, ordered based on the quantity determined as specified in 5.5.5.3;

1> if there is at least one applicable neighbouring cell to report:

2> set the *measResultNeighCells* to include the best neighbouring cells up to *maxReportCells* in accordance with the following:

3> if the *triggerType* is set to *event* and *eventId* is not set to *eventD1* or *eventD2*:

4> include the cells included in the *cellsTriggeredList* as defined within the *VarMeasReportList* for this *measId*;

3> else:

4> include the applicable cells for which the new measurement results became available since the last periodical reporting or since the measurement was initiated or reset;

NOTE 1: The reliability of the report (i.e. the certainty it contains the strongest cells on the concerned frequency) depends on the measurement configuration i.e. the *reportInterval*. The related performance requirements are specified in TS 36.133 [16].

3> for each cell that is included in the *measResultNeighCells*, include the *physCellId*;

3> if the *triggerType* is set to *event*; or the *purpose* is set to *reportStrongestCells* or to *reportStrongestCellsForSON*:

4> for each included cell, include the layer 3 filtered measured results in accordance with the *reportConfig* for this *measId*, ordered as follows:

5> if the *measObject* associated with this *measId* concerns E-UTRA:

6> set the *measResult* to include the quantity(ies) indicated in the *reportQuantity* within the concerned *reportConfig*;

6> sort the included cells in order of decreasing *triggerQuantity*, i.e. the best cell is included first;

5> if the *measObject* associated with this *measId* concerns NR:

6> set the *measResultCell* to include the quantity(ies) indicated in the *reportQuantityCellNR* within the concerned *reportConfig*;

6> if *maxReportRS-Index* and *reportQuantityRS-IndexNR* are configured, set *measResultRS-IndexList* to include the result of the best beam and if *threshRS-Index* is included in the *VarMeasConfig* for the corresponding *measObject*, the remaining beams whose quantity is above *threshRS-Index*, up to *maxReportRS-Index* beams in total:

7> order beams based on the sorting quantity determined as specified in 5.5.5.3;

7> for each included beam:

8> include *ssbIndex*;

8> if *reportRS-IndexResultsNR* is set to TRUE, for each quantity indicated, include the corresponding measurement result in *measResultSSB-Index* for each *ssb-Index*;

6> sort the included cells in order of decreasing sorting quantity determined as specified in 5.5.5.3;

5> if the *measObject* associated with this *measId* concerns UTRA FDD and if *ReportConfigInterRAT* includes the *reportQuantityUTRA-FDD*:

6> set the *measResult* to include the quantities indicated by the *reportQuantityUTRA-FDD* in order of decreasing *measQuantityUTRA-FDD* within the *quantityConfig*, i.e. the best cell is included first;

5> if the *measObject* associated with this *measId* concerns UTRA FDD and if *ReportConfigInterRAT* does not include the *reportQuantityUTRA-FDD*; or

5> if the *measObject* associated with this *measId* concerns UTRA TDD, GERAN or CDMA2000:

6> set the *measResult* to the quantity as configured for the concerned RAT within the *quantityConfig* in order of either decreasing quantity for UTRA and GERAN or increasing quantity for CDMA2000 *pilotStrength*, i.e. the best cell is included first;

3> else if the *purpose* is set to *reportCGI* and the corresponding *measObject* concerns a RAT other than NR:

4> if the mandatory present fields of the *cgi-Info* for the cell indicated by the *cellForWhichToReportCGI* in the associated *measObject* have been obtained:

5> if the *includeMultiBandInfo* is configured:

6> include the *freqBandIndicator*;

6> if the cell broadcasts the *multiBandInfoList*, include the *multiBandInfoList*;

6> if the cell broadcasts the *freqBandIndicatorPriority*, include the *freqBandIndicatorPriority*;

5> if the cell broadcasts a CSG identity:

6> include the *csg-Identity*;

6> include the *csg-MemberStatus* and set it to *member* if the cell is a CSG member cell;

5> if the *si-RequestForHO* is configured within the *reportConfig* associated with this *measId*:

6> include the *cgi-Info* containing all the fields other than the *plmn-IdentityList* that have been successfully acquired;

6> include, within the *cgi-Info*, the field *plmn-IdentityList* in accordance with the following:

7> if the cell is a CSG member cell, determine the subset of the PLMN identities, starting from the second entry of PLMN identities in the broadcast information, that meet the following conditions:

a) equal to the RPLMN or an EPLMN; and

b) the Permitted CSG list of the UE includes an entry comprising of the concerned PLMN identity and the CSG identity broadcast by the cell;

7> if the subset of PLMN identities determined according to the previous includes at least one PLMN identity, include the *plmn-IdentityList* and set it to include this subset of the PLMN identities;

7> if the cell is a CSG member cell, include the *primaryPLMN-Suitable* if the primary PLMN meets conditions a) and b) specified above;

7> if the cell does not broadcast *csg-Identity* and the UE is capable of reporting the *plmn-IdentityList* from cells not broadcasting *csg-Identity*:

8> include in the plmn-IdentityList the list of identities starting from the second entry of PLMN identities in the broadcast information;

5> else:

6> include the *cgi-Info* containing all the fields that have been successfully acquired and in accordance with the following:

7> include in the *plmn-IdentityList* the list of identities starting from the second entry of PLMN Identities in the broadcast information;

4> if the *cellAccessRelatedInfoList-5GC* has been acquired:

5> include *cgi-Info-5GC*;

NOTE 1a: The UE may include the *cgi-Info-5GC* even when the N1 mode is disabled.

3> else if the *purpose* is set to *reportCGI* and the corresponding *measObject* concerns NR RAT:

4> if the Cell information of *cgi-Info* for the cell indicated by the *cellForWhichToReportCGI* in the associated *measObject* has been obtained:

5> include *plmn-IdentityInfoList* including *plmn-IdentityList*, *trackingAreaCode* (if available), *ran-AreaCode* (if available) and *cellIdentity* for each entry of the *plmn-IdentityInfoList*;

5> include *frequencyBandList* if broadcasted;

5> for each entry in *plmn-IdentityInfoList*, if the *gNB-ID-Length* is broadcasted:

6> include *gNB-ID-Length*;

4> else if MIB associated with the concerned *measObject* indicates that SIB1 is not broadcast*:*

5> include the *noSIB1* field;

1> for the cells included according to the previous (i.e. covering the PCell, the SCells, the best non-serving cells on serving frequencies as well as neighbouring EUTRA cells) include results according to the extended RSRQ if corresponding results are available according to the associated performance requirements defined in TS 36.133 [16];

1> if there is at least one applicable CSI-RS resource to report:

2> set the *measResultCSI-RS-List* to include the best CSI-RS resources up to *maxReportCells* in accordance with the following:

3> if the *triggerType* is set to *event*:

4> include the CSI-RS resources included in the *csi-RS-TriggeredList* as defined within the *VarMeasReportList* for this *measId*;

3> else:

4> include the applicable CSI-RS resources for which the new measurement results became available since the last periodical reporting or since the measurement was initiated or reset;

NOTE 2: The reliability of the report (i.e. the certainty it contains the strongest CSI-RS resources on the concerned frequency) depends on the measurement configuration i.e. the *reportInterval*. The related performance requirements are specified in TS 36.133 [16].

3> for each CSI-RS resource that is included in the *measResultCSI-RS-List*:

4> include the *measCSI-RS-Id*;

4> include the layer 3 filtered measured results in accordance with the *reportConfig* for this *measId*, ordered as follow:

5> set the *csi-RSRP-Result* to include the quantity indicated in the *reportQuantity* within the concerned *reportConfig* in order of decreasing *triggerQuantityCSI-RS*, i.e. the best CSI-RS resource is included first;

4> if *reportCRS-Meas* is set to *true* within the associated *reportConfig*, and the cell indicated by *physCellId* of this CSI-RS resource is not a serving cell:

5> set the *measResultNeighCells* to include the cell indicated by *physCellId* of this CSI-RS resource, and include the *physCellId*;

5> set the *rsrpResult* to include the RSRP of the concerned cell, if available according to performance requirements in TS 36.133 [16];

5> set the *rsrqResult* to include the RSRQ of the concerned cell, if available according to performance requirements in TS 36.133 [16];

1> if the *ue-RxTxTimeDiffPeriodical* is configured within the corresponding *reportConfig* for this *measId*;

2> set the *ue-RxTxTimeDiffResult* to the measurement result provided by lower layers;

2> set the *currentSFN*;

1> if the *measRSSI-ReportConfig* is configured within the corresponding *reportConfig* for this *measId:*

2> set the *rssi-Result* to the average of sample value(s) provided by lower layers in the *reportInterval*;

2> set the *channelOccupancy* to the rounded percentage of sample values which are beyond to the *channelOccupancyThreshold* within all the sample values in the *reportInterval*;

1> if the *measRSSI-ReportConfigNR* is configured within the corresponding *reportConfigInterRAT* for this *measId:*

2> set the *rssi-ResultNR* to the average of sample value(s) provided by lower layers in the *reportInterval*;

2> set the *channelOccupancyNR* to the rounded percentage of sample values which are beyond to the *channelOccupancyThresholdNR* within all the sample values in the *reportInterval*;

1> if uplink PDCP delay results are available:

2> set the *ul-PDCP-DelayResultList* to include the uplink PDCP delay results available;

1> if uplink PDCP delay value results are available:

2> set the *ul-PDCP-DelayValueResultList* to include the corresponding average uplink PDCP delay values;

1> if the *includeLocationInfo* is configured in the corresponding *reportConfig* for this *measId* or if *purpose* for the *reportConfig* associated with the *measId* that triggered the measurement reporting is set to *reportLocation*; and detailed location information that has not been reported is available, set the content of the *locationInfo* as follows:

2> include the *locationCoordinates*;

2> if available, include the *gnss-TOD-msec*, except if *purpose* for the *reportConfig* associated with the *measId* that triggered the measurement reporting is set to *reportLocation*;

2> include the *verticalVelocityInfo*, if available;

1> if the *coarseLocationReq* is set to *true* in the corresponding *reportConfig* for this *measId*:

2> if available, include the *coarseLocationInfo;*

1> if the *includeWLAN-Meas* is configured in the corresponding *reportConfig* for this *measId*, set the *measResults* as follows:

2> if available, include the *logMeasResultListWLAN*, in order of decreasing RSSI for WLAN APs;

1> if the *includeBT-Meas* is configured in the corresponding *reportConfig* for this *measId*, set the *measResults* as follows:

2> if available, include the *logMeasResultListBT*, in order of decreasing RSSI for Bluetooth beacons;

1> if the *includeUncomBarPreMeas* is configured in the corresponding *reportConfig* for this *measId* and if *includeUncomBarPreMeas* is set to *true*, set the *measResults* as follows:

2> if available, include the *uncomBarPreMeasResult*;

1> if the *reportSSTD-Meas* is set to *true* or *pSCell* within the corresponding *reportConfig* for this *measId*:

2> set the *measResultSSTD* to the measurement results provided by lower layers;

1> if the *reportSFTD-Meas* is set to *neighborCells* or *pSCell* within the corresponding *reportConfigInterRAT* for this *measId*, for each applicable cell for which results are available:

2> set *sfn-OffsetResult* and *frameBoundaryOffsetResult* to the measurement results provided by lower layers;

2> if the *ss-rsrp* in the *reportQuantityCellNR* is set to *TRUE* within the corresponding *reportConfigInterRAT* for this *measId*:

3> include *rsrpResult* set to the RSRP of the concerned cell;

1> if there is at least one applicable transmission resource pool to report:

2> set the *measResultListCBR* to include the CBR measurement results in accordance with the following:

3> if the *triggerType* is set to *event*:

4> include the transmission resource pools included in the *poolsTriggeredList* as defined within the *VarMeasReportList* for this *measId*;

3> else:

4> include the applicable transmission resource pools for which the new measurement results became available since the last periodical reporting or since the measurement was initiated or reset;

3> for each transmission resource pool to be reported:

4> set the *poolIdentity* to the *poolReportId* of this transmission resource pool;

4> if *adjacencyPSCCH-PSSCH* is set to *TRUE* for this transmission resource pool:

5> set the *cbr-PSSCH* to the CBR measurement result on PSSCH and PSCCH of this transmission resource pool provided by lower layers;

4> else:

5> set the *cbr-PSSCH* to the CBR measurement result on PSSCH of this transmission resource pool provided by lower layers if available;

5> set the *cbr-PSCCH* to the CBR measurement result on PSCCH of this transmission resource pool provided by lower layers if available;

2> set the *measResultSensing* to include the sensing measurement results in accordance with the following:

3> include the applicable transmission resource pools for which the new measurement results became available since the last periodical reporting or since the measurement was initiated or reset;

3> for each transmission resource pool to be reported:

4> set the *sensingResult* to the sensing measurement results provided by the lower layers;

1> if the *triggerType* is set to *event*; and if *eventId* is set to *eventH1* or *eventH2*:

2> set the *heightUE* to include the altitude of the UE;

1> increment the *numberOfReportsSent* as defined within the *VarMeasReportList* for this *measId* by 1;

1> stop the periodical reporting timer, if running;

1> if the *numberOfReportsSent* as defined within the *VarMeasReportList* for this *measId* is less than the *reportAmount* as defined within the corresponding *reportConfig* for this *measId*:

2> start the periodical reporting timer with the value of *reportInterval* as defined within the corresponding *reportConfig* for this *measId*;

1> else:

2> if the *triggerType* is set to *periodical*:

3> remove the entry within the *VarMeasReportList* for this *measId*;

3> remove this *measId* from the *measIdList* within *VarMeasConfig*;

1> if the measured results are for CDMA2000 HRPD:

2> set the *preRegistrationStatusHRPD* to the UE's CDMA2000 upper layer's HRPD *preRegistrationStatus*;

1> if the measured results are for CDMA2000 1xRTT:

2> set the preRegistrationStatusHRPD to *FALSE*;

1> if the measured results are for WLAN:

2> set the *measResultListWLAN* to include the quantities within the *quantityConfigWLAN* for up to *maxReportCells* WLAN(s), determined according to the following:

3> include WLAN the UE is connected to, if any;

3> if *reportAnyWLAN* is set to TRUE:

4> consider WLAN with any WLAN identifiers to be applicable for measurement reporting;

3> else:

4> consider only WLANs which do not match all WLAN identifiers of any entry within *wlan-MobilitySet* in *VarWLAN-MobilityConfig* to be applicable for measurement reporting;

3> include applicable WLAN in order of decreasing WLAN RSSI, i.e. the best WLAN is included first;

2> for each included WLAN:

3> set *wlan-Identifiers* to include all WLAN identifiers that can be acquired for the WLAN measured;

3> set *connectedWLAN* to *TRUE* if the UE is connected to the WLAN measured;

3> if *reportQuantityWLAN* existswithin the *ReportConfigInterRAT* within the *VarMeasConfig* for this *measId*:

4> if *bandRequestWLAN* is set to *TRUE*:

5> set *bandWLAN* to include WLAN band of the WLAN measured;

4> if *carrierInfoRequestWLAN* is set to *TRUE*:

5> set *carrierInfoWLAN* to include WLAN carrier information of the WLAN measured if it can be acquired;

4> if *availableAdmissionCapacityRequestWLAN* is set to *TRUE*:

5> set the *measResult* to include *avaiableAdmissionCapacityWLAN* if it can be acquired;

4> if *backhaulDL-BandwidthRequestWLAN* is set to *TRUE*:

5> set the *measResult* to include *backhaulDL-BandwidthWLAN* if it can be acquired;

4> if *backhaulUL-BandwidthRequestWLAN* is set to *TRUE*:

5> set the *measResult* to include *backhaulUL-BandwidthWLAN* if it can be acquired;

4> if *channelUtilizationRequestWLAN* is set to *TRUE*:

5> set the *measResult* to include *channelUtilizationWLAN* if it can be acquired;

4> if *stationCountRequestWLAN* is set to *TRUE*:

5> set the *measResult* to include *stationCountWLAN* if it can be acquired;

1> if the measurement configuration that triggered the measurement reporting procedure was configured by an *sl-ConfigDedicatedEUTRA* that was received within an NR *RRCReconfiguration* message:

2> submit the *MeasurementReport* message via SRB1 embedded in NR RRC message *ULInformationTransferIRAT* as specified in TS 38.331 [82].

1> else if the UE is configured with NE-DC:

2> submit the *MeasurementReport* message via SRB1 embedded in NR RRC message *ULInformationTransferMRDC* as specified in TS 38.331 [82].

1> else:

2> submit the *MeasurementReport* message to lower layers for transmission, upon which the procedure ends;

#### 5.5.5.2 Determination of available NR measurement results

When configured to report measurement results of the serving and the best neighbouring cells on NR serving frequencies, the UE shall consider NR measurement results to be available as follows:

1> only SSB based results are available and only if configured to measure these for the concerned serving frequency;

1> for the serving cell:

2> include cell quantities RSRP and RSRQ while SINR is included if the UE is configured to measure this quantity on an NR frequency, possibly different from the concerned serving frequency, but only if configured by NR *measConfig*:

2> include beam results and beam quantities if the UE is configured to measure these on an NR frequency, possibly different from the concerned serving frequency, but only if configured by NR *measConfig*;

1> for a neighbouring cell:

2> include cell quantities, beam results and beam quantities if the UE is configured to measure these on an NR frequency, possibly different from the concerned serving frequency, but only if configured by NR *measConfig*.

1> filter available results according to the applicable field in NR *quantityConfig*:

#### 5.5.5.3 Selection of NR sorting quality

When configured to report the best cells or beams, the UE shall determine the quantity that is used to order and select as follows:

1> for cells on the frequency associated with the *measId* that triggered the measurement reporting, if the *reportTrigger* is set to *event*, consider the quantity used in *bN-ThresholdYNR* to be the sorting quantity;

1> for other cases, determine the sorting quantity as follows:

2> consider the following quantities as candidate sorting quantities:

3> for cells on the frequency associated with the *measId* that triggered the measurement reporting (for a *triggerType* set to *periodical*):

4> the quantities defined by *reportQuantityCellNR*, when used for sorting cells;

4> the quantities defined by *reportQuantityRS-IndexNR*, when used for sorting beams;

3> for cells, serving or non-serving (i.e. within *reportAddNeighMeas*), on NR serving frequencies other than the one associated with the *measId* triggering reporting:

4> the available quantities of available NR measurement results as specified in 5.5.5.2;

2> if there is a single candidate sorting quantity;

3> consider the concerned quantity to be the sorting quantity;

2> else:

3> if RSRP is one of the candidate sorting quantities;

4> consider RSRP to be the sorting quantity;

3> else:

4> consider RSRQ to be the sorting quantity;

### 5.5.6 Measurement related actions

#### 5.5.6.1 Actions upon handover and re-establishment

E-UTRAN applies the handover procedure as follows:

- when performing the handover procedure, as specified in 5.3.5.4, ensure that a *measObjectId* corresponding to each handover target serving frequency is configured as a result of the procedures described in this clause and in 5.3.5.4;

- when changing the band while the physical frequency remains unchanged, E-UTRAN releases the *measObject* corresponding to the source frequency and adds a *measObject* corresponding to the target frequency (i.e. it does not reconfigure the *measObject*);

E-UTRAN applies the re-establishment procedure as follows:

- when performing the connection re-establishment procedure, as specified in 5.3.7, ensure that a *measObjectId* corresponding each target serving frequency is configured as a result of the procedure described in this clause and the subsequent connection reconfiguration procedure immediately following the re-establishment procedure;

- in the first reconfiguration following the re-establishment when changing the band while the physical frequency remains unchanged, E-UTRAN releases the *measObject* corresponding to the source frequency and adds a *measObject* corresponding to the target frequency (i.e. it does not reconfigure the *measObject*);

The UE shall:

1> for each *measId* included in the *measIdList* within *VarMeasConfig*:

2> if the *triggerType* is set to *periodical*:

3> remove this *measId* from the *measIdList* within *VarMeasConfig*:

1> if the procedure was triggered due to a handover or successful re-establishment and the procedure involves a change of primary frequency, update the *measId* values in the *measIdList* within *VarMeasConfig* as follows:

2> if a *measObjectId* value corresponding to the target primary frequency exists in the *measObjectList* within *VarMeasConfig*:

3> for each *measId* value in the *measIdList*:

4> if the *measId* value is linked to the *measObjectId* value corresponding to the source primary frequency:

5> link this *measId* value to the *measObjectId* value corresponding to the target primary frequency;

4> else if the *measId* value is linked to the *measObjectId* value corresponding to the target primary frequency:

5> link this *measId* value to the *measObjectId* value corresponding to the source primary frequency;

2> else:

3> remove all *measId* values that are linked to the *measObjectId* value corresponding to the source primary frequency;

1> remove all measurement reporting entries within *VarMeasReportList*;

1> stop the periodical reporting timer or timer T321, whichever one is running, as well as associated information (e.g. *timeToTrigger*) for all *measId*;

1> release the measurement gaps (configured by E-UTRA RRC), if activated;

NOTE 1: If the UE requires measurement gaps to perform inter-frequency or inter-RAT measurements, the UE resumes the inter-frequency and inter-RAT measurements after the E-UTRAN has setup the measurement gaps.

NOTE 2: In this procedure, the UE may or may not release the *measGapSharingConfig*.

#### 5.5.6.2 Speed dependant scaling of measurement related parameters

The UE shall adjust the value of the following parameter configured by the E-UTRAN depending on the UE speed: *timeToTrigger*. The UE shall apply 3 different levels, which are selected as follows:

The UE shall:

1> perform mobility state detection using the mobility state detection as specified in TS 36.304 [4] with the following modifications:

2> counting handovers instead of cell reselections;

2> applying the parameter applicable for RRC\_CONNECTED as included in *speedStatePars* within *VarMeasConfig*;

1> if high mobility state is detected:

2> use the *timeToTrigger* value multiplied by *sf-High* within *VarMeasConfig*;

1> else if medium mobility state is detected:

2> use the *timeToTrigger* value multiplied by *sf-Medium* within *VarMeasConfig*;

1> else:

2> no scaling is applied;

### 5.5.7 Inter-frequency RSTD measurement indication

#### 5.5.7.1 General



Figure 5.5.7.1-1: Inter-frequency RSTD measurement indication

The purpose of this procedure is to indicate to the network that the UE is going to start/stop OTDOA inter-frequency RSTD measurements which require measurement gaps as specified in TS 36.133 [16], clause 8.1.2.6. The procedure is also used to indicate to the network that the UE is going to start/stop OTDOA intra-frequency RSTD measurements which require measurement gaps. This procedure is also used to indicate to the network the measurement gap that the category M1 or M2 UE prefers to perform RSTD measurements with dense PRS configuration, as specified in TS 36.133 [16], Table 8.1.2.1-3.

NOTE: It is a network decision to configure the measurement gap.

#### 5.5.7.2 Initiation

The UE shall:

1> if and only if upper layers indicate to start performing inter-frequency RSTD measurements and the UE requires measurement gaps for these measurements while measurement gaps are either not configured or not sufficient:

2> initiate the procedure to indicate start;

NOTE 1: The UE verifies the measurement gap situation only upon receiving the indication from upper layers. If at this point in time sufficient gaps are available, the UE does not initiate the procedure. Unless it receives a new indication from upper layers, the UE is only allowed to further repeat the procedure in the same PCell once per frequency if the provided measurement gaps are insufficient.

1> if and only if upper layers indicate to stop performing inter-frequency RSTD measurements:

2> initiate the procedure to indicate stop;

NOTE 2: The UE may initiate the procedure to indicate stop even if it did not previously initiate the procedure to indicate start.

#### 5.5.7.3 Actions related to transmission of *InterFreqRSTDMeasurementIndication* message

The UE shall set the contents of *InterFreqRSTDMeasurementIndication* message as follows:

1> if the procedure is initiated to indicate start or stop of inter-frequency RSTD measurements:

2> set the *rstd-InterFreqIndication* as follows:

3> if the procedure is initiated to indicate start of inter-frequency RSTD measurements:

4> set the *rstd-InterFreqInfoList* according to the information received from upper layers;

4> for category M1 or M2 UE, if the procedure is initated to indicate the measurement gap that the UE prefers to perform RSTD measurements with dense PRS configuration:

5> set the *measPRS-Offset-r15* according to the UE preference;

3> else if the procedure is initiated to indicate stop of inter-frequency RSTD measurements:

4> set the *rstd-InterFreqIndication* to the value *stop*;

1> else:

2> set the *rstd-InterFreqIndication* as follows:

3> if the procedure is initiated to indicate start of intra-frequency RSTD measurements:

4> set the *carrierFreq* in the *rstd-InterFreqInfoList* to the carrier frequency of the serving cell;

4> for category M1 or M2 UE, if the procedure is initated to indicate the measurement gap that the UE prefers to perform RSTD measurements with dense PRS configuration:

5> set the *measPRS-Offset-r15* according to the UE preference;

3> else if the procedure is initiated to indicate stop of intra-frequency RSTD measurements:

4> set the *rstd-InterFreqIndication* to the value *stop*;

1> submit the *InterFreqRSTDMeasurementIndication* message to lower layers for transmission, upon which the procedure ends;

### 5.5.8 Measurements in NB-IoT

Upon transition to RRC\_CONNECTED mode, the UE shall:

1> if *neighCellMeasCriteria* is present in *SystemInformationBlockType3-NB:*

2> set NRSRPRef to the latest result of the serving cell measurement as used for cell selection/reselection evaluation;

2> if therelaxed monitoring criterion defined in TS 36.304 [4] was not fulfilled:

3> start T326 with the value *t-MeasureDeltaP*;

While in RRC\_CONNECTED mode, after performing a measurement, the UE shall:

1> in the following use the NRSRP measurement for the measured carrier and *nrs-PowerOffsetNonAnchor* corresponding to the measured carrier;

1> if *neighCellMeasCriteria* is present in *SystemInformationBlockType3-NB*:

2> if (NRSRPRef – (NRSRP– *nrs-PowerOffsetNonAnchor*)) > *s-MeasureDeltaP*:

3> set NRSRPRef = (NRSRP – *nrs-PowerOffsetNonAnchor*);

3> start or restart T326 with the value *t-MeasureDeltaP*;

1> if *neighCellMeasCriteria* is not present in *SystemInformationBlockType3-NB*; or

1> if T326 is running:

2> if (NRSRP – *nrs-PowerOffsetNonAnchor*) < *s-MeasureIntra*, perform intra-frequency measurements as defined in TS 36.133 [16];

2> if (NRSRP – *nrs-PowerOffsetNonAnchor*) < *s-MeasureInter*, perform inter-frequency measurements as defined in TS 36.133 [16];

While in RRC\_CONNECTED mode, the UE shall:

1> if *t-Service* is present in *SystemInformationBlockType3-NB*:

2> perform intra-frequency measurements or inter-frequency measurements before *t-Service*;

NOTE: The exact time to start measurements is left up to UE implementation and *t-ServiceStartNeigh* may be used to decide when to start measurements.

1> if *referenceLocation* and *distanceThresh* are present in *SystemInformationBlockType31-NB*:

2> if *referenceLocation* is set to *fixedReferenceLocation*:

3> perform intra-frequency measurements or inter-frequency measurements when the distance between UE and *referenceLocation* is above *distanceThresh*;

2> if *referenceLocation* is set to *movingReferenceLocation*:

3> perform intra-frequency measurements or inter-frequency measurements when the distance between UE and serving cell reference location derived from serving cell ephemeris, *epochTime* and *referenceLocation* in *SystemInformationBlockType31-NB* is above *distanceThresh*.

### 5.5.9 GNSS measurement triggering and reporting

For BL UEs or UEs in CE or NB-IoT UEs that are connected to NTN, GNSS measurement can be triggered aperiodically by the GNSS Measurement Command MAC CE (see TS 36.321 [6]), or triggered by the UE autonomously if enabled by the network, or triggered by the UE using available idle periods.

The UE shall:

1> if an indication to perform GNSS measurement is received from lower layers:

2> perform GNSS measurement using the measurement gap with a gap length indicated by lower layers, as specified in TS 36.213 [23];

2> stop timer T390, if running;

1> if *gnss-AutonomousEnabled* is configured:

2> if the gap length is indicated by lower layers:

3> set the autonomous gap length to the gap length indicated by lower layers;

2> else:

3> set the autonomous gap length to the latest reported time duration required for the UE to acquire a GNSS position;

2> perform GNSS measurement using the autonomous gap starting from T390 expiry if *ul-TransmissionExtensionEnabled* is configured, otherwise starting from GNSS validity duration expiry;

NOTE: UE can autonomously start GNSS measurements during available idle periods in RRC\_CONNECTED to keep GNSS valid and stop T390 upon indication that a new GNSS position becomes valid. The exact time of starting GNSS measurements during available idle periods is left to UE implementation.

1> upon starting GNSS measurement:

2> stop timer T318, if running;

1> upon indication that a new GNSS position becomes valid:

2> instruct lower layers to report the remaining GNSS validity duration (see TS 36.321 [6]);

1> upon indication that GNSS measurement has failed:

2> if GNSS position is out-of-date; and

2> if *ul-TransmissionExtensionEnabled* is not configured or T390 is not running:

3> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'other'.

## 5.6 Other

### 5.6.0 General

For NB-IoT, only a subset of the procedures described in this clause apply.

Table 5.6.0-1 specifies the procedures that are applicable to NB-IoT. All other procedures are not applicable to NB-IoT; this is not further stated in the corresponding procedures.

Table 5.6.0-1: "Other″ Procedures applicable to a NB-IoT UE

| Clause | Procedures |
| --- | --- |
| 5.6.1 | DL information transfer |
| 5.6.2 | UL information transfer |
| 5.6.3 | UE Capability transfer |
| 5.6.5 | UE information (see NOTE) |
| 5.6.23 | PUR Configuration Request |
| 5.6.24 | Neighbour Relation Reporting for SON ANR in NB-IoT |

NOTE: Not applicable for a UE that only supports the Control Plane CIoT EPS optimisation (see TS 24.301 [35]).

### 5.6.1 DL information transfer

#### 5.6.1.1 General



Figure 5.6.1.1-1: DL information transfer

The purpose of this procedure is to transfer NAS, (tunnelled) non-3GPP dedicated information or time reference information from E-UTRAN to a UE in RRC\_CONNECTED, or to transfer F1-C related information from IAB-donor-CU to IAB-DU via IAB-MT in RRC\_CONNECTED.

#### 5.6.1.2 Initiation

E-UTRAN initiates the DL information transfer procedure whenever there is a need to transfer NAS, non-3GPP dedicated information, time reference information or F1-C related information. E-UTRAN initiates the DL information transfer procedure by sending the *DLInformationTransfer* message.

#### 5.6.1.3 Reception of the *DLInformationTransfer* by the UE

Upon receiving *DLInformationTransfer* message, the UE shall:

1> if the UE is a NB-IoT UE; or

1> if the *dedicatedInfoType* is present and set to *dedicatedInfoNAS*:

2> forward the *dedicatedInfoNAS* to the NAS upper layers.

1> if the *dedicatedInfoType* is present and set to *dedicatedInfoCDMA2000-1XRTT* or to *dedicatedInfoCDMA2000-HRPD*:

2> forward the *dedicatedInfoCDMA2000* to the CDMA2000 upper layers;

1> if *timeReferenceInfo* is included:

2> calculate the time reference based on the included *time*, *timeInfoType* and *referenceSFN* in *timeReferenceInfo*;

2> calculate the inaccuracy of the time reference based on the *uncertainty* and other implementation-related inaccuracies, if *uncertainty* is included in *timeReferenceInfo*;

2> inform upper layers of the time reference and, if *uncertainty* is included in *timeReferenceInfo*, of the inaccuracy of the time reference.

Upon receiving *DLInformationTransfer* message, the IAB-MT shall:

1> if *dedicatedInfoF1c* is included:

2> forward *dedicatedInfoF1c* to the IAB-DU.

### 5.6.2 UL information transfer

#### 5.6.2.1 General



Figure 5.6.2.1-1: UL information transfer

The purpose of this procedure is to transfer NAS or (tunnelled) non-3GPP dedicated information from the UE to E-UTRAN, or to transfer F1-C related information from IAB-DU to IAB-donor-CU via IAB-MT in RRC\_CONNECTED.

#### 5.6.2.2 Initiation

A UE in RRC\_CONNECTED initiates the UL information transfer procedure whenever there is a need to transfer NAS, non-3GPP dedicated information, except at RRC connection establishment or resume in which case the NAS information is piggybacked to the *RRCConnectionSetupComplete* or *RRCConnectionResumeComplete* message correspondingly. In addition, an IAB-MT in RRC\_CONNECTED may initiate the UL information transfer procedure whenever there is a need to transfer F1-C related information. The UE initiates the UL information transfer procedure by sending the *ULInformationTransfer* message. When CDMA2000 information has to be transferred, the UE shall initiate the procedure only if SRB2 is established. When F1-C related information has to be transferred, the IAB-MT shall initiate the procedure only if SRB2 is established.

#### 5.6.2.3 Actions related to transmission of *ULInformationTransfer* message

The UE shall set the contents of the *ULInformationTransfer* message as follows:

1> if there is a need to transfer NAS information:

2> if the UE is a NB-IoT UE:

3> set the *dedicatedInfoNAS* to include the information received from upper layers;

2> else:

3> set the *dedicatedInfoType* to include the *dedicatedInfoNAS*;

1> if there is a need to transfer CDMA2000 1XRTT information:

2> set the *dedicatedInfoType* to include the *dedicatedInfoCDMA2000-1XRTT*;

1> if there is a need to transfer CDMA2000 HRPD information:

2> set the *dedicatedInfoType* to include the *dedicatedInfoCDMA2000-HRPD*;

1> upon RRC connection establishment, if UE supports the Control Plane CIoT EPS/5GS optimisation and UE does not need UL gaps during continuous uplink transmission:

2> configure lower layers to stop using UL gaps during continuous uplink transmission in FDD for *ULInformationTransfer* message and subsequent uplink transmission in RRC\_CONNECTED except for UL transmissions as specified in TS 36.211 [21];

1> if there is a need to transfer F1-C related information (applies only to IAB-MT):

2> include the *dedicatedInfoF1c*;

1> submit the *ULInformationTransfer* message to lower layers for transmission, upon which the procedure ends;

#### 5.6.2.4 Failure to deliver *ULInformationTransfer* message

The UE shall:

1> if the UE is a NB-IoT UE, AS security is not started and radio link failure occurs before the successful delivery of *ULInformationTransfer* messages has been confirmed by lower layers; or

1> if mobility (i.e. handover, RRC connection re-establishment) occurs before the successful delivery of *ULInformationTransfer* messages has been confirmed by lower layers:

2> inform upper layers about the possible failure to deliver the information contained in the concerned *ULInformationTransfer* messages, unless the messages include *dedicatedInfoF1c* and no *dedicatedInfoType* is included;

### 5.6.2a UL information transfer for MR-DC

#### 5.6.2a.1 General



Figure 5.6.2a.1-1: UL information transfer MR-DC

The purpose of this procedure is to transfer from the UE to E-UTRAN MR-DC dedicated information e.g. the NR RRC *MeasurementReport,* the NR RRC *UEAssistanceInformation,* the NR RRC *IABOtherInformation*, NR RRC *FailureInformation* or an NR *RRCReconfigurationComplete* (transmitted upon intra-SN CPC without MN involvement execution if NR *RRCReconfiguration* with *conditionalReconfiguration* for CPC was received via SRB1 and the UE is operating in EN-DC) messages.

#### 5.6.2a.2 Initiation

A UE in RRC\_CONNECTED initiates the UL information transfer procedure whenever there is a need to transfer MR DC dedicated information as specified in TS 38.331 [82]. I.e. the procedure is not used during an RRC connection reconfiguration involving NR connection reconfiguration, in which case the MR DC information is piggybacked to the *RRCConnectionReconfigurationComplete* message, except in the case the UE executes an intra-SN Conditional PSCell Change without MN involvement.

#### 5.6.2a.3 Actions related to transmission of *ULInformationTransferMRDC* message

The UE shall set the contents of the *ULInformationTransferMRDC* message as follows:

1> if there is a need to transfer MR DC dedicated information:

2> set the *ul-DCCH-MessageNR* to include the MR DC dedicated information to be transferred;

1> submit the *ULInformationTransferMRDC* message to lower layers for transmission, upon which the procedure ends;

#### 5.6.2a.4 Void

### 5.6.3 UE capability transfer

#### 5.6.3.1 General



Figure 5.6.3.1-1: UE capability transfer

The purpose of this procedure is to transfer UE radio access capability information from the UE to E-UTRAN.

If the UE is NTN capable, the UE reports its E-UTRAN radio access capabilities for the network type (TN or NTN) to which it is connected.

If the UE has changed its E-UTRAN radio access capabilities, the UE shall request higher layers to initiate the necessary NAS procedures (see TS 23.401 [41]) that would result in the update of UE radio access capabilities using a new RRC connection.

NOTE: Change of the UE's GERAN UE radio capabilities in RRC\_IDLE is supported by use of Tracking Area Update.

#### 5.6.3.2 Initiation

E-UTRAN initiates the procedure to a UE in RRC\_CONNECTED when it needs (additional) UE radio access capability information. Except if the UE is using Control plane CIoT EPS optimisation, E-UTRAN should retrieve UE capabilities only after AS security activation and E-UTRAN does not forward capabilities that were retrieved before AS security activation to the CN.

#### 5.6.3.3 Reception of the *UECapabilityEnquiry* by the UE

The UE shall:

1> for NB-IoT, set the contents of *UECapabilityInformation* message as follows:

2> include the UE Radio Access Capability Parameters within the *ue-Capability*;

2> include *ue-RadioPagingInfo*;

2> submit the *UECapabilityInformation* message to lower layers for transmission, upon which the procedure ends;

1> else, set the contents of *UECapabilityInformation* message as follows:

2> if the *ue-CapabilityRequest* includes *eutra*:

3> include the *UE-EUTRA-Capability* within a *ue-CapabilityRAT-Container* and with the *rat-Type* set to *eutra*;

3> if the UE supports FDD and TDD:

4> set all fields of *UECapabilityInformation*, except field *fdd-Add-UE-EUTRA-Capabilities* and *tdd-Add-UE-EUTRA-Capabilities* (including their sub-fields), to include the values applicable for both FDD and TDD (i.e. functionality supported by both modes);

4> if (some of) the UE capability fields have a different value for FDD and TDD:

5> if for FDD, the UE supports additional functionality compared to what is indicated by the previous fields of *UECapabilityInformation*:

6> include field *fdd-Add-UE-EUTRA-Capabilities* and set it to include fields reflecting the additional functionality applicable for FDD;

5> if for TDD, the UE supports additional functionality compared to what is indicated by the previous fields of *UECapabilityInformation*:

6> include field *tdd-Add-UE-EUTRA-Capabilities* and set it to include fields reflecting the additional functionality applicable for TDD;

NOTE 1: The UE includes fields of *XDD-Add-UE-EUTRA-Capabilities* in accordance with the following:

- The field is included only if one or more of its sub-fields (or bits in the feature group indicators string) has a value that is different compared to the value signalled elsewhere within *UE-EUTRA-Capability*;

(this value signalled elsewhere is also referred to as the *Common value*, that is supported for both XDD modes)

- For the fields that are included in *XDD-Add-UE-EUTRA-Capabilities*, the UE sets:

- the sub-fields (or bits in the feature group indicators string) that are not allowed to be different to the same value as the *Common value*;

- the sub-fields (or bits in the feature group indicators string) that are allowed to be different to a value indicating at least the same functionality as indicated by the *Common value*;

3> else (UE supports single xDD mode):

4> set all fields of *UECapabilityInformation*, except field *fdd-Add-UE-EUTRA-Capabilities* and *tdd-Add-UE-EUTRA-Capabilities* (including their sub-fields), to include the values applicable for the xDD mode supported by the UE;

3> compile a list of band combinations, candidate for inclusion in the *UECapabilityInformation* message, comprising of band combinations supported by the UE according to the following priority order (i.e. listed in order of decreasing priority):

4> include all non-CA bands, regardless of whether UE supports carrier aggregation, only:

- if the UE includes *ue-Category-v1020* (i.e. indicating category 6 to 8); or

- if for at least one of the non-CA bands, the UE supports more MIMO layers with TM9 and TM10 than implied by the UE category; or

- if the UE supports TM10 with one or more CSI processes; or

- if the UE supports 1024QAM in DL;

4> if the *UECapabilityEnquiry* message includes *requestedFrequencyBands* and UE supports *requestedFrequencyBands*:

5> include all 2DL+1UL CA band combinations, only consisting of bands included in *requestedFrequencyBands*;

5> include all other CA band combinations, only consisting of bands included in *requestedFrequencyBands*, and prioritized in the order of *requestedFrequencyBands*, (i.e. first include remaining band combinations containing the first-listed band, then include remaining band combinations containing the second-listed band, and so on);

4> else (no requested frequency bands):

5> include all 2DL+1UL CA band combinations;

5> include all other CA band combinations;

4> if UE supports *maximumCCsRetrieval* and if the *UECapabilityEnquiry* message includes the *requestedMaxCCsDL* and the *requestedMaxCCsUL* (i.e. both UL and DL maximums are given):

5> remove from the list of candidates the band combinations for which the number of CCs in DL exceeds the value indicated in the *requestedMaxCCsDL* or for which the number of CCs in UL exceeds the value indicated in the *requestedMaxCCsUL*;

5> indicate in *requestedCCsUL* the same value as received in *requestedMaxCCsUL*;

5> indicate in *requestedCCsDL* the same value as received in *requestedMaxCCsDL*;

4> else if UE supports *maximumCCsRetrieval* and if the *UECapabilityEnquiry* message includes the *requestedMaxCCsDL* (i.e. only DL maximum limit is given):

5> remove from the list of candidates the band combinations for which the number of CCs in DL exceeds the value indicated in the *requestedMaxCCsDL*;

5> indicate value in *requestedCCsDL* the same value as received in *requestedMaxCCsDL*;

4> else if UE supports *maximumCCsRetrieval* and if the *UECapabilityEnquiry* message includes the *requestedMaxCCsUL* (i.e. only UL maximum limit is given):

5> remove from the list of candidates the band combinations for which the number of CCs in UL exceeds the value indicated in the *requestedMaxCCsUL*;

5> indicate in *requestedCCsUL* the same value as received in *requestedMaxCCsUL;*

4> if the UE supports *reducedIntNonContComb* and the *UECapabilityEnquiry* message includes *requestReducedIntNonContComb*:

5> set *reducedIntNonContCombRequested* to true;

5> remove from the list of candidates the intra-band non-contiguous CA band combinations which support is implied by another intra-band non-contiguous CA band combination included in the list of candidates as specified in TS 36.306 [5], clause 4.3.5.21:

4> if the UE supports *requestReducedFormat* and UE supports *skipFallbackCombinations* and *UECapabilityEnquiry* message includes *requestSkipFallbackComb*:

5> set *skipFallbackCombRequested* to true;

5> for each band combination included in the list of candidates (including 2DL+1UL CA band combinations), starting with the ones with the lowest number of DL and UL carriers, that concerns a fallback band combination of another band combination included in the list of candidates as specified in TS 36.306 [5]:

6> remove the band combination from the list of candidates;

6> include *differentFallbackSupported* in the band combination included in the list of candidates whose fallback concerns the removed band combination, if its capabilities differ from the removed band combination;

4> if the UE supports *requestReducedFormat* and *diffFallbackCombReport*, and *UECapabilityEnquiry* message includes *requestDiffFallbackCombList*:

5> if the UE does not support *skipFallbackCombinations* or *UECapabilityEnquiry* message does not include *requestSkipFallbackComb*:

6> remove all band combination from the list of candidates;

5> for each CA band combination indicated in *requestDiffFallbackCombList*:

6> include the CA band combination, if not already in the list of candidates;

6> include the fallback combinations for which the supported UE capabilities are different from the capability of the CA band combination;

5> include CA band combinations indicated in *requestDiffFallbackCombList* into *requestedDiffFallbackCombList*;

3> if the *UECapabilityEnquiry* message includes *requestReducedFormat* and UE supports *requestReducedFormat*:

4> include in *supportedBandCombinationReduced* as many as possible of the band combinations included in the list of candidates, including the non-CA combinations, determined according to the rules and priority order defined above;

3> else:

4> if the *UECapabilityEnquiry* message includes *requestedFrequencyBands* and UE supports *requestedFrequencyBands*:

5> include in *supportedBandCombination* as many as possible of the band combinations included in the list of candidates, including the non-CA combinations and up to 5DL+5UL CA band combinations, determined according to the rules and priority order defined above;

5> include in *supportedBandCombinationAdd* as many as possible of the remaining band combinations included in the list of candidates, (i.e. the candidates not included in *supportedBandCombination)*, up to 5DL+5UL CA band combinations, determined according to the rules and priority order defined above;

4> else:

5> include in *supportedBandCombination* as many as possible of the band combinations included in the list of candidates, including the non-CA combinations and up to 5DL+5UL CA band combinations, determined according to the rules defined above;

5> if it is not possible to include in *supportedBandCombination* all the band combinations to be included according to the above, selection of the subset of band combinations to be included is left up to UE implementation;

3> indicate in *requestedBands* the same bands and in the same order as included in *requestedFrequencyBands*, if received;

3> if the UE is a category 0, M1 or M2 UE, or supports any UE capability information in *ue-RadioPagingInfo,* according to TS 36.306 [5]:

4> include *ue-RadioPagingInfo* and set the fields according to TS 36.306 [5];

3> if the UE supports (NG)EN-DC or NE-DC and if *requestedFreqBandsNR-MRDC* is included in the request:

4> include into *featureSetsEUTRA* the feature sets that are applicable for the received *requestedFreqBandsNR-MRDC* and *requestedCapabilityCommon* as specified in TS 38.331 [82], clause 5.6.1.4.

NOTE 2: The network must include the *requestedFreqBandsNR-MRDC* in order to obtain feature sets for E-UTRA and MR-DC.

NOTE 3: Even if the network requests (only) capabilities for *eutra*, it may include NR band numbers in the *requestedFreqBandsNR-MRDC* in order to ensure that the UE includes all necessary feature sets (i.e. E-UTRA and NR) needed for subsequently requested *eutra-nr* capabilities.

3> if the *UECapabilityEnquiry* message includes *requestSTTI-SPT-Capability* and if the UE supports short TTI and/or SPT (i.e., *sTTI-SPT-Supported*):

4> for each band combination the UE included in a field of the *UECapabilityInformation* message in accordance with the previous:

5> if the UE supports short TTI, include the short TTI capabilities for each of the band combinations using the *stti-SPT-BandParameters*;

5> if the UE supports SPT, include the SPT capabilities for each of the band combinations using the *stti-SPT-BandParameters*;

NOTE 4: The UE may have to add/repeat the band combinations to the list of band combinations included earlier, to include short TTI capabilities and/or SPT capabilities.

3> if the *UECapabilityEnquiry* message includes *sidelinkRequest*:

4> for a sidelink band combination the UE included in *v2x-SupportedBandCombinationListEUTRA-NR*:

5> if the UE supports partial sensing for a band of the sidelink band combination, include the partial sensing capabilities for the band using the *v2x-BandParametersEUTRA-NR-v1710*;

4> set *sidelinkRequested* to true;

2> if the *ue-CapabilityRequest* includes *geran-cs* and if the UE supports GERAN CS domain:

3> include the UE radio access capabilities for GERAN CS within a *ue-CapabilityRAT-Container* and with the *rat-Type* set to *geran-cs*;

2> if the *ue-CapabilityRequest* includes *geran-ps* and if the UE supports GERAN PS domain:

3> include the UE radio access capabilities for GERAN PS within a *ue-CapabilityRAT-Container* and with the *rat-Type* set to *geran-ps*;

2> if the *ue-CapabilityRequest* includes *utra* and if the UE supports UTRA:

3> include the UE radio access capabilities for UTRA within a *ue-CapabilityRAT-Container* and with the *rat-Type* set to *utra*;

2> if the *ue-CapabilityRequest* includes *cdma2000-1XRTT* and if the UE supports CDMA2000 1xRTT:

3> include the UE radio access capabilities for CDMA2000 within a *ue-Capability**RAT-Container* and with the *rat-Type* set to *cdma2000-1XRTT*;

2> if the *ue-CapabilityRequest* includes *nr* and if the UE supports NR:

3> include the UE radio access capabilities for NR within a *ue-CapabilityRAT-Container*, with the *rat-Type* set to *nr*;

3> include band combinations and feature sets as specified in TS 38.331 [82], clause 5.6.1.4, considering the included *requestedFreqBandsNR-MRDC*, *requestedCapabilityNR*, the *eutra-nr-only* flag and *requestedCapabilityCommon* (if present);

2> if the *ue-CapabilityRequest* includes *eutra-nr* and if the UE supports (NG)EN-DC or NE-DC:

3> include the UE radio access capabilities for EUTRA-NR within a *ue-CapabilityRAT-Container*, with the *rat-Type* set to *eutra-nr*;

3> include band combinations as specified in TS 38.331 [82], clause 5.6.1.4, considering the included *requestedFreqBandsNR-MRDC*, *requestedCapabilityNR* (if present) and *requestedCapabilityCommon* (if included)*;*

1> if the RRC message segmentation is enabled based on the field *rrc-SegAllowed* received, and the encoded RRC message is larger than the maximum supported size of a PDCP SDU specified in TS 36.323 [8]:

2> consider the maximum number of UL segments the UE is allowed to use when segmenting the *UECapabilityInformation* message is 16;

2> initiate the UL message segment transfer procedure as specified in clause 5.6.22;

1> else if the RRC message segmentation is enabled based on the field *rrc-MaxCapaSegAllowed* received, and the encoded RRC message is larger than the maximum supported size of a PDCP SDU specified in TS 36.323 [8]:

2> consider the maximum number of UL segments the UE is allowed to use when segmenting the *UECapabilityInformation* message to be the value indicated by *rrc-MaxCapaSegAllowed*;

2> initiate the UL message segment transfer procedure as specified in clause 5.6.22;

1> else:

2> submit the *UECapabilityInformation* message to lower layers for transmission, upon which the procedure ends;

### 5.6.4 CSFB to 1x Parameter transfer

#### 5.6.4.1 General



Figure 5.6.4.1-1: CSFB to 1x Parameter transfer

The purpose of this procedure is to transfer the CDMA2000 1xRTT parameters required to register the UE in the CDMA2000 1xRTT network for CSFB support.

#### 5.6.4.2 Initiation

A UE in RRC\_CONNECTED initiates the CSFB to 1x parameter transfer procedure upon request from the CDMA2000 upper layers. The UE initiates the CSFB to 1x parameter transfer procedure by sending the *CSFBParametersRequestCDMA2000* message.

#### 5.6.4.3 Actions related to transmission of *CSFBParametersRequestCDMA2000* message

The UE shall:

1> submit the *CSFBParametersRequestCDMA2000* message to lower layers for transmission using the current configuration;

#### 5.6.4.4 Reception of the *CSFBParametersResponseCDMA2000* message

Upon reception of the *CSFBParametersResponseCDMA2000* message, the UE shall:

1> forward the *rand* and the *mobilityParameters* to the CDMA2000 1xRTT upper layers;

### 5.6.5 UE Information

#### 5.6.5.1 General



Figure 5.6.5.1-1: UE information procedure

The UE information procedure is used by E-UTRAN to request the UE to report information.

#### 5.6.5.2 Initiation

E-UTRAN initiates the procedure by sending the *UEInformationRequest* message. E-UTRAN should initiate this procedure only after successful security activation.

#### 5.6.5.3 Reception of the *UEInformationRequest* message

Upon receiving the *UEInformationRequest* message, the UE shall, only after successful security activation:

1> if *rach-ReportReq* is set to *true*, set the contents of the *rach-Report* in the *UEInformationResponse* message as follows:

2> set the *numberOfPreamblesSent* to indicate the number of preambles sent by MAC for the last successfully completed random access procedure;

2> if contention resolution was not successful as specified in TS 36.321 [6] for at least one of the transmitted preambles for the last successfully completed random access procedure:

3> set the *contentionDetected* to *true*;

2> else:

3> set the *contentionDetected* to *false*;

2> if the UE is a BL UE or UE in CE:

3> set the *initialCEL* to indicate the initial CE level used for the last successfully completed random access procedure;

2> if the UE is a NB-IoT UE:

3> set the *initialNRSRP-Level* to indicate the NRSRP level of the NPRACH resource selected for the first preamble transmission for the last successfully completed random access procedure;

2> if the UE is a BL UE, UE in CE or NB-IoT UE:

3> if the last successfully completed random access procedure was initiated with EDT PRACH resource and succeeded after receiving EDT fallback indication from lower layers:

4> set the *edt-Fallback* to *true*;

3> else:

4> set the *edt-Fallback* to *false*;

1> if *rlf-ReportReq* is set to *true* and the UE has radio link failure information or handover failure information available in *VarRLF-Report* (*VarRLF-Report-NB* in NB-IoT) and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report*:

2> for NB-IoT, if the global cell identity of the selected cell is the same as the *reestablishmentCellId* in the *VarRLF-Report-NB*:

3> remove the *reestablishmentCellId* from the *VarRLF-Report-NB*;

2> set *timeSinceFailure* in *VarRLF-Report* (*VarRLF-Report-NB* in NB-IoT) to the time that elapsed since the last radio link or handover failure in E-UTRA;

2> set the *rlf-Report* in the *UEInformationResponse* message to the value of *rlf-Report* in *VarRLF-Report* (*VarRLF-Report-NB* in NB-IoT);

2> discard the *rlf-Report* from *VarRLF-Report* (*VarRLF-Report-NB* in NB-IoT) upon successful delivery of the *UEInformationResponse* message confirmed by lower layers;

1> except for NB-IoT, if *connEstFailReportReq* is set to *true* and the UE has connection establishment failure information in *VarConnEstFailReport* and if the RPLMN is equal to *plmn-Identity* stored in *VarConnEstFailReport*:

2> set *timeSinceFailure* in *VarConnEstFailReport* to the time that elapsed since the last connection establishment failure in E-UTRA;

2> set the *connEstFailReport* in the *UEInformationResponse* message to the value of *connEstFailReport* in *VarConnEstFailReport*;

2> discard the *connEstFailReport* from *VarConnEstFailReport* upon successful delivery of the *UEInformationResponse* message confirmed by lower layers;

1> except for NB-IoT, if the *logMeasReportReq* is present and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:

2> if *VarLogMeasReport* includes one or more logged measurement entries, set the contents of the *logMeasReport* in the *UEInformationResponse* message as follows:

3> include the *absoluteTimeStamp* and set it to the value of *absoluteTimeInfo* in the *VarLogMeasReport*;

3> include the *traceReference* and set it to the value of *traceReference* in the *VarLogMeasReport*;

3> include the *traceRecordingSessionRef* and set it to the value of *traceRecordingSessionRef* in the *VarLogMeasReport;*

3> include the *tce-Id* and set it to the value of *tce-Id* in the *VarLogMeasReport*;

3> include the *logMeasInfoList* and set it to include one or more entries from the *VarLogMeasReport* starting from the entries logged first, and for each entry of the *logMeasInfoList* that is included, include all information stored in the corresponding *logMeasInfoList* entry in *VarLogMeasReport*;

3> if the *VarLogMeasReport* includes one or more additional logged measurement entries that are not included in the *logMeasInfoList* within the *UEInformationResponse* message:

4> include the *logMeasAvailable*;

4> if *logMeasResultListBT* is included in one or more of the additional logged measurement entries in *VarLogMeasReport* that are not included in the *logMeasInfoList* within the *UEInformationResponse* message:

5> include the *logMeasAvailableBT*;

4> if *logMeasResultListWLAN* is included in one or more of the additional logged measurement entries in *VarLogMeasReport* that are not included in the *logMeasInfoList* within the *UEInformationResponse* message:

5> include the *logMeasAvailableWLAN*;

1> except for NB-IoT, if *mobilityHistoryReportReq* is set to *true*:

2> include the *mobilityHistoryReport* and set it to include entries from *VarMobilityHistoryReport*;

2> include in the *mobilityHistoryReport* an entry for the current cell, possibly after removing the oldest entry if required, and set its fields as follows:

3> set *visitedCellId* to the global cell identity or the physical cell identity and carrier frequency of the current cell:

3> set field *timeSpent* to the time spent in the current cell;

1> except for NB-IoT, if the *idleModeMeasurementReq* is included in the *UEInformationRequest* and the UE has stored *VarMeasIdleReport* that contains measurement information concerning cells other than the PCell:

2> set the *measResultListIdle-r15* in the *UEInformationResponse* message to the value of *measReportIdle-r15* in the *VarMeasIdleReport*;

2> set the *measResultListExtIdle* in the *UEInformationResponse* message to the value of *measReportIdle-r16* in the *VarMeasIdleReport*, if available;

2> set the *measResultListIdleNR* in the *UEInformationResponse* message to the value of *measReportIdleNR* in the *VarMeasIdleReport*, if available;

2> discard the *VarMeasIdleReport* upon successful delivery of the *UEInformationResponse* message confirmed by lower layers;

1> except for NB-IoT, if *flightPathInfoReq* field is present and the UE has flight path information available:

2> include the *flightPathInfoReport* and set it to include the list of waypoints along the flight path;

2> if the *includeTimeStamp* is set to TRUE:

3> set the field *timeStamp* to the time when UE intends to arrive to each waypoint if this information is available at the UE;

1> for NB-IoT, if *anr-ReportReq* is set to *true* and the UE has *measResultList* available in *VarANR-MeasReport-NB*:

2> set the *anr-MeasReport* in the *UEInformationResponse* message as follows:

3> if the global cell identity of the PCell is different from *servCellIdentity* in the *VarANR-MeasReport-NB*;

4> include the *servCellIdentity* and set it to the value of *servCellIdentity* in the *VarANR-MeasReport-NB*;

3> set *measResultServCell* to the value of *measResultServCell* in the *VarANR-MeasReport-NB*;

3> set *relativeTimeStamp* to the value of *relativeTimeStamp* in the *VarANR-MeasReport-NB*;

3> set *measResultList* to the value of *measResultList* in the *VarANR-MeasReport-NB*;

2> discard the *VarANR-MeasReport-NB* upon successful delivery of the *UEInformationResponse* message confirmed by lower layers;

1> except for NB-IoT, if the *coarseLocationReq* is set to true:

2> if available, include the *coarseLocationInfo;*

1> if *rach-ReportReqNR* is included, and if the UE has NR RACH report information available in *VarRA-Report* of TS 38.331 [82] that is stored and the RPLMN is included in *plmn-IdentityList* stored in *VarRA-Report* of TS 38.331 [82], set the content of *rach-ReportNR* in the *UEInformationResponse message* as below:

2> for each *RA-Report* of *ra-ReportList* in *VarRA-Report* of TS 38.331 [82]:

3> include it as part of *rach-ReportListNR*;

3> if the *cellIdListNR* is not set or the *cellId* of *RA-Report* has not been included in *cellIdListNR*:

4> add a new entry in *cellIdListNR* and set the *cellIdNR* to the global cell identity and the tracking area code, if available, otherwise to the physical cell identity and carrier frequency, as indicated in the *cellId* of *RA-Report*;

2> discard the *RA-Report* that was included in *rach-ReportListNR* from *ra-ReportList* in *VarRA-Report* of TS 38.331[82] upon successful delivery of the *UEInformationResponse* message as confirmed by lower layers;

1> if the *logMeasReport* is included in the *UEInformationResponse*:

2> submit the *UEInformationResponse* message to lower layers for transmission via SRB2;

2> discard the logged measurement entries included in the *logMeasInfoList* from *VarLogMeasReport* upon successful delivery of the *UEInformationResponse* message confirmed by lower layers;

1> else:

2> submit the *UEInformationResponse* message to lower layers for transmission via SRB1.

### 5.6.6 Logged Measurement Configuration

#### 5.6.6.1 General



Figure 5.6.6.1-1: Logged measurement configuration

The purpose of this procedure is to configure the UE to perform logging of measurement results while in RRC\_IDLE and to perform logging of measurement results for MBSFN in both RRC\_IDLE and RRC\_CONNECTED. The procedure applies to logged measurements capable UEs that are in RRC\_CONNECTED.

NOTE: E-UTRAN may retrieve stored logged measurement information by means of the UE information procedure.

#### 5.6.6.2 Initiation

E-UTRAN initiates the logged measurement configuration procedure to UE in RRC\_CONNECTED by sending the *LoggedMeasurementConfiguration* message.

#### 5.6.6.3 Reception of the *LoggedMeasurementConfiguration* by the UE

Upon receiving the *LoggedMeasurementConfiguration* message the UE shall:

1> discard the logged measurement configuration as well as the logged measurement information as specified in 5.6.7;

1> store the received *loggingDuration*, *loggingInterval* and *areaConfiguration*, if included, in *VarLogMeasConfig*;

1> if the *LoggedMeasurementConfiguration* message includes *plmn-IdentityList*:

2> set *plmn-IdentityList* in *VarLogMeasReport* to include the RPLMN as well as the PLMNs included in *plmn-IdentityList*;

1> else:

2> set *plmn-IdentityList* in *VarLogMeasReport* to include the RPLMN;

1> store the received *absoluteTimeInfo*, *traceReference,* *traceRecordingSessionRef* and *tce-Id* in *VarLogMeasReport*;

1> store the received *targetMBSFN-AreaList*, if included, in *VarLogMeasConfig*;

1> store the received *bt-NameList*, if included, in *VarLogMeasConfig*;

1> store the received *wlan-NameList*, if included, in *VarLogMeasConfig*;

1> store the received *loggedEventTriggerConfig*, if included, in *VarLogMeasConfig*;

1> store the received *measUncomBarPre*, if included, in *VarLogMeasConfig*;

1> start timer T330 with the timer value set to the *loggingDuration*;

1> store the received *sigLoggedMeasType,* if included, in *VarLogMeasReport*;

#### 5.6.6.4 T330 expiry

Upon expiry of T330 the UE shall:

1> release *VarLogMeasConfig*;

The UE is allowed to discard stored logged measurements, i.e. to release *VarLogMeasReport*, 48 hours after T330 expiry.

### 5.6.7 Release of Logged Measurement Configuration

#### 5.6.7.1 General

The purpose of this procedure is to release the logged measurement configuration as well as the logged measurement information.

#### 5.6.7.2 Initiation

The UE shall initiate the procedure upon receiving a logged measurement configuration in another RAT. The UE shall also initiate the procedure upon power off or detach.

The UE shall:

1> stop timer T330, if running;

1> if stored, discard the logged measurement configuration as well as the logged measurement information, i.e. release the UE variables *VarLogMeasConfig* and *VarLogMeasReport*;

### 5.6.8 Measurements logging

#### 5.6.8.1 General

This procedure specifies the logging of available measurements by a UE in RRC\_IDLE that has a logged measurement configuration and the logging of available measurements by a UE in both RRC\_IDLE and RRC\_CONNECTED if *targetMBSFN-AreaList* is included in *VarLogMeasConfig*.

When UE is configured to perform logging of measurements, measurements are performed with CRS.

#### 5.6.8.2 Initiation

While T330 is running, the UE shall:

1> if measurement logging is suspended:

2> if during the last logging interval the IDC problems detected by the UE is resolved, resume measurement logging;

1> if not suspended, perform the logging in accordance with the following:

2> if *targetMBSFN-AreaList* is included in *VarLogMeasConfig*:

3> if the UE is camping normally on an E-UTRA cell or is connected to E-UTRA; and

3> if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*;and

3> if the PCell (in RRC\_CONNECTED) or cell where the UE is camping (in RRC\_IDLE) is part of the area indicated by *areaConfiguration* if configured in *VarLogMeasConfig*:

4> for MBSFN areas, indicated in *targetMBSFN-AreaList,* from which the UE is receiving MBMS service:

5> perform MBSFN measurements in accordance with the performance requirements as specified in TS 36.133 [16];

NOTE 1: When configured to perform MBSFN measurement logging by *targetMBSFN-AreaList*, the UE is not required to receive additional MBSFN subframes, i.e. logging is based on the subframes corresponding to the MBMS services the UE is receiving.

5> perform logging at regular time intervals as defined by the *loggingInterval* in *VarLogMeasConfig,* but only for those intervals for which MBSFN measurement results are available as specified in TS 36.133 [16];

2> else:

3> if the *loggedEventTriggerConfig* is configured in *VarLogMeasConfig*, and *eventType* is set to *outOfCoverage*:

4> perform the logging at regular time intervals as defined by the *loggingInterval* in *VarLogMeasConfig* only when the UE is in *any cell selection* state;

4> upon transition from *any cell selection* state to *camped normally* state in E-UTRA:

5> if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*; and

5> if *areaConfiguration* is not included in *VarLogMeasConfig* or if the current camping cell is part of the area indicated by *areaConfiguration* in *VarLogMeasConfig*:

6> perform the logging;

3> else if the *loggedEventTriggerConfig* is configured in *VarLogMeasConfig* and *eventType* is set to *eventL1*:

4> if the UE is in *camped normally* state on an E-UTRA cell and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:

5> if *areaConfiguration* is not included in *VarLogMeasConfig*; or

5> if the serving cell is part of the area indicated by *areaConfiguration* in *VarLogMeasConfig*:

6> perform the logging at regular time intervals as defined by the *loggingInterval* in *VarLogMeasConfig* only when the conditions indicated by the *eventL1* are met;

3> else if the UE is in *any cell selection* state (as specified in TS 36.304 [4]):

4> perform the logging at regular time intervals, as defined by the *loggingInterval* in *VarLogMeasConfig*;

3> else if the UE is camping normally on an E-UTRA cell and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport* and, if the cell is part of the area indicated by *areaConfiguration* if configured in *VarLogMeasConfig*:

4> perform the logging at regular time intervals, as defined by the *loggingInterval* in *VarLogMeasConfig*;

2> when adding a logged measurement entry in *VarLogMeasReport*, include the fields in accordance with the following:

3> if the UE detected IDC problems during the last logging interval:

4> if *measResultServCell* in *VarLogMeasReport* is not empty:

5> include *inDeviceCoexDetected*;

5> suspend measurement logging from the next logging interval;

4> else:

5> suspend measurement logging;

NOTE 1A: The UE may detect the start of IDC problems as early as Phase 1 as described in clause 23.4 of TS 36.300 [9].

3> set the *relativeTimeStamp* to indicate the elapsed time since the moment at which the logged measurement configuration was received;

3> if detailed location information became available during the last logging interval, set the content of the *locationInfo* as follows:

4> include the *locationCoordinates*;

3> if *wlan-NameList* is included in *VarLogMeasConfig*:

4> if detailed WLAN measurements are available:

5> include *logMeasResultListWLAN*, in order of decreasing RSSI for WLAN APs;

3> if *bt-NameList* is included in *VarLogMeasConfig*:

4> if detailed Bluetooth measurements are available:

5> include *logMeasResultListBT*, in order of decreasing RSSI for Bluetooth beacons;

3> if *measUncomBarPre* is included in *VarLogMeasConfig*:

4> if available, include the *uncomBarPreMeasResult*;

3> if *targetMBSFN-AreaList* is included in *VarLogMeasConfig*:

4> for each MBSFN area, for which the mandatory measurements result fields became available during the last logging interval:

5> set the *rsrpResultMBSFN*, *rsrqResultMBSFN* to include measurement results that became available during the last logging interval;

5> include the fields *signallingBLER-Result* or *dataBLER-MCH-ResultList* if the concerned BLER results are availble,

5> set the *mbsfn-AreaId* and *carrierFreq* to indicate the MBSFN area in which the UE is receiving MBSFN transmission;

4> if in RRC\_CONNECTED:

5> set the *servCellIdentity* to indicate global cell identity of the PCell;

5> set the *measResultServCell* to include the layer 3 filtered measured results of the PCell;

5> if available, set the *measResultNeighCells* to include the layer 3 filtered measured results of SCell(s) and neighbouring cell(s) measurements that became available during the last logging interval, in order of decreasing RSRP, for at most the following number of cells: 6 intra-frequency and 3 inter-frequency cells per frequency and according to the following:

6> for each cell included, include the optional fields that are available;

5> if available, optionally set the *measResultNeighCells* to include the layer 3 filtered measured results of neighbouring cell(s) measurements that became available during the last logging interval, in order of decreasing RSCP(UTRA)/RSSI(GERAN)/PilotStrength(cdma2000), for at most the following number of cells: 3 inter-RAT cells per frequency/set of frequencies (GERAN), and according to the following:

6> for each cell included, include the optional fields that are available;

4> if in RRC\_IDLE:

5> set the *servCellIdentity* to indicate global cell identity of the serving cell;

5> set the *measResultServCell* to include the quantities of the serving cell;

5> if available, set the *measResultNeighCells*, in order of decreasing ranking-criterion as used for cell re-selection, to include neighbouring cell measurements that became available during the last logging interval for at most the following number of neighbouring cells: 6 intra-frequency and 3 inter-frequency neighbours per frequency and according to the following:

6> for each neighbour cell included, include the optional fields that are available;

5> if available, optionally set the *measResultNeighCells,* in order of decreasing ranking-criterion as used for cell re-selection, to include neighbouring cell measurements that became available during the last logging interval, for at most the following number of cells: 3 inter-RAT cells per frequency/set of frequencies (GERAN), and according to the following:

6> for each cell included, include the optional fields that are available;

4> for the cells included according to the previous (i.e. covering previous and current serving cells as well as neighbouring EUTRA cells) include results according to the extended RSRQ if corresponding results are available according to the associated performance requirements defined in TS 36.133 [16];

4> for the cells included according to the previous (i.e. covering previous and current serving cells as well as neighbouring EUTRA cells) include RSRQ type if the result was based on measurements using a wider band or using all OFDM symbols;

NOTE 2: The UE includes the latest results in accordance with the performance requirements as specified in TS 36.133 [16]. E.g. RSRP and RSRQ results are available only if the UE has a sufficient number of results/ receives a sufficient number of subframes during the logging interval.

3> else:

4> if the UE is in *any cell selection* state (as specified in TS 36.304 [4]):

5> set *anyCellSelectionDetected* to indicate the detection of no suitable or no acceptable cell found;

5> if the *loggedEventTriggerConfig* is not configured in the *VarLogMeasConfig*;

6> set the *servCellIdentity* to indicate global cell identity of the last logged cell that the UE was camping on;

6> set the *measResultServCell* to include the quantities of the last logged cell the UE was camping on;

5> else if the RPLMN at the time of entering the *any cell selection* state is included in *plmn-IdentityList* stored in *VarLogMeasReport*; and

5> if *areaConfiguration* is not included in *VarLogMeasConfig* or if the last suitable cell that the UE was camping on is part of the area indicated by *areaConfiguration* in *VarLogMeasConfig*:

6> set the *servCellIdentity* to indicate global cell identity of the last suitable cell that the UE was camping on;

6> set the *measResultServingCell* to include the quantities of the last suitable cell the UE was camping on;

5> else:

6> set the fields within the *servCellIdentity* and *measResultServingCell* to all zeros to indicate unavailability of the *servCellIdentity* and *measResultServCell*.

4> else:

5> set the *servCellIdentity* to indicate global cell identity of the cell the UE is camping on;

5> set the *measResultServCell* to include the quantities of the cell the UE is camping on;

4> if available, set the *measResultNeighCells*, in order of decreasing ranking-criterion as used for cell re-selection, to include neighbouring cell measurements that became available during the last logging interval for at most the following number of neighbouring cells: 6 intra-frequency and 3 inter-frequency neighbours per frequency as well as 3 inter-RAT neighbours, per frequency/ set of frequencies (GERAN) per RAT and according to the following:

5> for each neighbour cell included, include the optional fields that are available;

4> for the cells included according to the previous (i.e. covering previous and current serving cells as well as neighbouring EUTRA cells) include results according to the extended RSRQ if corresponding results are available according to the associated performance requirements defined in TS 36.133 [16];

4> for the cells included according to the previous (i.e. covering previous and current serving cells as well as neighbouring EUTRA cells) include RSRQ type if the result was based on measurements using a wider band or using all OFDM symbols;

NOTE 3: The UE includes the latest results of the available measurements as used for cell reselection evaluation in RRC\_IDLE or as used for evaluation of reporting criteria or for measurement reporting according to 5.5.3 in RRC\_CONNECTED, which are performed in accordance with the performance requirements as specified in TS 36.133 [16].

2> when the memory reserved for the logged measurement information becomes full, stop timer T330 and perform the same actions as performed upon expiry of T330, as specified in 5.6.6.4;

### 5.6.9 In-device coexistence indication

#### 5.6.9.1 General



Figure 5.6.9.1-1: In-device coexistence indication

The purpose of this procedure is to inform E-UTRAN about (a change of) the In-Device Coexistence (IDC) problems experienced by the UE in RRC\_CONNECTED, as described in TS 36.300 [9], and to provide the E-UTRAN with information in order to resolve them.

#### 5.6.9.2 Initiation

A UE capable of providing IDC indications may initiate the procedure when it is configured to provide IDC indications and upon change of IDC problem information.

Upon initiating the procedure, the UE shall:

1> if configured to provide IDC indications:

2> if the UE did not transmit an *InDeviceCoexIndication* message since it was configured to provide IDC indications:

3> if on one or more frequencies for which a *measObjectEUTRA* is configured, the UE is experiencing IDC problems that it cannot solve by itself; or

3> if configured to provide IDC indications for UL CA; and if on one or more supported UL CA combination comprising of carrier frequencies for which a measurement object is configured, the UE is experiencing IDC problems that it cannot solve by itself; or

3> if configured to provide IDC indications for MR-DC, and if on one or more supported MR-DC combination comprising of at least one E-UTRA carrier frequency for which a measurement object is configured and at least one NR carrier frequency included in *candidateServingFreqListNR*, the UE is experiencing IDC problems that it cannot solve by itself:

4> initiate transmission of the *InDeviceCoexIndication* message in accordance with 5.6.9.3;

2> else:

3> if the set of frequencies, for which a *measObjectEUTRA* is configured and on which the UE is experiencing IDC problems that it cannot solve by itself, is different from the set indicated in the last transmitted *InDeviceCoexIndication* message; or

3> if for one or more of the frequencies in the previously reported set of frequencies, the *interferenceDirection* is different from the value indicated in the last transmitted *InDeviceCoexIndication* message; or

3> if the TDM assistance information is different from the assistance information included in the last transmitted *InDeviceCoexIndication* message; or

3> if configured to provide IDC indications for UL CA; and if the *victimSystemType* is different from the value indicated in the last transmitted *InDeviceCoexIndication* message; or

3> if configured to provide IDC indications for UL CA; and if the set of supported UL CA combinations on which the UE is experiencing IDC problems that it cannot solve by itself and that the UE includes in *affectedCarrierFreqCombList* according to 5.6.9.3, is different from the set indicated in the last transmitted *InDeviceCoexIndication* message; or

3> if configured to provide IDC indications for MR-DC, and if the *victimSystemType* is different from the value indicated in the last transmitted *InDeviceCoexIndication* message; or

3> if configured to provide IDC indications for MR-DC, for one or more of the frequencies in the previously reported set of frequencies, if *interferenceDirectionMRDC* is different from the value indicated in the last transmitted *InDeviceCoexIndication* message; or

3> if configured to provide IDC indications for MR-DC, and if the set of supported MR-DC combinations on which the UE is experiencing IDC problems that it cannot solve by itself and that the UE includes in *affectedCarrierFreqCombInfoListMRDC* according to 5.6.9.3, is different from the set indicated in the last transmitted *InDeviceCoexIndication* message:

4> initiate transmission of the *InDeviceCoexIndication* message in accordance with 5.6.9.3;

NOTE 1: The term "IDC problems" refers to interference issues applicable across several subframes/slots where not necessarily all the subframes/slots are affected.

NOTE 2: For the frequencies on which a serving cell or serving cells is configured that is activated, IDC problems consist of interference issues that the UE cannot solve by itself, during either active data exchange or upcoming data activity which is expected in up to a few hundred milliseconds.  
For frequencies on which a SCell or SCells is configured that is deactivated, reporting IDC problems indicates an anticipation that the activation of the SCell or SCells would result in interference issues that the UE would not be able to solve by itself.  
For a non-serving frequency, reporting IDC problems indicates an anticipation that if the non-serving frequency or frequencies became a serving frequency or serving frequencies then this would result in interference issues that the UE would not be able to solve by itself.

#### 5.6.9.3 Actions related to transmission of *InDeviceCoexIndication* message

The UE shall set the contents of the *InDeviceCoexIndication* message as follows:

1> if there is at least one E-UTRA carrier frequency, for which a measurement object is configured, that is affected by IDC problems:

2> include the field *affectedCarrierFreqList* with an entry for each affected E-UTRA carrier frequency for which a measurement object is configured;

2> for each E-UTRA carrier frequency included in the field *affectedCarrierFreqList*, include *interferenceDirection* and set it accordingly;

2> include Time Domain Multiplexing (TDM) based assistance information, unless *idc-HardwareSharingIndication* is configured and the UE has no Time Doman Multiplexing based assistance information that could be used to resolve the IDC problems:

3> if the UE has DRX related assistance information that could be used to resolve the IDC problems:

4> include *drx-CycleLength*, *drx-Offset* and *drx-ActiveTime*;

3> else (the UE has desired subframe reservation patterns related assistance information that could be used to resolve the IDC problems):

4> include *idc-SubframePatternList*;

3> use the MCG as timing reference if TDM based assistance information regarding the SCG is included;

1> if the UE is configured to provide UL CA information and there is a supported UL CA combination comprising of carrier frequencies for which a measurement object is configured, that is affected by IDC problems:

2> include *victimSystemType* in *ul-CA-AssistanceInfo*;

2> if the UE sets *victimSystemType* to *wlan* or *Bluetooth*:

3> include *affectedCarrierFreqCombList* in *ul-CA-AssistanceInfo* with an entry for each supported UL CA combination comprising of carrier frequencies for which a measurement object is configured, that is affected by IDC problems;

2> else:

3> optionally include *affectedCarrierFreqCombList* in *ul-CA-AssistanceInfo* with an entry for each supported UL CA combination comprising of carrier frequencies for which a measurement object is configured, that is affected by IDC problems;

1> if *idc-HardwareSharingIndication* is configured, and there is at least one E-UTRA carrier frequency, for which a measurement object is configured, the UE is experiencing hardware sharing problems that it cannot solve by itself:

2> include the *hardwareSharingProblem* and set it accordingly;

1> if the UE is configured to provide IDC indications for MR-DC and there is a supported MR-DC band combination comprising of at least one E-UTRA carrier frequency for which a measurement object is configured and at least one NR carrier frequency included in *candidateServingFreqListNR*, that is affected by IDC problems; and

1> if the IDC problem does not only concern the E-UTRA band combination as the UE already included in *affectedCarrierFreqCombList*:

2> for each entry of *affectedCarrierFreqCombInfoListMRDC* in *mrdc-AssistanceInfo*;

3> include *victimSystemType*;

3> include *interferenceDirectionMRDC*;

3> if the UE sets *victimSystemType* to *wlan* or *Bluetooth*:

4> include a set of at least one NR carrier frequency included in *candidateServingFreqListNR* and optionally one or more E-UTRA carrier frequency for which a measurement object is configured, that is affected by IDC problems;

3> else:

4> optionally include a set of at least one NR carrier frequency included in *candidateServingFreqListNR* and optionally one or more E-UTRA carrier frequency for which a measurement object is configured, that is affected by IDC problems;

NOTE 1: When sending an *InDeviceCoexIndication* message to inform E-UTRAN the IDC problems, the UE includes all assistance information (rather than providing e.g. the changed part(s) of the assistance information).

NOTE 2: Upon not anymore experiencing a particular IDC problem that the UE previously reported, the UE provides an IDC indication with the modified contents of the *InDeviceCoexIndication* message (e.g. by an empty message).

The UE shall submit the *InDeviceCoexIndication* message to lower layers for transmission.

### 5.6.10 UE Assistance Information

#### 5.6.10.1 General



Figure 5.6.10.1-1: UE Assistance Information

The purpose of this procedure is to inform E-UTRAN of the UE's power saving preference and SPS assistance information, maximum PDSCH/PUSCH bandwidth configuration preference, overheating assistance information, or the UE's delay budget report carrying desired increment/decrement in the Uu air interface delay or connected mode DRX cycle length and for BL UEs or UEs in CE of the RLM event ("early-out-of-sync" or "early-in-sync") and RLM information or the UE preference for the NR SCG deactivation or that the UE with a deactivated NR SCG has uplink data to send on a DRB for which there is no MCG RLC bearer. Upon configuring the UE to provide power preference indications E-UTRAN may consider that the UE does not prefer a configuration primarily optimised for power saving until the UE explictly indicates otherwise.

#### 5.6.10.2 Initiation

A UE capable of providing power preference indications in RRC\_CONNECTED may initiate the procedure in several cases including upon being configured to provide power preference indications and upon change of power preference.

A UE capable of providing SPS assistance information in RRC\_CONNECTED may initiate the procedure in several cases including upon being configured to provide SPS assistance information and upon change of SPS assistance information.

A UE capable of providing delay budget report in RRC\_CONNECTED may initiate the procedure in several cases, including upon being configured to provide delay budget report and upon change of delay budget preference.

A UE capable of CE mode and providing maximum PDSCH/PUSCH bandwidth preference in RRC\_CONNECTED may initiate the procedure upon being configured to provide maximum PDSCH/PUSCH bandwidth preference and/or upon change of maximum PDSCH/PUSCH bandwidth preference.

A UE capable of providing overheating assistance information in RRC\_CONNECTED may initiate the procedure if it was configured to do so, upon detecting internal overheating, or upon detecting that it is no longer experiencing an overheating condition.

A UE supporting NR SCG deactivation may intiate the procedure in several cases including upon being configured to provide its preference for NR SCG deactivation and upon change of its preference for NR SCG deactivation.

A UE in EN-DC that has uplink data to transmit for a DRB for which there is no MCG RLC bearer while the SCG is deactivated shall initiate the procedure.

Upon initiating the procedure, the UE shall:

1> if configured to provide power preference indications:

2> if the UE did not transmit a *UEAssistanceInformation* message with *powerPrefIndication* since it was configured to provide power preference indications; or

2> if the current power preference is different from the one indicated in the last transmission of the *UEAssistanceInformation* message and timer T340 is not running:

3> start or restart timer T340 with the timer value set to the *powerPrefIndicationTimer*, if the UE does not prefer a configuration primarily optimised for power saving;

3> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.6.10.3;

1> if configured to provide maximum PDSCH/PUSCH bandwidth preference:

2> if the UE did not transmit a *UEAssistanceInformation* message with *bw-Preference* since it was configured to provide maximum PDSCH/PUSCH bandwidth preference; or

2> if the current maximum PDSCH/PUSCH bandwidth preference is different from the one indicated in the last transmission of the *UEAssistanceInformation* message and timer T341 is not running;

3> start timer T341 with the timer value set to the *bw-PreferenceIndicationTimer*;

3> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.6.10.3;

1> if configured to provide SPS assistance information:

2> if the UE did not transmit a *UEAssistanceInformation* message with *sps-AssistanceInformation* since it was configured to provide SPS assistance information; or

2> if the current SPS assistance information is different from the one indicated in the last transmission of the *UEAssistanceInformation* message:

3> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.6.10.3;

1> if configured to report RLM events:

2> if "early-out-of-sync" event has been detected (T314 has expired) and T343 is not running:

3> start timer T343 with the timer value set to the *rlmReportTimer*:

3> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.6.10.3;

2> if "early-in-sync" event has been detected (T315 has expired) and T344 is not running:

3> start timer T344 with the timer value set to the *rlmReportTimer*:

3> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.6.10.3;

1> if configured to provide delay budget report:

2> if the UE did not transmit a *UEAssistanceInformation* message with *delayBudgetReport* since it was configured to provide delay budget report; or

2> if the current delay budget is different from the one indicated in the last transmission of the *UEAssistanceInformation* message and timer T342 is not running:

3> start or restart timer T342 with the timer value set to the *delayBudgetReportingProhibitTimer*;

3> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.6.10.3;

1> if configured to provide overheating assistance information:

2> if the overheating condition has been detected and T345 is not running; or

2> if the current overheating assistance information is different from the one indicated in the last transmission of the *UEAssistanceInformation* message and timer T345 is not running:

3> start timer T345 with the timer value set to the *overheatingIndicationProhibitTimer*;

3> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.6.10.3;

NOTE: In case overheating assistance for NR SCG is released while the regular overheating assistance remains configured, a UE that included SCG overheating parameters in the last reported overheating assistance considers overheating assistance information to be different regardless whether or not its preferences for the regular overheating assistance changed.

1> if configured to provide its preference for NR SCG deactivation:

2> if the UE did not transmit a *UEAssistanceInformation* message with *scg-DeactivationPreference* since it was configured to provide its preference for NR SCG deactivation and the UE prefers the NR SCG to be deactivated; or

2> if the UE preference for NR SCG deactivation is different from the one indicated in the last transmission of the *UEAssistanceInformation* message and timer T346 is not running:

3> start or restart timer T346 with the timer value set to the *scg-DeactivationPreferenceProhibitTimer*;

3> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.6.10.3;

1> if the UE is configured with a deactivated NR SCG and there are uplink data to send on a DRB for which *rlc-Config* is not configured in *drb-ToAddModList*; and

1> if the UE previously did not have any uplink data to send for any SCG RLC entity:

2> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.6.10.3.

#### 5.6.10.3 Actions related to transmission of *UEAssistanceInformation* message

The UE shall set the contents of the *UEAssistanceInformation* message for power preference indications:

1> if configured to provide power preference indication and if the UE prefers a configuration primarily optimised for power saving:

2> set *powerPrefIndication* to *lowPowerConsumption*;

1> else if configured to provide power preference indication:

2> set *powerPrefIndication* to *normal*;

The UE shall set the contents of the *UEAssistanceInformation* message for SPS assistance information:

1> if configured to provide SPS assistance information:

2> if there is any traffic for V2X sidelink communication which needs to report SPS assistance information:

3> include *trafficPatternInfoListSL* in the *UEAssistanceInformation* message;

2> if there is any traffic for uplink communication which needs to report SPS assistance information:

3> include *trafficPatternInfoListUL* in the *UEAssistanceInformation* message;

The UE shall set the contents of the *UEAssistanceInformation* message for bandwidth preference indications:

1> set *bw-Preference* to its preferred configuration;

The UE shall set the contents of the *UEAssistanceInformation* message for delay budget report:

1> if configured to provide delay budget report:

2> if the UE prefers an adjustment in the connected mode DRX cycle length:

3> set *delayBudgetReport* to *type1* according to a desired value;

2> else if the UE prefers coverage enhancement configuration change:

3> set *delayBudgetReport* to *type2* according to a desired value;

The UE shall set the contents of the *UEAssistanceInformation* message for the RLM report:

1> if configured to provide RLM report:

2> if T314 has expired:

3> set *rlm-event* to *earlyOutOfSync*;

2> if T315 has expired:

3> set *rlm-event* to *earlyInSync*;

3> if configured to report *rlmReportRep-MPDCCH*:

4> set *excessRep-MPDCCH* to the value indicated by lower layers;

The UE shall set the contents of the *UEAssistanceInformation* message for overheating assistance indication:

1> if configured to provide overheating assistance indication:

2> if the UE experiences internal overheating:

3> if the UE prefers to temporarily reduce its DL category and UL category:

4> include *reducedUE-Category* in the *OverheatingAssistance* IE;

4> set *reducedUE-CategoryDL* to the number to which the UE prefers to temporarily reduce its DL category;

4> set *reducedUE-CategoryUL* to the number to which the UE prefers to temporarily reduce its UL category;

3> if the UE prefers to temporarily reduce the number of maximum secondary component carriers:

4> include *reducedMaxCCs* in the *OverheatingAssistance* IE;

4> set *reducedCCsDL* to the number of maximum SCells the UE prefers to be temporarily configured in downlink;

4> set *reducedCCsUL* to the number of maximum SCells the UE prefers to be temporarily configured in uplink;

3> if configured to provide overheating assistance indication for NR SCG:

4> include *overheatingAssistanceForSCG* in the *OverheatingAssistance* IE;

4> if configured with serving cells operating on FR2-2 for NR SCG

5> include *overheatingAssistanceForSCG-FR2-2* in the *OverheatingAssistance* IE;

4> set *overheatingAssistanceForSCG* and if applicable, *overheatingAssistanceForSCG-FR2-2,* in accordance with clause 5.7.4.3a as specified in TS 38.331 [82];

2> else (if the UE no longer experiences an overheating condition):

3> if the UE had a preference for the *OverheatingAssistance*:

4> do not include *reducedUE-Category*, *reducedMaxCCs* in *OverheatingAssistance* IE;

3> if the UE had a preference for the *overheatingAssistanceForSCG*:

4> do not include *overheatingAssistance-v1610* in the *UEAssistanceInformation-v1610* IE; or

4> do not include *UEAssistanceInformation-v1610* IE in the *UEAssistanceInformation-v1530* IE; or

4> do not include *UEAssistanceInformation-v1530* IEs in *UEAssistanceInformation-v1450* IEs;

4> if configured with serving cells operating on FR2-2 for NR SCG

5> do not include *OverheatingAssistance-v1710* in the *UEAssistanceInformation-v1710* IE;

NOTE 0: It is up to UE implementation to whether include an empty *OverheatingAssistance* IE or not, for the case where UE only had a preference for the *overheatingAssistanceForSCG*.

The UE shall set the contents of the *UEAssistanceInformation* message for NR SCG deactivation:

1> if configured to provide its preference for NR SCG deactivation;

2> if the UE prefers NR SCG to be deactivated

3> include the *scg-DeactivationPreference* and set it to *scgDeactivationPreferred*:

2> else:

3> include the *scg-DeactivationPreference* and set it to *noPreference*:

The UE shall:

1> if the UE is configured with a deactivated NR SCG and there are uplink data to send on a DRB for which *rlc-Config* is not configured in *drb-ToAddModList*: and

1> if the UE previously did not have any uplink data to send for any SCG RLC entity:

2> include *uplinkData* in the *UEAssistanceInformation* message;

1> if the procedure was triggered to provide SPS assistance information and the related configuration was provided by an *RRCConnectionReconfiguration* message that was received embedded within an NR *RRCReconfiguration* message:

2> submit the *UEAssistanceInformation* message via SRB1 embedded in NR RRC message *ULInformationTransferIRAT* as specified in TS 38.331 [82];

1> else:

2> submit the *UEAssistanceInformation* message to lower layers for transmission.

NOTE 1: It is up to UE implementation when and how to trigger SPS assistance information.

NOTE 2: It is up to UE implementation to set the content of *trafficPatternInfoListSL* and *trafficPatternInfoListUL*.

NOTE 3: Traffic patterns for different Destination Layer 2 IDs are provided in different entries in *trafficPatternInfoListSL.*

NOTE 4: Although not recommended, UE may start or restart the following timers whenever it sends the *UEAssistanceInformation* message (i.e. even if the message was not triggered for the concerned feature): T340, T341, T342, T343, T344 and T345*.*

### 5.6.11 Mobility history information

#### 5.6.11.1 General

This procedure specifies how the mobility history information is stored by the UE, covering RRC\_CONNECTED and RRC\_IDLE.

#### 5.6.11.2 Initiation

If the UE supports storage of mobility history information, the UE shall:

1> Upon change of cell, consisting of PCell in RRC\_CONNECTED or serving cell in RRC\_IDLE, to another E-UTRA or inter-RAT cell or when entering out of service:

2> include an entry in variable *VarMobilityHistoryReport* possibly after removing the oldest entry, if necessary, according to following*:*

3> if the global cell identity of the previous PCell/ serving cell is available:

4> include the global cell identity of that cell in the field *visitedCellId* of the entry;

3> else:

4> include the physical cell identity and carrier frequency of that cell in the field *visitedCellId* of the entry;

3> set the field *timeSpent* of the entry as the time spent in the previous PCell/ serving cell;

1> upon entering E-UTRA (in RRC\_CONNECTED or RRC\_IDLE) while previously out of service and/ or using another RAT:

2> include an entry in variable *VarMobilityHistoryReport* possibly after removing the oldest entry, if necessary, according to following:

3> set the field *timeSpent* of the entry as the time spent outside E-UTRA;

### 5.6.12 RAN-assisted WLAN interworking

#### 5.6.12.1 General

The purpose of this procedure is to facilitate access network selection and traffic steering between E-UTRAN and WLAN.

If required by upper layers (see TS 24.312 [66], the UE shall provide an up-to-date set of the applicable parameters provided by *wlan-OffloadConfigCommon* or *wlan-OffloadConfigDedicated* to upper layers, and inform upper layers when no parameters are configured. The parameter set from either *wlan-OffloadConfigCommon* or *wlan-OffloadConfigDedicated* is selected as specified in clauses 5.2.2.24, 5.3.12, 5.6.12.2 and 5.6.12.4.

#### 5.6.12.2 Dedicated WLAN offload configuration

The UE shall:

1> if the received *wlan-OffloadInfo* is set to *release*:

2> release *wlan-OffloadConfigDedicated* and *t350*;

2> if the *wlan-OffloadConfigCommon* corresponding to the RPLMN is broadcast by the cell:

3> apply the *wlan-OffloadConfigCommon* corresponding to the RPLMN included in *SystemInformationBlockType17*;

1> else:

2> apply the received *wlan-OffloadConfigDedicated*:

#### 5.6.12.3 WLAN offload RAN evaluation

The UE shall:

1> if the UE is configured with either *wlan-OffloadConfigCommon* or *wlan-OffloadConfigDedicated*; and

1> if the UE is in RRC\_IDLE or none of *rclwi-Configuration, lwa-Configuration* and *lwip-Configuration* is configured:

2> provide measurement results required for the evaluation of the network selection and traffic steering rules as defined in TS 24.312 [66] to upper layers;

2> evaluate the network selection and traffic steering rules as defined in TS 36.304 [4] using WLAN identifiers as indicated in other clauses (either provided in *steerToWLAN* included in *rclwi-Configuration* or in *wlan-Id-List* included in *SystemInformationBlockType17*);

#### 5.6.12.4 T350 expiry or stop

The UE shall:

1> if T350 expires or is stopped:

2> release the *wlan-OffloadConfigDedicated* and *t350*;

2> release *rclwi-Configuration* if configured;

2> if the *wlan-OffloadConfigCommon* corresponding to the RPLMN is broadcast by the cell:

3> apply the *wlan-OffloadConfigCommon* and the *wlan-Id-List* corresponding to the RPLMN included in *SystemInformationBlockType17*;

#### 5.6.12.5 Cell selection/ re-selection while T350 is running

The UE shall:

1> if, while T350 is running, the UE selects/ reselects a cell which is not the PCell when the *wlan-OffloadDedicated* was configured:

2> stop timer T350;

2> perform the actions as specified in 5.6.12.4;

### 5.6.13 SCG failure information

#### 5.6.13.1 General



Figure 5.6.13.1-1: SCG failure information

The purpose of this procedure is to inform E-UTRAN about an SCG failure the UE has experienced i.e. SCG radio link failure, SCG change failure.

#### 5.6.13.2 Initiation

A UE initiates the procedure to report SCG failures when neither MCG nor SCG transmission is suspended and when one of the following conditions is met:

1> upon detecting radio link failure for the SCG, in accordance with 5.3.11; or

1> upon SCG change failure, in accordance with 5.3.5.7a; or

1> upon stopping uplink transmission towards the PSCell due to exceeding the maximum uplink transmission timing difference when *powerControlMode* is configured to 1, in accordance with clause 7.17.2 of TS 36.133 [29].

In case of DC, upon initiating the procedure, the UE shall:

1> suspend all SCG DRBs and suspend SCG transmission for split DRBs;

1> reset SCG-MAC;

1> stop T307;

1> if the UE is configured with NE-DC:

2> initiate transmission of the *SCGFailureInformationEUTRA* message via the NR MCG as specified in TS 38.331 [82], clause 5.7.3a;

1> else:

2> initiate transmission of the *SCGFailureInformation* message in accordance with 5.6.13.3;

#### 5.6.13.3 Actions related to transmission of *SCGFailureInformation* message

The UE shall set the contents of the *SCGFailureInformation* message as follows:

1> if the UE initiates transmission of the *SCGFailureInformation* message to provide SCG radio link failure information:

2> include *failureType* and set it to the trigger for detecting SCG radio link failure;

1> else if the UE initiates transmission of the *SCGFailureInformation* message to provide SCG change failure information:

2> include *failureType* and set it to scg-ChangeFailure;

1> else if the UE initiates transmission of the *SCGFailureInformation* message due to exceeding maximum uplink transmission timing difference:

2> include *failureType* and set it to *maxUL-TimingDiff*;

1> set the *measResultServFreqList* to include for each E-UTRA SCG cell that is configured, if any, within *measResultSCell* the quantities of the concerned SCell, if available according to performance requirements in TS 36.133 [16];

1> for each E-UTRA SCG serving frequency included in *measResultServFreqList*, include within *measResultBestNeighCell* the *physCellId* and the quantities of the best non-serving cell, based on RSRP, on the concerned serving frequency;

1> set the *measResultNeighCells* to include the best measured cells on non-serving E-UTRA frequencies, ordered such that the best cell is listed first, and based on measurements collected up to the moment the UE detected the failure, and set its fields as follows;

2> if the UE was configured to perform measurements for one or more non-serving EUTRA frequencies and measurement results are available, include the *measResultListEUTRA*;

2> for each neighbour cell included, include the optional fields that are available;

NOTE 1: The measured quantities are filtered by the L3 filter as configured in the mobility measurement configuration. The measurements are based on the time domain measurement resource restriction, if configured. Exclude-listed cells are not required to be reported.

The UE shall submit the *SCGFailureInformation* message to lower layers for transmission.

#### 5.6.13.4 Failure type determination in NE-DC

The UE shall:

1> if SCG failure is due to T313 expiry:

2> consider the *failureType* to be *t313-Expiry*;

1> else if SCG failure is due to indication from SCG MAC that a random access problem was detected:

2> consider the *failureType* to be *randomAccessProblem*;

1> else if SCG failure is due to indication from SCG RLC that the maximum number of retransmissions was reached:

2> consider the *failureType* to be *rlc-MaxNumRetx*;

1> else if SCG failure is due to SCG change failure:

2> consider the *failureType* to be *scg-ChangeFailure*;

#### 5.6.13.5 Setting the contents of *MeasResultSCG-FailureMRDC*

The UE shall:

1> set the contents of the *MeasResultSCG-FailureMRDC* as follows:

2> for each *measObjectEUTRA* for which a *measId* is configured and for which measurement results are available;

3> include an entry in *measResultsFreqListEUTRA*;

3> if a serving cell is associated with the *MeasObjectEUTRA*:

4> set *measResultServingCell* to include the available quantities of the concerned cell and in accordance with the performance requirements in TS 36.133 [16];

3> set the *measResultNeighCellList* to include the best measured cells, ordered such that the best cell is listed first, and based on measurements collected up to the moment the UE detected the failure, and set its fields as follows;

4> ordering the cells with sorting as follows:

5> using RSRP if RSRP measurement results are available, otherwise using RSRQ if RSRQ measurement results are available, otherwise using SINR;

4> for each neighbour cell included:

5> include the optional fields for which measurement results are available;

2> if detailed location information is available, set the content of the *locationInfo* as follows;

3> include the *locationCoordinates*;

3> include the *horizontalVelocity*, if available:

2> if available, set the *logMeasResultListWLAN* to include the WLAN measurement results, in order of decreasing RSSI for WLAN APs;

2> if available, set the *logMeasResultListBT* to include the Bluetooth measurement results, in order of decreasing RSSI for Bluetooth beacons;

NOTE: The measured quantities are filtered by the L3 filter as configured in the mobility measurement configuration. The measurements are based on the time domain measurement resource restriction, if configured. Exclude-listed cells are not required to be reported.

### 5.6.13a NR SCG failure information

#### 5.6.13a.1 General



Figure 5.6.13a.1-1: NR SCG failure information

The purpose of this procedure is to inform E-UTRAN about an SCG failure the UE has experienced (e.g. SCG radio link failure, failure to successfully complete an SCG reconfiguration with sync), as specified in TS 38.331 [82], clause 5.7.3.2.

#### 5.6.13a.2 Initiation

A UE initiates the procedure to report NR SCG failures when neither E-UTRA MCG nor NR SCG transmission is suspended and in accordance with TS 38.331 [82], clause 5.7.3.2. Actions the UE shall perform upon initiating the procedure, other than related to the transmission of the *SCGFailureInformationNR* message are specified in TS 38.331 [82], clause 5.7.3.2.

#### 5.6.13a.3 Actions related to transmission of *SCGFailureInformationNR* message

The UE shall set the contents of the *SCGFailureInformationNR* message as follows:

1> include *failureType* within *failureReportSCG-NR* and set it to indicate the SCG failure in accordance with TS 38.331 [82], clause 5.7.3.3;

NOTE 1: This may involve including both *failureType-r15* and *failureType-v1610*, see TS 38.331 [82], clause 5.7.3.3.

1> include and set *measResultSCG* in accordance with TS 38.331 [82], clause 5.7.3.4:

1> for each NR frequency the UE is configured to measure by *measConfig* for which measurement results are available:

2> set the *measResultFreqListNR* to include the best measured cells, ordered such that the best cell is listed first using RSRP to order if RSRP measurement results are available for cells on this frequency, otherwise using RSRQ to order if RSRQ measurement results are available for cells on this frequency, otherwise using SINR to order, and based on measurements collected up to the moment the UE detected the failure, and for each cell that is included, include the optional fields that are available;

NOTE 2: Field *measResultSCG* is used to report available results for NR frequencies the UE is configured to measure by NR RRC signalling.

1> if detailed location information is available, set the content of the *locationInfo* as follows:

2> include the *locationCoordinates*;

2> include the *horizontalVelocity*, if available;

1> if available, set the *logMeasResultListWLAN* to include the WLAN measurement results, in order of decreasing RSSI for WLAN APs;

1> if available, set the *logMeasResultListBT* to include the Bluetooth measurement results, in order of decreasing RSSI for Bluetooth beacons;

The UE shall submit the *SCGFailureInformationNR* message to lower layers for transmission.

### 5.6.14 LTE-WLAN Aggregation

#### 5.6.14.1 Introduction

E-UTRAN can configure the UE to connect to a WLAN and configure bearers for LWA (referred to as LWA DRBs). The UE uses the WLAN parameters received from E-UTRAN in performing WLAN measurements. The UE also performs WLAN connection management as described in 5.6.15 while LWA is configured.

#### 5.6.14.2 Reception of LWA configuration

Upon reception of LWA configuration, the UE shall:

1> if the received *lwa-Configuration* is set to *release*:

2> release the LWA configuration as described in 5.6.14.3;

1> else:

2> if the received *lwa-Config* includes *lwa-WT-Counter*:

3> determine the S-KWT key based on the KeNB key and received *lwa-WT-Counter* value, as specified in TS 33.401 [32];

3> forward the S-KWT key to upper layers to be used as a PMK or PSK for WLAN authentication;

2> if the received *lwa-Config* includes *lwa-MobilityConfig:*

3> if the received *lwa-MobilityConfig* includes *wlan-ToReleaseList*:

4> for each *WLAN-Identifiers* included in *wlan-ToReleaseList*:

5> remove the *WLAN-Identifiers* if already part of the current *wlan-MobilitySet* in *VarWLAN-MobilityConfig;*

3> if the received *lwa-MobilityConfig* includes *wlan-ToAddList*:

4> for each *WLAN-Identifiers* included in *wlan-ToAddList*:

5> add the *WLAN-Identifiers* to the current *wlan-MobilitySet* in *VarWLAN-MobilityConfig*;

3> if the received *lwa-MobilityConfig* includes *associationTimer*:

4> start or restart timer T351 with the timer value set to the *associationTimer*;

3> if the received *lwa-MobilityConfig* includes *successReportRequested*:

4> set *successReportRequested* in *VarWLAN-MobilityConfig* to the value of *successReportRequested*;

3> if the received *lwa-MobilityConfig* includes *wlan-SuspendConfig*:

4> set the field(s) in *wlan-SuspendConfig* within *VarWLAN-MobilityConfig* to the value(s) of field(s) included in *wlan-SuspendConfig*;

2> start WLAN Status Monitoring as described in 5.6.15.4;

#### 5.6.14.3 Release of LWA configuration

To release the LWA configuration, the UE shall:

1> for each LWA DRB that is part of the current UE configuration:

2> disable data handling for this DRB at the LWAAP entity;

2> perform PDCP data recovery as specified in TS 36.323 [8];

1> delete any existing values in *VarWLAN-MobilityConfig* and *VarWLAN-Status;*

1> stop timer T351, if running;

1> stop WLAN status monitoring and WLAN connection attempts for LWA;

1> indicate the release of LWA configuration, if configured, to upper layers;

### 5.6.15 WLAN connection management

#### 5.6.15.1 Introduction

WLAN connection management procedures in this clause are triggered as specified in other clauses where the UE is using a WLAN connection for LWA, RCLWI or LWIP.

The UE stores the current WLAN mobility set, which is a set of one or more WLAN identifier(s) (e.g. BSSID, SSID, HESSID) in *wlan-MobilitySet* in *VarWLAN-MobilityConfig.* This WLAN mobility set can be configured and updated by the eNB. A WLAN is considered to be inside the WLAN mobility set if its identifiers match all WLAN identifiers of at least one entry in *wlan-MobilitySet* and outside the WLAN mobility set otherwise. When the UE receives a new or updated WLAN mobility set, it initiates connection to a WLAN inside the WLAN mobility set*,* if not already connected to such a WLAN, and starts WLAN status monitoring as described in 5.6.15.4. The UE can perform WLAN mobility within the WLAN mobility set (connect or reconnect to a WLAN inside the WLAN mobility set) without any signalling to E-UTRAN.

The UE reports the WLAN connection status information to E-UTRAN as described in 5.6.15.2. The information in this report is based on the monitoring of WLAN connection as described in 5.6.15.4.

#### 5.6.15.2 WLAN connection status reporting

##### 5.6.15.2.1 General



Figure 5.6.15.2.1-1: WLAN connection status reporting

The purpose of this procedure is to inform E-UTRAN about the status of WLAN connection for LWA, RCLWI, or LWIP.

##### 5.6.15.2.2 Initiation

The UE in RRC\_CONNECTED initiates the WLAN status reporting procedure when:

1> it connects successfully to a WLAN inside WLAN mobility set while T351 is running after a WLAN mobility set change; or

1> after a *lwa-WT-Counter* update or after a *lwip-Counter* update (if success report is requested by the eNB); or

1> its connection or connection attempts to all WLAN(s) inside WLAN mobility set fails in accordance with WLAN Status Monitoring described in 5.6.15.4; or

1> T351 expires; or

1> its WLAN connection to all WLAN(s) inside WLAN mobility set becomes temporarily unavailable; or

1> its WLAN connection to a WLAN inside the WLAN mobility set is successfully established after its previous WLAN Connection Status Report indicating WLAN temporary suspension;

Upon initiating the procedure, the UE shall:

1> initiate transmission of the *WLANConnectionStatusReport* message in accordance with 5.6.15.2.3;

##### 5.6.15.2.3 Actions related to transmission of *WLANConnectionStatusReport* message

The UE shall set the contents of the *WLANConnectionStatusReport* message as follows:

1> set *wlan-status* to *status* in *VarWLAN-Status;*

1> submit the *WLANConnectionStatusReport* message to lower layers for transmission, upon which the procedure ends;

#### 5.6.15.3 T351 Expiry (WLAN connection attempt timeout)

Upon T351 expiry, the UE shall:

1> set the *status* in *VarWLAN-Status* to *failureTimeout*;

1> perform WLAN connection status reporting procedure in 5.6.15.2;

1> stop WLAN status monitoring and WLAN connection attempts;

#### 5.6.15.4 WLAN status monitoring

To perform WLAN status monitoring, the UE shall:

1> if UE is not configured with *rclwi-Configuration* and WLAN connection to a WLAN inside the WLAN mobility set is successfully established or maintained after a WLAN mobility set configuration update, after a *lwa-WT-Counter* update or after a *lwip-Counter* update:

2> set the *status* in *VarWLAN-Status* to *successfulAssociation*;

2> stop timer T351, if running;

2> if *successReportRequested* in *VarWLAN-MobilityConfig* is set to *TRUE*:

3> perform WLAN Connection Status Reporting procedure in 5.6.15.2;

1> if WLAN connection or connection attempts to all WLAN(s) inside WLAN mobility set fails:

2> if the failure is due to WLAN radio link issues:

3> set the *status* in *VarWLAN-Status* to *failureWlanRadioLink;*

2> else if the failure is due to UE internal problems related to WLAN:

3> set the *status* in *VarWLAN-Status* to *failureWlanUnavailable;*

NOTE 1: The UE internal problems related to WLAN include connection to another WLAN based on user preferences or turning off WLAN connection or connection rejection from WLAN or other WLAN problems.

3> remove all WLAN related measurement reporting entries within *VarMeasReportList*;

2> stop timer T351, if running;

2> perform WLAN Connection Status Reporting procedure in 5.6.15.2;

2> if the UE is configured with *rclwi-Configuration*:

3> release *rclwi-Configuration* and inform upper layers of a move-traffic-from-WLAN indication (see TS 24.302 [74]);

2> stop WLAN Status Monitoring and WLAN connection attempts;

1> if *wlan-SuspendResumeAllowed* in *wlan-SuspendConfig* within *VarWLAN-MobilityConfig* is set to *TRUE*:

2> if WLAN connection to all WLAN(s) inside WLAN mobility set becomes temporarily unavailable:

3> set the *status* in *VarWLAN-Status* to *suspended*;

3> if *wlan-SuspendTriggersStatusReport* in *wlan-SuspendConfig* within *VarWLAN-MobilityConfig* is set to *TRUE*:

4> trigger PDCP Status Report as specified in TS 36.323 [8];

3> perform WLAN Connection Status Reporting procedure in 5.6.15.2;

2> if the *status* in *VarWLAN-Status* in the last WLAN Connection Status Report by this UE was *suspended* and WLAN connection to a WLAN inside the WLAN mobility set is successfully established:

3> set the *status* in *VarWLAN-Status* to *resumed*;

3> perform WLAN Connection Status Reporting procedure in 5.6.15.2;

### 5.6.16 RAN controlled LTE-WLAN interworking

#### 5.6.16.1 General

The purpose of this procedure is to perform RAN-controlled LTE-WLAN interworking (RCLWI) i.e. control access network selection and traffic steering between E-UTRAN and WLAN.

#### 5.6.16.2 WLAN traffic steering command

The UE shall:

1> if the received *rclwi-Configuration* is set to *setup*:

2> if the *command* is set to *steerToWLAN*:

3> inform the upper layers of a move-traffic-to-WLAN indication along with the WLAN identifier lists in *steerToWLAN* (see TS 24.302 [74]);

3> store *steerToWLAN* in *wlan-MobilitySet* in *VarWLAN-MobilityConfig*;

3> perform the WLAN status monitoring procedure as specified in 5.6.15.4 using *steerToWLAN* as the WLAN mobility set;

2> else:

3> inform the upper layers of a move-traffic-from-WLAN indication (see TS 24.302 [74]);

3> clear *wlan-MobilitySet* in *VarWLAN-MobilityConfig*;

3> stop performing the WLAN status monitoring procedure as specified in 5.6.15.4;

3> delete any existing values in *VarWLAN-Status*;

1> else (the *rclwi-Configuration* is released):

2> clear *wlan-MobilitySet* in *VarWLAN-MobilityConfig*;

2> stop performing the WLAN status monitoring procedure as specified in 5.6.15.4;

2> delete any existing values in *VarWLAN-Status*;

2> inform the upper layers of release of the *rclwi-Configuration*.

### 5.6.17 LTE-WLAN aggregation with IPsec tunnel

#### 5.6.17.1 General

The WLAN resources that are used over the LWIP tunnel as described in TS 36.300 [9] established as part of LWIP procedures are referred to as 'LWIP resources'. The purpose of this clause is to specify procedures to indicate to higher layers to initiate the establishment/ release of the LWIP tunnel over WLAN and to indicate which DRB(s) shall use the LWIP resources.

#### 5.6.17.2 LWIP reconfiguration

The UE shall:

1> if the received *lwip-Configuration* is set to *release*:

2> release the LWIP configuration, if configured, as described in 5.6.17.3;

1> else:

2> if *lwip-MobilityConfig* is included:

3> if the received *lwip-MobilityConfig* includes *wlan-ToReleaseList*:

4> for each *WLAN-Identifiers* included in *wlan-ToReleaseList*:

5> remove the *WLAN-Identifiers* if already part of the current *wlan-MobilitySet* in *VarWLAN-MobilityConfig*;

3> if the received *lwip-MobilityConfig* includes *wlan-ToAddList*:

4> for each *WLAN-Identifiers* included in *wlan-ToAddList*:

5> add the *WLAN-Identifiers* to the current *wlan-MobilitySet* in *VarWLAN-MobilityConfig*;

3> if the received *lwip-MobilityConfig* includes *associationTimer*:

4> start timer T351 with the timer value set according to the value of *associationTimer*;

3> if the received *lwip-MobilityConfig* includes *successReportRequested*:

4> set *successReportRequested* in *VarWLAN-MobilityConfig* to the value of *successReportRequested*;

2> if *tunnelConfigLWIP* is included:

3> indicate to higher layers to configure the LWIP tunnel according to the received *tunnelConfi*g*LWIP*, as specified in TS 33.401[32];

3> if *lwip-Counter* is included:

4> determine the LWIP-PSK based on the KeNB key and received *lwip-Counter* value, as specified in TS 33.401 [32];

4> forward the LWIP-PSKto upper layers for LWIP tunnel establishment;

2> start WLAN Status Monitoring as described in 5.6.15.4;

#### 5.6.17.3 LWIP release

The UE shall:

1> delete any existing values in *VarWLAN-MobilityConfig* and *VarWLAN-Status*;

1> stop timer T351, if running;

1> release the *lwip-Configuration*;

1> indicate to higher layers to stop all DRBs from using the LWIP resources;

1> indicate to higher layers to release the LWIP tunnel, as specified in TS 33.401 [32];

1> stop WLAN status monitoring and WLAN connection attempts for LWIP;

### 5.6.18 Void

### 5.6.19 Application layer measurement reporting

#### 5.6.19.1 General



Figure 5.6.19.1-1: Application layer measurement reporting

The purpose of this procedure is to inform E-UTRAN about application layer measurement report.

#### 5.6.19.2 Initiation

A UE capable of application layer measurement reporting in RRC\_CONNECTED may initiate the procedure when configured with application layer measurement, i.e. when *measConfigAppLayer* has been configured by E-UTRAN.

Upon initiating the procedure, the UE shall:

1> if configured with application layer measurement, and SRB4 is configured, and the UE has received application layer measurement report information from upper layers:

2> set the *measReportAppLayerContainer* in the *MeasReportAppLayer* message to the value of the application layer measurement report information;

2> set the *serviceType* in the *MeasReportAppLayer* message to the type of the application layer measurement report information;

2> submit the *MeasReportAppLayer* message to lower layers for transmission via SRB4.

### 5.6.20 Idle/Inactive Measurements

#### 5.6.20.1 General

This procedure specifies the measurements to be performed and stored by a UE in RRC\_IDLE or RRC\_INACTIVE when it has an idle/inactive measurement configuration.

#### 5.6.20.1a Measurement configuration

The purpose of this procedure is to update the idle/inactive measurement configuration.

The UE initiates this procedure while T331 is running and one of the following conditions is met:

1> upon selecting a cell when entering RRC\_IDLE or RRC-INACTIVE from RRC\_CONNECTED; or

1> upon update of system information (*SIB5*, or *SIB24*), e.g. due to intra-RAT cell (re)selection;

While in RRC\_IDLE or RRC\_INACTIVE and T331 is running, the UE shall:

1> if *VarMeasIdleConfig* includes neither a *measIdleCarrierListEUTRA* nor a *measIdleCarrierListNR* received from the *RRCConnectionRelease* message:

2> if the UE is capable of idle/inactive measurements for E-UTRA:

3> if the *SIB5* includes the *measIdleConfigSIB*:

4> store or replace the *measIdleCarrierListEUTRA* of *measIdleConfigSIB* of *SIB5* within *VarMeasIdleConfig*;

3> else:

4> remove the *measIdleCarrierListEUTRA* in *VarMeasIdleConfig*, if stored;

2> if the UE is capable of idle/inactive measurements for NR:

3> if the *SIB5* includes the *measIdleConfigSIB-NR*:

4> store or replace the *measIdleCarrierListNR* of *measIdleConfigSIB-NR* of *SIB5* within *VarMeasIdleConfig*;

3> else:

4> remove the *measIdleCarrierListNR* in *VarMeasIdleConfig*, if stored;

1> for each entry in the *measIdleCarrierListNR* within *VarMeasIdleConfig* that does not contain an *ssb-MeasConfig* received from the *RRCConnectionRelease* message:

2> if there is an entry in *measIdleCarrierListNR* in *measIdleConfigSIB-NR* of *SIB5* that has the same carrier frequency and subcarrier spacing as the entry in the *measIdleCarrierListNR* within *VarMeasIdleConfig* and that contains *ssb-MeasConfig*:

3> delete the *ssb-MeasConfig* of the corresponding entry in the *measIdleCarrierListNR* within *VarMeasIdleConfig*;

3> store the SSB measurement configuration from *SIB5* into *maxRS-IndexCellQual*, *threshRS-Index*, *measTimingConfig*, *ssb-ToMeasure*, *deriveSSB-IndexFromCell*, and *ss-RSSI-Measurement* within *ssb-MeasConfig* of the corresponding entry in the *measIdleCarrierListNR* within *VarMeasIdleConfig*;

2> else if there is an entry in *carrierFreqListNR* of *SIB24* with the same carrier frequency and subcarrier spacing as the entry in *measIdleCarrierListNR* within *VarMeasIdleConfig*:

3> delete the *ssb-MeasConfig* of the corresponding entry in the *measIdleCarrierListNR* within *VarMeasIdleConfig*;

3> store the SSB measurement configuration from *SIB24* into *maxRS-IndexCellQual*, *threshRS-Index*, *measTimingConfig*, *ssb-ToMeasure*, *deriveSSB-IndexFromCell*, and *ss-RSSI-Measurement* within *ssb-MeasConfig* of the corresponding entry in *measIdleCarrierListNR* within *VarMeasIdleConfig*;

2> else:

3> remove the *ssb-MeasConfig* of the corresponding entry in the *measIdleCarrierListNR* within *VarMeasIdleConfig*, if stored;

#### 5.6.20.2 Performing measurements

When performing measurements on NR carriers according to this clause, the UE shall derive the cell quality as specified in 5.5.3.3 and consider the beam quality to be the value of the measurement results of the concerned beam, where each result is averaged as described in TS 38.215 [89].

While in RRC\_IDLE or RRC\_INACTIVE, and T331 is running, the UE shall:

1> perform the measurements in accordance with the following:

2> if the SIB2 contains *idleModeMeasurements*, for each entry in *measIdleCarrierListEUTRA* within *VarMeasIdleConfig*:

3> if UE supports carrier aggregation between serving carrier and the carrier frequency and bandwidth indicated by *carrierFreq* and *allowedMeasBandwidth* within the corresponding entry;

4> perform measurements in the carrier frequency and bandwidth indicated by *carrierFreq* and *allowedMeasBandwidth* within the corresponding entry;

NOTE 1: How the UE performs the idle/inactive measurements is up to UE implementation as long as the requirements in TS 36.133 [16] are met for measurement reporting.

4> if the *reportQuantities* is set to *rsrq*:

5> consider RSRQ as the sorting quantity;

4> else:

5> consider RSRP as the sorting quantity;

4> if the *measCellList* is included:

5> consider cells identified by each entry within the *measCellList* to be applicable for idle /inactive measurement reporting;

4> else:

5> consider up to *maxCellMeasIdle* strongest identified cells, according to the sorting quantity, to be applicable for idle/inactive measurement reporting;

4> for all cells applicable for idle/inactive measurement reporting and for the serving cell, derive measurement results for the measurement quantities indicated by *reportQuantities;*

4> store the derived measurement result as indicated by *reportQuantities* for the serving cell within *measResultServingCell* in the *measReportIdle* in *VarMeasIdleReport*;

4> store the derived measurement results as indicated by *reportQuantities* for cells applicable for idle/inactive measurement reporting within *measResultNeighCells* in the *measReportIdle* in *VarMeasIdleReport* in decreasing order of the sorting quantity, i.e. the best cell is included first, as follows:

5> if *qualityThreshold* is configured:

6> include the measurement results from the cells applicable for idle/inactive measurement reporting whose RSRP/RSRQ measurement results are above the value(s) provided in *qualityThreshold;*

5> else:

6> include the measurement results from all cells applicable for idle/inactive measurement reporting;

2> if the SIB2 contains *idleModeMeasurementsNR* and *VarMeasIdleConfig* includes the *measIdleCarrierListNR*:

3> for each entry in *measIdleCarrierListNR* within *VarMeasIdleConfig* that contains *ssb-MeasConfig*:

4> if UE supports (NG)EN-DC between serving carrier and the carrier frequency and subcarrier spacing indicated by *carrierFreqNR* and *subCarrierSpacingSSB* within the corresponding entry:

5> perform measurements in the carrier frequency and subcarrier spacing indicated by *carrierFreqNR* and *subCarrierSpacingSSB* within the corresponding entry;

5> if the *reportQuantitiesNR* is set to *rsrq*:

6> consider RSRQ as the cell sorting quantity;

5> else:

6> consider RSRP as the cell sorting quantity;

5> if the *measCellListNR* is included:

6> consider cells identified by each entry within the *measCellListNR* to be applicable for idle/inactive measurement reporting;

5> else:

6> consider up to *maxCellMeasIdle* strongest identified cells, according to the sorting quantity, to be applicable for idle/inactive measurement reporting;

5> for all cells applicable for idle/inactive measurement reporting, derive the cell measurement results for the measurement quantities indicated by *reportQuantitiesNR*;

5> store the derived measurement results as indicated by *reportQuantitiesNR* within the *measReportIdleNR* in *VarMeasIdleReport* in decreasing order of the cell sorting quantity, i.e. the best cell is included first, as follows:

6> if *qualityThresholdNR* is configured:

7> include the measurement results from the cells applicable for idle/inactive measurement reporting whose RSRP/RSRQ measurement results are above the value(s) provided in *qualityThresholdNR;*

6> else:

7> include the measurement results from all cells applicable for idle/inactive measurement reporting;

5> if *beamMeasConfigIdle* is included in the associated entry in *measIdleCarrierListNR* and if UE supports *nr-IdleInactiveBeamMeasFR1* or *nr-IdleInactiveBeamMeasFR2* for the FR of the carrier frequency indicated by *carrierFreqNR* within the associated entry, for each cell in the measurement results:

6> derive beam measurements based on SS/PBCH block for each measurement quantity indicated in *reportQuantityRS-IndexNR*, as described in TS 38.215 [89];

6> if the *reportQuantityRS*-*IndexNR* is set to *rsrq*:

7> consider RSRQ as the beam sorting quantity;

6> else:

7> consider RSRP as the beam sorting quantity;

6> set *resultRS-IndexList* to include up to *maxReportRS-Index* SS/PBCH block indexes in order of decreasing sorting quantity as follows:

7> include the index associated to the best beam for the sorting quantity and if *threshRS-Index* is included, the remaining beams whose sorting quantity is above *threshRS-Index*;

6> if the *reportRS-IndexResultsNR* is set to true:

7> include the beam measurement results as indicated by *reportQuantityRS*-*IndexNR*;

3> if, as the result of the procedure in this clause, the UE performs measurements in one or more carrier frequency indicated by *measIdleCarrierListNR:*

4> store the cell measurement results for RSRP and RSRQ for the serving cell within *measResultServingCell* in the *measReportIdle* in *VarMeasIdleReport*;

NOTE 2: The UE is not required to perform idle/inactive measurements on a given carrier if the SSB configuration of that carrier provided via dedicated signaling is different from the SSB configuration broadcasted in the serving cell, if any.

NOTE 3: How the UE prioritizes which frequencies to measure or report (in case it is configured with more frequencies than it can measure or report) is left to UE implementation.

#### 5.6.20.3 T331 expiry or stop

The UE shall:

1> if T331 expires or is stopped:

2> release the *VarMeasIdleConfig*;

NOTE: It is up to UE implementation whether to continue idle/inactive measurements according to SIB5 and SIB24 configuration or according to NR SIB11 and NR SIB4 configuration as specified in TS 38.331 [82] upon inter-RAT cell reselection to NR, after T331 has expired or stopped.

#### 5.6.20.4 Cell re-selection or selection while T331 is running

The UE shall:

1> if intra-RAT cell selection or reselection occurs while T331 is runing:

2> if *validityAreaList* is configured in *VarMeasIdleConfig*:

3> if the serving cell frequency does not match with the *carrierFreq* of any entry in the *validityAreaList*; or

3> if the serving frequency matches with the *carrierFreq* of an entry in the *validityAreaList*, the *validityCellList* is included in that entry, and the physical cell identity of the serving cell does not match with any entry in *validityCellList*:

4> stop timer T331;

4> perform the actions as specified in 5.6.20.3, upon which the procedure ends;

2> else if *validityArea* is configured in *VarMeasIdleConfig* and UE reselects to a serving cell whose physical cell identity does not match any entry in *validityArea* for the corresponding carrier frequency:

3> stop timer T331;

3> perform the actions as specified in 5.6.20.3, upon which the procedure ends;

1> if inter-RAT cell selection or reselection occurs while timer T331 is running;

2> stop timer T331;

2> perform the actions as specified in 5.6.20.3;

### 5.6.21 Failure information

#### 5.6.21.1 General



Figure 5.6.21.1-1: Failure information



The purpose of this procedure is to inform E-UTRAN about a failure that the UE has experienced.

#### 5.6.21.2 Initiation

A UE initiates the procedure to report failures when one of the following conditions is met:

1> upon detecting RLC failure, in accordance with 5.3.11;

1> upon detecting a DAPS HO failure, in accordance with 5.3.5.6.

Upon initiating the procedure, the UE shall:

1> initiate transmission of the *FailureInformation* message in accordance with 5.6.21.3;

#### 5.6.21.3 Actions related to transmission of *FailureInformation* message

When initiating the procedure according to 5.6.21.2, the UE shall:

1> set the contents of the *FailureInformation* message as follows:

2> if the procedure is initiated to report RLC failure:

3> set *logicalChannelIdentity* to the logical channel identity of the RLC entity;

3> set *cellGroupIndication* to the cell group where the RLC entity is located;

3> set *failureType* to the type of failure that has been detected;

2> if the procedure is initiated to report a DAPS HO failure:

3> set *failureType* to *dapsHO-failure*;

1> submit the *FailureInformation* message to lower layers for transmission.

### 5.6.22 UL message segment transfer

#### 5.6.22.1 General



Figure 5.6.22.1-1: UL message segment transfer

The purpose of this procedure is to transfer segments of UL DCCH messages from UE to E-UTRAN in RRC\_CONNECTED.

NOTE: The segmentation of UL DCCH message is only applicable to *UECapabilityInformation* in this release.

#### 5.6.22.2 Initiation

A UE capable of UL RRC message segmentation in RRC\_CONNECTED will initiate the procedure when the following conditions are met:

1> if the RRC message segmentation is enabled based on the field *rrc-SegAllowed* or *rrc-MaxCapaSegAllowed* received, and

1> if the encoded RRC message is larger than the maximum supported size of a PDCP SDU specified in TS 36.323 [8];

Upon initiating the procedure, the UE shall:

1> initiate transmission of the *ULDedicatedMessageSegment* message as specified in 5.6.22.3;

#### 5.6.22.3 Actions related to transmission of *ULDedicatedMessageSegment* message

The UE shall segment the encoded RRC PDU based on the maximum supported size of a PDCP SDU specified in TS 36.323 [8] and the maximum number of UL segments according to *rrc-SegAllowed* or *rrc-MaxCapaSegAllowed*, if received. UE shall minimize the number of segments and set the contents of the *ULDedicatedMessageSegment* messages as follows:

1> For each new UL DCCH message, set the *segmentNumber* to 0 for the first message segment and increment the *segmentNumber* for each subsequent RRC message segment;

1> set *rrc-MessageSegmentContainer* to include the segment of the UL DCCH message corresponding to the *segmentNumber*;

1> if the segment included in the *rrc-MessageSegmentContainer* is the last segment of the UL DCCH message:

2> set the *rrc-MessageSegmentType* to *lastSegment*;

1> else:

2> set the *rrc-MessageSegmentType* to *notLastSegment*;

1> submit all the *ULDedicatedMessageSegment* messages generated for the segmented RRC message to lower layers for transmission in ascending order based on the *segmentNumber*, upon which the procedure ends.

### 5.6.23 PUR Configuration Request

#### 5.6.23.1 General



Figure 5.6.23.1-1: PUR Configuration Request

The purpose of this procedure is to indicate to the E-UTRAN that the UE is interested to be configured with PUR and provide PUR related information to E-UTRAN, or that the UE is no longer interested to be configured with PUR.

The procedure is applicable only for BL UEs, UEs in CE or NB-IoT UEs.

#### 5.6.23.2 Initiation

A UE in RRC\_CONNECTED may initiate the procedure when all of the following conditions are fulfilled:

1> if the UE is connected to EPC:

2> for CP transmission using PUR, *SystemInformationBlockType2* (*SystemInformationBlockType2-NB* in NB-IoT) includes *cp-PUR-EPC*; or

2> for UP transmission using PUR, *SystemInformationBlockType2* (*SystemInformationBlockType2-NB* in NB-IoT) includes *up-PUR-EPC*;

1> else if the UE is connected to 5GC:

2> for CP transmission using PUR, *SystemInformationBlockType2* (*SystemInformationBlockType2-NB* in NB-IoT) includes *cp-PUR-5GC*; or

2> for UP transmission using PUR, *SystemInformationBlockType2* (*SystemInformationBlockType2-NB* in NB-IoT) includes *up-PUR-5GC*;

1> the size of the resulting MAC PDU including the total UL data size of the traffic is smaller than or equal to the maximum supported TBS based on the UE category.

NOTE 1: It is up to UE implementation how the UE determines whether the size of UL data is suitable for transmission using PUR.

Upon initiating the procedure, the UE shall:

1> initiate transmission of the *PURConfigurationRequest* message in accordance with 5.6.23.3;

#### 5.6.23.3 Actions related to transmission of *PURConfigurationRequest* message

When initiating the procedure according to 5.6.23.2, the UE shall set the contents of the *PURConfigurationRequest* message as follows:

1> if the UE is interested to be configured with PUR, include *pur-SetupRequest* and set the contents of *pur-SetupRequest* as follows:

2> set *requestedNumOccasions* to the requested number of PUR occasions requested;

2> set *requestedPeriodicityAndOffset* according to the requested periodicity between consecutive PUR occasions and the requested time offset with respect to current time until the first PUR occasion;

2> set *requestedTBS* to the requested TBS for the PUR occasion(s);

2> if RRC response message is preferred by the UE for acknowledging the reception of a transmission using PUR, include *rrc-ACK*;

1> if the UE is no longer interested to be configured with PUR:

2> include *pur-ReleaseRequest*;

The UE shall submit the *PURConfigurationRequest* message to lower layers for transmission.

### 5.6.24 Neighbour Relation Reporting for SON ANR in NB-IoT

#### 5.6.24.0 General

This procedure specifies the neighbour measurements and CGI reading performed when the UE is in RRC\_IDLE when it has an ANR measurement configuration and the storage of the associated information by a UE in RRC\_IDLE and RRC\_CONNECTED.

NOTE: E-UTRAN may retrieve the stored ANR measurements information by means of the UE information procedure.

#### 5.6.24.1 Initiation

While the UE is in RRC\_IDLE, the UE shall:

1> store the measurement results for the serving cell in *measResultServCell* in *VarANR-MeasReport-NB*;

1> while the serving cell global cell identity is the same as stored in *servCellIdentity* in *VarANR-MeasReport-NB*:

2> perform the measurements once in accordance with the following:

3> for each carrier frequency indicated by an entry in *anr-CarrierList,* if present, within *VarANR-MeasConfig-NB*:

4> add a new entry in *measResultList* in *VarANR-MeasReport-NB*;

4> set the *carrierFreq* to the carrier frequency;

4> perform measurements on the corresponding carrier frequency and determines the strongest cell, if any, on the carrier frequency;

NOTE: How the UE performs ANR measurement in RRC\_IDLE is up to UE implementation as long as the measurement requirements (see TS 36.133 [16], clause 4.6) are met. While performing an ANR measurement, the UE performs inter-frequency measurements on the configured frequency regardless of the measurement rules for cell re-selection and the relaxed monitoring measurement rules as specified in TS 36.304 [4].

4> if the strongest cell is not identified by an entry within the *excludedCellList*,if present, for the corresponding entry in *anr-CarrierList*:

5> set the *physCellId* to the physical cell identity of the cell;

5> set the *measResultLastServCell* to the last measurement results of the PCell;

5> set the *measResult* to the measurement results of the cell;

5> if the NRSRP measurement result is above the value provided in *anr-qualityThreshold*:

6> set the *cgi-Info* with the information obtained from the *systemInformationBlockType1-NB* of the cell;

2> set the *relativeTimeStamp* to the elapsed time since the measurements configuration was received;

1> release the *VarANR-MeasConfig-NB*.

The UE may discard the ANR measurements information, i.e. release the UE variables *VarANR-MeasConfig-NB* and *VarANR-MeasReport-NB*, 96 hours after the configuration was received, upon power off or upon detach and upon entering another RAT.

### 5.6.25 DL message segment transfer

#### 5.6.25.1 General



Figure 5.6.25.1-1: DL message segment transfer

The purpose of this procedure is to transfer segments of DL DCCH messages from E-UTRAN to the UE.

NOTE: The segmentation of DL DCCH message is only applicable to *RRCConnectionReconfiguration* and *RRCConnectionResume* messages in this release.

#### 5.6.25.2 Initiation

E-UTRAN initiates the DL Dedicated Message Segment transfer procedure whenever the encoded RRC message PDU exceeds the maximum PDCP SDU size. E-UTRAN initiates the DL Dedicated Message Segment transfer procedure by sending the *DLDedicatedMessageSegment* message.

#### 5.6.25.3 Reception of *DLDedicatedMessageSegment* by the UE

Upon receiving *DLDedicatedMessageSegment* message, the UE shall:

1> store the segment;

1> if all segments of the message have been received:

2> assemble the message from the received segments and process the message according to 5.3.5 for the *RRCConnectionReconfiguration* message or 5.3.3.4a for the *RRCConnectionResume* message;

2> discard all segments.

### 5.6.26 MCG failure information

#### 5.6.26.1 General



Figure 5.6.26.1-1: MCG failure information

The purpose of this procedure is to inform the network about an MCG failure the UE has experienced i.e. MCG radio link failure. A UE in RRC\_CONNECTED, for which AS security has been activated with SRB2 and at least one DRB setup, may initiate the fast MCG link recovery procedure in order to continue the RRC connection without re-establishment.

#### 5.6.26.2 Initiation

A UE configured with split SRB1 or SRB3 initiates the procedure to report MCG failures when neither MCG nor SCG transmission is suspended, the SCG is not deactivated, *t316* is configured, and when the following condition is met:

1> upon detecting radio link failure of the MCG, in accordance with 5.3.11, while T316 is not running.

Upon initiating the procedure, the UE shall:

1> stop timer T310, if running;

1> stop timer T312, if running;

1> suspend MCG transmission for all SRBs and DRBs, except SRB0;

1> reset MCG MAC;

1> stop conditional reconfiguration evaluation for CHO, if configured;

1> stop conditional reconfiguration evaluation for CPC, if configured;

1> initiate transmission of the *MCGFailureInformation* message in accordance with 5.6.26.4.

NOTE: The handling of any outstanding UL RRC messages during the initiation of the fast MCG link recovery is left to UE implementation.

#### 5.6.26.3 Failure type determination

The UE shall set the MCG failure type as follows:

1> if the UE initiates transmission of the *MCGFailureInformation* message due to T310 expiry:

2> set the *failureType* as *t310-Expiry*;

1> else if the UE initiates transmission of the *MCGFailureInformation* message due to T312 expiry:

2> set the *failureType* as *t312-Expiry*;

1> else if the UE initiates transmission of the *MCGFailureInformation* message to provide random access problem indication from MCG MAC:

2> set the *failureType* as *randomAccessProblem*;

1> else if the UE initiates transmission of the *MCGFailureInformation* message to provide indication from MCG RLC that the maximum number of retransmissions has been reached:

2> set the *failureType* as *rlc-MaxNumRetx*.

#### 5.6.26.4 Actions related to transmission of *MCGFailureInformation* message

The UE shall set the contents of the *MCGFailureInformation* message as follows:

1> include and set *failureType* in accordance with 5.6.26.3;

1> for each *measObjectEUTRA* for which a *measId* is configured and for which measurement results are available:

2> include an entry in *measResultsFreqListEUTRA*;

2> if a serving cell is associated with the *MeasObjectEUTRA*:

3> set *measResultServingCell* to include the available quantities of the concerned cell and in accordance with the performance requirements in TS 36.133 [16];

2> set the *measResultNeighCellList* to include the best measured cells, ordered such that the best cell is listed first, and based on measurements collected up to the moment the UE detected the failure, and set its fields as follows:

3> ordering the cells with sorting as follows:

4> using RSRP if RSRP measurement results are available, otherwise using RSRQ if RSRQ measurement results are available, otherwise using SINR;

3> for each neighbour cell included:

4> include the optional fields for which measurement results are available;

NOTE 1: The measured quantities are filtered by the L3 filter as configured in the mobility measurement configuration. The measurements are based on the time domain measurement resource restriction, if configured. Exclude-listed cells are not required to be reported.

1> for each NR frequency the UE is configured to measure by *measConfig* for which measurement results are available:

2> set the *measResultFreqListNR* to include the best measured cells, ordered such that the best cell is listed first using RSRP to order the cells if RSRP measurement results are available for cells on this frequency, otherwise using RSRQ to order the cells if RSRQ measurement results are available for cells on this frequency, otherwise using SINR to order the cells, based on measurements collected up to the moment the UE detected the failure, and for each cell that is included, include the optional fields that are available;

1> for each UTRA frequency the UE is configured to measure by *measConfig* for which measurement results are available:

2> set the *measResultFreqListUTRA* to include the best measured cells, ordered such that the best cell is listed first using RSCP to order the cells if RSCP measurement results are available for cells on this frequency, otherwise using EcN0 to order the cells, based on measurements collected up to the moment the UE detected the failure, and for each cell that is included, include the optional fields that are available;

1> for each GERAN frequency the UE is configured to measure by *measConfig* for which measurement results are available:

2> set the *measResultFreqListGERAN* to include the best measured cells based on measurements collected up to the moment the UE detected the failure, and for each cell that is included, include the optional fields that are available;

1> if the UE is in (NG)EN-DC:

2> include and set *measResultSCG* in accordance with TS 38.331 [82], clause 5.7.3.4:

NOTE 2: Field *measResultSCG* is used to report available results for NR frequencies the UE is configured to measure by NR RRC signalling.

1> if SRB1 is configured as split SRB and *pdcp-Duplication* is not configured in accordance with TS 38.331 [82, 6.3.2]:

2> if the *primaryPath* for the PDCP entity of SRB1 refers to to the MCG:

3> set the *primaryPath* to refer to the SCG.

The UE shall:

1> start timer T316;

1> if SRB1 is configured as split SRB:

2> submit the *MCGFailureInformation* message to lower layers for transmission via SRB1, upon which the procedure ends;

1> else (i.e. SRB3 is configured):

2> submit the *MCGFailureInformation* message to lower layers for transmission, embedded in NR RRC message *ULInformationTransferMRDC* via SRB3as specified in TS 38.331 [82], clause 5.7.2a.3.

#### 5.6.26.5 T316 expiry

The UE shall:

1> if T316 expires:

2> initiate the connection re-establishment procedure as specified in 5.3.7.

### 5.6.27 Void

### 5.6.28 UL transfer of IRAT information

#### 5.6.28.1 General



Figure 5.6.28.1-1: UL transfer of IRAT information

The purpose of this procedure is to transfer from the UE to E-UTRAN dedicated information terminated by E-UTRAN but specified by another RAT e.g. the NR RRC *MeasurementReport* message, the NR RRC *SidelinkUEInformationNR* message or the NR RRC *UEAssistanceInformation* message. The specific information transferred in this message is set in accordance with:

- the procedure specified in 5.7.4 of TS 38.331 [82] for NR *UEAssistanceInformation* message;

- the procedure specified in 5.8.3 of TS 38.331 [82] for NR *SidelinkUEInformationNR* message;

- the procedure specified in 5.5.5 of TS 38.331 [82] for NR *MeasurementReport* Message.

#### 5.6.28.2 Initiation

A UE in RRC\_CONNECTED initiates the UL information transfer procedure whenever there is a need to transfer dedicated IRAT information as specified in TS 38.331 [82].

#### 5.6.28.3 Actions related to transmission of *ULInformationTransferIRAT* message

The UE shall set the contents of the *ULInformationTransferIRAT* message as follows:

1> if there is a need to transfer dedicated NR information:

2> set the *ul-DCCH-MessageNR* to include the IRAT dedicated information to be transferred;

1> submit the *ULInformationTransferIRAT* message to lower layers for transmission, upon which the procedure ends.

## 5.7 Generic error handling

### 5.7.1 General

The generic error handling defined in the subsequent clauses applies unless explicitly specified otherwise e.g. within the procedure specific error handling.

The UE shall consider a value as not comprehended when it is set:

- to an extended value that is not defined in the version of the transfer syntax supported by the UE.

- to a spare or reserved value unless the specification defines specific behaviour that the UE shall apply upon receiving the concerned spare/ reserved value.

The UE shall consider a field as not comprehended when it is defined:

- as spare or reserved unless the specification defines specific behaviour that the UE shall apply upon receiving the concerned spare/ reserved field.

### 5.7.2 ASN.1 violation or encoding error

The UE shall:

1> when receiving an RRC message on the BCCH, BR-BCCH, PCCH, CCCH, MCCH, SC-MCCH or SBCCH for which the abstract syntax is invalid, as specified in ITU-T X.680 (07/2002) [13]:

2> ignore the message;

NOTE: This clause applies in case one or more fields is set to a value, other than a spare, reserved or extended value, not defined in this version of the transfer syntax. E.g. in the case the UE receives value 12 for a field defined as INTEGER (1..11). In cases like this, it may not be possible to reliably detect which field is in the error hence the error handling is at the message level.

### 5.7.3 Field set to a not comprehended value

The UE shall, when receiving an RRC message on any logical channel:

1> if the message includes a field that has a value that the UE does not comprehend:

2> if a default value is defined for this field:

3> treat the message while using the default value defined for this field;

2> else if the concerned field is optional:

3> treat the message as if the field were absent and in accordance with the need code for absence of the concerned field;

2> else:

3> treat the message as if the field were absent and in accordance with clause 5.7.4;

### 5.7.4 Mandatory field missing

The UE shall:

1> if the message includes a field that is mandatory to include in the message (e.g. because conditions for mandatory presence are fulfilled) and that field is absent or treated as absent:

2> if the RRC message was received on DCCH or CCCH:

3> ignore the message;

2> else:

3> if the field concerns a (sub-field of) an entry of a list (i.e. a SEQUENCE OF):

4> treat the list as if the entry including the missing or not comprehended field was not present;

3> else if the field concerns a sub-field of another field, referred to as the 'parent' field i.e. the field that is one nesting level up compared to the erroneous field:

4> consider the 'parent' field to be set to a not comprehended value;

4> apply the generic error handling to the subsequent 'parent' field(s), until reaching the top nesting level i.e. the message level;

3> else (field at message level):

4> ignore the message;

NOTE 1: The error handling defined in these clauses implies that the UE ignores a message with the message type or version set to a not comprehended value.

NOTE 2: The nested error handling for messages received on logical channels other than DCCH and CCCH applies for errors in extensions also, even for errors that can be regarded as invalid E-UTRAN operation e.g. E-UTRAN not observing conditional presence.

The following ASN.1 further clarifies the levels applicable in case of nested error handling for errors in extension fields.

-- /example/ ASN1START

-- Example with extension addition group

ItemInfoList ::= SEQUENCE (SIZE (1..max)) OF ItemInfo

ItemInfo ::= SEQUENCE {

itemIdentity INTEGER (1..max),

field1 Field1,

field2 Field2 OPTIONAL, -- Need ON

...

[[ field3-r9 Field3-r9 OPTIONAL, -- Cond Cond1

field4-r9 Field4-r9 OPTIONAL -- Need ON

]]

}

-- Example with traditional non-critical extension (empty sequence)

BroadcastInfoBlock1 ::= SEQUENCE {

itemIdentity INTEGER (1..max),

field1 Field1,

field2 Field2 OPTIONAL, -- Need ON

nonCriticalExtension BroadcastInfoBlock1-v940-IEs OPTIONAL

}

BroadcastInfoBlock1-v940-IEs::= SEQUENCE {

field3-r9 Field3-r9 OPTIONAL, -- Cond Cond1

field4-r9 Field4-r9 OPTIONAL, -- Need ON

nonCriticalExtension SEQUENCE {} OPTIONAL -- Need OP

}

-- ASN1STOP

The UE shall, apply the following principles regarding the levels applicable in case of nested error handling:

- an extension additon group is not regarded as a level on its own. E.g. in the ASN.1 extract in the previous, a error regarding the conditionality of *field3* would result in the entire itemInfo entry to be ignored (rather than just the extension addition group containing *field3* and *field4*)

- a traditional *nonCriticalExtension* is not regarded as a level on its own. E.g. in the ASN.1 extract in the previous, a error regarding the conditionality of *field3* would result in the entire *BroadcastInfoBlock1* to be ignored (rather than just the non critical extension containing *field3* and *field4*).

### 5.7.5 Not comprehended field

The UE shall, when receiving an RRC message on any logical channel:

1> if the message includes a field that the UE does not comprehend:

2> treat the rest of the message as if the field was absent;

NOTE: This clause does not apply to the case of an extension to the value range of a field. Such cases are addressed instead by the requirements in clause 5.7.3.

## 5.8a SC-PTM

### 5.8a.1 Introduction

#### 5.8a.1.1 General

SC-PTM control information is provided on a specific logical channel: the SC-MCCH. The SC-MCCH carries the *SCPTMConfiguration* message which indicates the MBMS sessions that are ongoing as well as the (corresponding) information on when each session may be scheduled, i.e. scheduling period, scheduling window and start offset. The *SCPTMConfiguration* message also provides information about the neighbour cells transmitting the MBMS sessions which are ongoing on the current cell. In this release of the specification, an SC-PTM capable UE is only required to support reception of a single MBMS service at a time, and reception of more than one MBMS service in parallel is left for UE implementation.

A limited amount of SC-PTM control information is provided on the BCCH or BR-BCCH. This primarily concerns the information needed to acquire the SC-MCCH.

NOTE: For BL UEs and UEs in CE, SC-MCCH transmission uses a 1.4 MHz channel bandwidth and a maximum TBS of 936 bits, see TS 36.213 [23]. For NB-IoT UEs, the maximum TBS for SC-MCCH transmission is 680 bits, see TS 36.213 [23].

#### 5.8a.1.2 SC-MCCH scheduling

The SC-MCCH information (i.e. information transmitted in messages sent over SC-MCCH) is transmitted periodically, using a configurable repetition period. SC-MCCH transmissions (and the associated radio resources and MCS) are indicated on PDCCH.

#### 5.8a.1.3 SC-MCCH information validity and notification of changes

Change of SC-MCCH information only occurs at specific radio frames, i.e. the concept of a modification period is used. Within a modification period, the same SC-MCCH information may be transmitted a number of times, as defined by its scheduling (which is based on a repetition period). The modification period boundaries are defined by SFN values for which SFN mod *m*= 0, where *m* is the number of radio frames comprising the modification period. The modification periodis configured by means of *SystemInformationBlockType20* (*SystemInformationBlockType20-NB* in NB-IoT). If H-SFN is provided in *SystemInformationBlockType1-BR*, modification period boundaries for BL UEs or UEs in CE are defined by SFN values for which (H-SFN \* 1024 + SFN) mod *m*=0. The modification period boundaries for NB-IoT UEs are defined by SFN values for which (H-SFN \* 1024 + SFN) mod *m*=0.

When the network changes (some of) the SC-MCCH information, it notifies the UEs, other than BL UEs, UEs in CE or NB-IoT UEs, about the change in the first subframe which can be used for SC-MCCH transmission in a repetition period. LSB bit in 8-bit bitmap when set to '1' indicates the change in SC-MCCH. Upon receiving a change notification, a UE interested to receive MBMS services transmitted using SC-PTM acquires the new SC-MCCH information starting from the same subframe. The UE applies the previously acquired SC-MCCH information until the UE acquires the new SC-MCCH information.

When the network changes (some of) the SC-MCCH information for start of new MBMS service(s) transmitted using SC-PTM, it notifies BL UEs, UEs in CE or NB-IoT UEs about the change in every PDCCH which schedules the first SC-MCCH in a repetition period in the current modification period. The notification is transmitted with 1 bit. The bit, when set to '1', indicates the start of new MBMS service(s), see TS 36.212 [22], clauses 5.3.3.1.14 and 6.4.3.3. Upon receiving a change notification, a BL UE, UE in CE or NB-IoT UE interested to receive MBMS services transmitted using SC-PTM acquires the new SC-MCCH information scheduled by the PDCCH. The BL UE, UE in CE or NB-IoT UE applies the previously acquired SC-MCCH information until the BL UE, UE in CE or NB-IoT UE acquires the new SC-MCCH information.

When the network changes SC-MTCH specific information e.g. start of new MBMS service(s) transmitted using SC-PTM or change of ongoing MBMS service(s) transmitted using SC-PTM, it notifies the BL UEs, UEs in CE or NB-IoT UEs in the PDCCH which schedules the SC-MTCH in the current modification period. The notification is transmitted with a 2 bit bitmap. The LSB in the 2-bit bitmap, when set to '1', indicates the change of the on-going MBMS service and the MSB in the 2-bit bitmap, when set to '1', indicates the start of new MBMS service(s), see TS 36.212 [22], clauses 5.3.3.1.12, 5.3.3.1.13 and 6.4.3.2. In the case the network changes an on-going SC-MTCH transmission in the next modification period, it notifies the BL UEs, UEs in CE or NB-IoT UEs in the PDCCH which schedules this SC-MTCH in the current modification period. In the case the network starts new MBMS service(s) transmitted using SC-PTM, the network notifies the UEs which have on-going SC-MTCH in the PDCCH scheduling each of the SC-MTCH. Upon receiving such notification, a BL UE, UE in CE or NB-IoT UE acquires the new SC-MCCH information at the start of the next modification period. The BL UE, UE in CE or NB-IoT UE applies the previously acquired SC-MCCH information until the BL UE, UE in CE or NB-IoT UE acquires the new SC-MCCH information.

#### 5.8a.1.4 Procedures

The SC-PTM capable UE receiving or interested to receive MBMS service(s) via SC-MRB applies SC-PTM procedures described in 5.8a and, except for NB-IoT UE, the MBMS interest indication procedure as specified in 5.8.5.

### 5.8a.2 SC-MCCH information acquisition

#### 5.8a.2.1 General



Figure 5.8a.2.1-1: SC-MCCH information acquisition

The UE applies the SC-MCCH information acquisition procedure to acquire the SC-PTM control information that is broadcast by the E-UTRAN. The procedure applies to SC-PTM capable UEs that are in RRC\_IDLE except for BL UEs, UEs in CE and NB-IoT UEs, performing EDT procedure. This procedure also applies to SC-PTM capable UEs that are in RRC\_CONNECTED except for BL UEs, UEs in CE or NB-IoT UEs.

#### 5.8a.2.2 Initiation

A UE interested to receive MBMS services via SC-MRB shall apply the SC-MCCH information acquisition procedure upon entering the cell broadcasting *SystemInformationBlockType20* (*SystemInformationBlockType20-NB* in NB-IoT) (e.g. upon power on, following UE mobility) and upon receiving a notification that the SC-MCCH information has changed. A UE, except for BL UE, UE in CE or NB-IoT UE, that is receiving an MBMS service via SC-MRB shall apply the SC-MCCH information acquisition procedure to acquire the SC-MCCH information that corresponds with the service that is being received, at the start of each modification period. The BL UE, UE in CE or NB-IoT UE that is receiving an MBMS service via SC-MRB shall apply the SC-MCCH information acquisition procedure upon receiving a notification that the SC-MCCH information that corresponds with the service that is being received is about to be changed. The BL UE, UE in CE or NB-IoT UE that is receiving an MBMS service via SC-MRB may apply the SC-MCCH information acquisition procedure upon receiving a notification that the SC-MCCH information is about to be changed due to start of a new service.

Unless explicitly stated otherwise in the procedural specification, the SC-MCCH information acquisition procedure overwrites any stored SC-MCCH information, i.e. delta configuration is not applicable for SC-MCCH information and the UE discontinues using a field if it is absent in SC-MCCH information unless explicitly specified otherwise.

#### 5.8a.2.3 SC-MCCH information acquisition by the UE

A SC-PTM capable UE shall:

1> if the procedure is triggered by an SC-MCCH information change notification and the UE has no ongoing MBMS service:

2> except for a BL UE, UE in CE or NB-IoT UE, start acquiring the *SCPTMConfiguration* message from the subframe in which the change notification was received;

2> for a BL UE, UE in CE or NB-IoT UE, acquire the *SCPTMConfiguration* message scheduled by the PDCCH in which the change notification was received;

NOTE 1: The UE continues using the previously received SC-MCCH information until the new SC-MCCH information has been acquired.

1> if the UE enters a cell broadcasting *SystemInformationBlockType20* (*SystemInformationBlockType20-NB* in NB-IoT):

2> acquire the *SCPTMConfiguration* message at the next repetition period;

1> if the UE is receiving an MBMS service via an SC-MRB:

2> except for BL UE, UE in CE or NB-IoT UE, start acquiring the *SCPTMConfiguration* message from the beginning of each modification period;

2> a BL UE, UE in CE or NB-IoT UE shall start acquiring the *SCPTMConfiguration* message at the start of the next modification period upon receiving a notification that the SC-MCCH information that corresponds with the service that is being received is about to be changed;

2> a BL UE, UE in CE or NB-IoT UE may start acquiring the *SCPTMConfiguration* message at the start of the next modification period upon receiving a notification that the SC-MCCH information is about to be changed due to start of a new service;

#### 5.8a.2.4 Actions upon reception of the *SCPTMConfiguration* message

No UE requirements related to the contents of this *SCPTMConfiguration* apply other than those specified elsewhere e.g. within procedures using the concerned system information, the corresponding field descriptions.

### 5.8a.3 SC-PTM radio bearer configuration

#### 5.8a.3.1 General

The SC-PTM radio bearer configuration procedure is used by the UE to configure RLC, MAC and the physical layer upon starting and/or stopping to receive an SC-MRB transmitted on SC-MTCH. The procedure applies to SC-PTM capable UEs that are in RRC\_IDLE and to SC-PTM capable UEs that are not BL UEs, UEs in CE or NB-IoT UEs in RRC\_CONNECTED, and are interested to receive one or more MBMS services via SC-MRB.

NOTE: In case the UE is unable to receive an MBMS service via an SC-MRB due to capability limitations, upper layers may take appropriate action e.g. terminate a lower priority unicast service.

#### 5.8a.3.2 Initiation

The UE applies the SC-MRB establishment procedure to start receiving a session of a MBMS service it has an interest in. The procedure may be initiated e.g. upon start of the MBMS session, upon entering a cell providing via SC-MRB a MBMS service in which the UE has interest, upon becoming interested in the MBMS service, upon removal of UE capability limitations inhibiting reception of the concerned service.

The UE applies the SC-MRB release procedure to stop receiving a session. The procedure may be initiated e.g. upon stop of the MBMS session, upon leaving the cell where a SC-MRB is established, upon losing interest in the MBMS service, when capability limitations start inhibiting reception of the concerned service.

#### 5.8a.3.3 SC-MRB establishment

Upon SC-MRB establishment, the UE shall:

1> establish an RLC entity in accordance with the configuration specified in 9.1.1.7;

1> configure a SC-MTCH logical channel applicable for the SC-MRB and instruct MAC to receive DL-SCH on the cell where the *SCPTMConfiguration* message was received for the MBMS service for which the SC-MRB is established and using *g-RNTI* and *sc-mtch-SchedulingInfo* (if included) in this message for this MBMS service;

1> configure the physical layer in accordance with the *sc-mtch-InfoList*, applicable for the SC-MRB, as included in the *SCPTMConfiguration* message;

1> inform upper layers about the establishment of the SC-MRB by indicating the corresponding *tmgi* and *sessionId*;

#### 5.8a.3.4 SC-MRB release

Upon SC-MRB release, the UE shall:

1> release the RLC entity as well as the related MAC and physical layer configuration;

1> inform upper layers about the release of the SC-MRB by indicating the corresponding *tmgi* and *sessionId*;

# 6 Protocol data units, formats and parameters (tabular & ASN.1)

## 6.1 General

The contents of each RRC message is specified in clause 6.2 using ASN.1 to specify the message syntax and using tables when needed to provide further detailed information about the fields specified in the message syntax. The syntax of the information elements that are defined as stand-alone abstract types is further specified in a similar manner in clause 6.3.

The need for fields to be present in a message or an abstract type, i.e., the ASN.1 fields that are specified as OPTIONAL in the abstract notation (ASN.1), is specified by means of comment text tags attached to the OPTIONAL statement in the abstract syntax. All comment text tags are available for use in the downlink direction only. The meaning of each tag is specified in table 6.1-1.

Table 6.1-1: Meaning of abbreviations used to specify the need for fields to be present

| Abbreviation | Meaning |
| --- | --- |
| Cond *conditionTag*  (Used in downlink only) | *Conditionally present*  A field for which the need is specified by means of conditions. For each *conditionTag*, the need is specified in a tabular form following the ASN.1 segment. In case, according to the conditions, a field is not present, the UE takes no action and where applicable shall continue to use the existing value (and/ or the associated functionality) unless explicitly stated otherwise (e.g. in the conditional presence table or in the description of the field itself). |
| Need OP  (Used in downlink only) | *Optionally present*  A field that is optional to signal. For downlink messages, the UE is not required to take any special action on absence of the field beyond what is specified in the procedural text or the field description table following the ASN.1 segment. The UE behaviour on absence should be captured either in the procedural text or in the field description. |
| Need ON  (Used in downlink only) | *Optionally present, No action*  A field that is optional to signal. If the message is received by the UE, and in case the field is absent, the UE takes no action and where applicable shall continue to use the existing value (and/ or the associated functionality). |
| Need OR  (Used in downlink only) | *Optionally present, Release*  A field that is optional to signal. If the message is received by the UE, and in case the field is absent, the UE shall discontinue/ stop using/ delete any existing value (and/ or the associated functionality). |

Any field with Need ON in system information shall be interpreted as Need OR.

Need codes may not be specified for a parent extension field/ extension group, used in downlink, which includes one or more child extension fields. Upon absence of such a parent extension field/ extension group, the UE shall:

- For each individual child extension field, including extensions that are mandatory to include in the optional group, act in accordance with the need code that is defined for the extension;

- Apply this behaviour not only for child extension fields included directly within the optional parent extension field/ extension group, but also for extension fields defined at further nesting levels as long as for none of the fields in-between the concerned extension field and the parent extension field a need code is specified;

NOTE 1: The above applies for groups of non critical extensions using double brackets (referred to as extension groups), as well as non-critical extensions at the end of a message or at the end of a structure contained in a BIT STRING or OCTET STRING (referred to as parent extension fields).

Need codes, conditions and ASN.1 defaults specified for a particular (child) field only apply in case the (parent) field including the particular field is present. This rule does not apply for optional parent extension fields/ extension groups without need codes,

NOTE 2: The previous rule implies that E-UTRAN has to include such a parent extension field to release a child field that is either:

- Optional with need OR, or

- Conditional while the UE releases the child field when absent.

The handling of need codes as specified in the previous is illustrated by means of an example, as shown in the following ASN.1.

-- /example/ ASN1START

RRCMessage-r8-IEs ::= SEQUENCE {

field1 InformationElement1,

field2 InformationElement2 OPTIONAL, -- Need ON

nonCriticalExtension RRCMessage-v8a0-IEs OPTIONAL

}

RRCMessage-v8a0-IEs ::= SEQUENCE {

field3 InformationElement3 OPTIONAL, -- Need ON

nonCriticalExtension RRCMessage-v940-IEs OPTIONAL

}

RRCMessage-v940-IEs ::= SEQUENCE {

field4 InformationElement4 OPTIONAL, -- Need OR

nonCriticalExtension SEQUENCE {} OPTIONAL

}

InformationElement1 ::= SEQUENCE {

field11 InformationElement11 OPTIONAL, -- Need ON

field12 InformationElement12 OPTIONAL, -- Need OR

...,

[[ field13 InformationElement13 OPTIONAL, -- Need OR

field14 InformationElement14 OPTIONAL -- Need ON

]]

}

InformationElement2 ::= SEQUENCE {

field21 InformationElement11 OPTIONAL, -- Need OR

...

}

-- ASN1STOP

The handling of need codes as specified in the previous implies that:

- if *field2* in *RRCMessage-r8-IEs* is absent, the UE does not modify *field21*;

- if *field2* in *RRCMessage-r8-IEs* is present but does not include *field21*, the UE releases *field21*;

- if the extension group containing *field13* is absent, the UE releases *field13* and does not modify *field14*;

- if *nonCriticalExtension* defined by IE *RRCMessage-v8a0-IEs* is absent, the UE does not modify *field3* and releases *field4*;

In the ASN.1 of this specification, the first bit of a bit string refers to the leftmost bit, unless stated otherwise.

### 6.3.1 System information blocks

#### *– SystemInformationBlockType31*

The IE *SystemInformationBlockType31* contains satellite assistance information for the serving cell. *SystemInformationBlockType31* is only signalled for an NTN cell.

*SystemInformationBlockType31* information element

-- ASN1START

SystemInformationBlockType31-r17 ::= SEQUENCE {

servingSatelliteInfo-r17 ServingSatelliteInfo-r17,

lateNonCriticalExtension OCTET STRING OPTIONAL,

...,

[[ servingSatelliteInfo-v1820 ServingSatelliteInfo-v1820 OPTIONAL -- Need OR

]]

}

ServingSatelliteInfo-r17 ::= SEQUENCE {

ephemerisInfo-r17 CHOICE {

stateVectors EphemerisStateVectors-r17,

orbitalParameters EphemerisOrbitalParameters-r17

},

nta-CommonParameters-r17 SEQUENCE {

nta-Common-r17 INTEGER (0..8316827) OPTIONAL, -- Need OP

nta-CommonDrift-r17 INTEGER (-261935..261935) OPTIONAL, -- Need OP

nta-CommonDriftVariation-r17 INTEGER (0..29479) OPTIONAL -- Need OP

},

ul-SyncValidityDuration-r17 ENUMERATED {s5, s10, s15, s20, s25, s30, s35, s40,

s45, s50, s55, s60, s120, s180, s240, s900},

epochTime-r17 SEQUENCE {

startSFN-r17 INTEGER (0..1023),

startSubFrame-r17 INTEGER (0..9)

} OPTIONAL, -- Need OP

k-Offset-r17 INTEGER (0..1023),

k-Mac-r17 INTEGER (1..512) OPTIONAL, -- Need OP

...

}

ServingSatelliteInfo-v1820 ::= SEQUENCE {

satelliteId-r18 SatelliteId-r18 OPTIONAL, -- Need OR

referenceLocation-r18 CHOICE {

fixedReferenceLocation-r18 ReferenceLocation-r18,

movingReferenceLocation-r18 ReferenceLocation-r18

} OPTIONAL, -- Need OR

distanceThresh-r18 INTEGER(0..65535) OPTIONAL -- Need OR

}

-- ASN1STOP

|  |
| --- |
| *SystemInformationBlockType31* field descriptions |
| ***distanceThresh***  Distance from the serving cell reference location and is used in location-based measurement initiation in RRC\_IDLE (as specified in TS 36.304 [4]) and RRC\_CONNECTED. Each step represents 50m. |
| ***epochTime***  Epoch time of the satellite ephemeris data and common TA parameters, see TS 36.213 [23]. This field also indicates the epoch time for the reference location of earth moving cells if present. The reference point for epoch time of the serving satellite ephemeris and Common TA parameters is the uplink time synchronization reference point of the serving cell.  *epochTime* is the starting time of a DL subframe indicated by *startSFN* and *startSubframe*. For serving cell, the *epochTime* is no earlier than the frame where the last repetition of the message indicating the *epochTime* is transmitted.  If the field is absent, the epoch time is the starting time of the DL subframe corresponding to the end of the SI window during which the SI message carrying SIB31(-NB) is transmitted.  E-UTRAN always includes *epochTime* when SIB31(-NB) is provided through dedicated signalling.  In case of handover or conditional handover, this field is based on the timing of the target cell, i.e. the *startSFN* and *startSubFrame* number indicated in this field refers to the SFN and sub-frame of the target cell, and UE considers the target cell epoch time (indicated by the *startSFN* and *startSubFrame* in this field) to be the frame nearest to the frame where *RRCConnectionReconfiguration* message is received. In case of handover or conditional handover, the reference point for epoch time of the target NTN payload ephemeris and Common TA parameters is the uplink time synchronization reference point of the target cell. |
| ***k-Mac***  Scheduling offset used when downlink and uplink frame timing are not aligned at the eNB, see TS 36.213 [23]. Unit in ms.  If the field if absent, the UE uses the (default) value of 0. |
| ***k-Offset***  Scheduling offset used in the timing relationships in NTN, see TS 36.213 [23]. Unit in ms. |
| ***nta-Common***  Network-controlled common TA, see TS 36.213 [23]. Unit of μs.  Step of 32.55208 ×10-3 μs. Actual value = field value \* 32.55208 ×10-3.  If the field is absent, the UE uses the (default) value of 0. |
| ***nta-CommonDrift***  Drift rate of the common TA, see TS 36.213 [23]. Unit of μs/s.  Step of 0.2 ×10-3 μs/s. Actual value = field value \* 0.2 ×10-3.  If the field is absent, the UE uses the (default) value of 0. |
| ***nta-CommonDriftVariation***  Drift rate variation of the common TA, see TS 36.213 [23]. Unit of μs/s2.  Step of 0.2 ×10-4 μs/s2. Actual value = field value \* 0.2 ×10-4.  If the field is absent, the UE uses the (default) value of 0. |
| ***orbitalParameters***  Instantaneous values of the satellite orbital parameters. The signalled values are valid at least for the duration as defined by *ul-SyncValidityDuration* and *epochTime*. |
| ***referenceLocation***  Reference location of the NTN (quasi-)earth fixed cell or earth moving cell, used in location-based measurement initiation in RRC\_IDLE (as specified in TS 36.304 [4]) and RRC\_CONNECTED if *distanceThresh* is also configured. If configured by an earth moving cell, the broadcast reference location corresponds to the epoch time and is also used in the evaluation of Event D2 and CondEvent D2, and the UE derives the real-time reference location based on the serving satellite ephemeris, see TS 36.304 [4]. |
| ***stateVectors***  Instantaneous values of the satellite state vectors. The signalled values are valid at least for the duration as defined by *ul-SyncValidityDuration* and *epochTime*. |
| ***ul-SyncValidityDuration***  Validity duration of the satellite ephemeris data and common TA parameters, i.e. maximum time duration (from *epochTime*) during which the UE can apply the satellite ephemeris without acquiring new satellite ephemeris, see TS 36.213 [23]. Unit in second.  Value *s5* corresponds to 5 seconds, value *s10* corresponds to 10 seconds and so on.  The *ul-SyncValidityDuration* is only updated when at least one of *epochTime*, *nta-CommonParameters*, *ephemerisInfo* is updated. |

## 6.7 NB-IoT RRC messages

### 6.7.1 General NB-IoT message structure

-- ASN1START

NBIOT-RRC-Definitions DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS

RRCConnectionReestablishmentReject,

SecurityModeCommand,

SecurityModeComplete,

SecurityModeFailure,

AdditionalSpectrumEmission,

ARFCN-ValueEUTRA-r9,

CarrierFreqsGERAN,

CellGlobalIdEUTRA,

CellIdentity,

C-RNTI,

DedicatedInfoNAS,

DRB-Identity,

GNSS-PositionFixDuration-r18,

GNSS-ValidityDuration-r17,

InitialUE-Identity,

IntraFreqExcludedCellList,

IntraFreqNeighCellList,

I-RNTI-r15,

LocationInfo-r10,

maxAccessCat-1-r15,

maxBands,

maxExcludedCell,

maxCellInter,

maxCellIntra,

maxFBI2,

maxFreq,

maxMultiBands,

maxNrofS-NSSAI-r15,

maxPageRec,

maxPLMN-r11,

maxSAI-MBMS-r11,

maxSat-r17,

maxSIB,

maxSIB-1,

MBMS-SAI-r11,

MBMS-SAI-List-r11,

MBMSSessionInfo-r13,

NeighSatelliteInfoList-r18,

NextHopChainingCount,

NG-5G-S-TMSI-r15,

PagingUE-Identity,

PLMN-Identity,

PLMN-IdentityList2,

P-Max,

PowerRampingParameters,

PreambleTransMax,

PhysCellId,

Q-OffsetRange,

Q-QualMin-r9,

Q-RxLevMin,

ReestabUE-Identity,

RegisteredAMF-r15,

RegisteredMME,

ReselectionThreshold,

ResumeIdentity-r13,

RRC-TransactionIdentifier,

RSRP-Range,

S-NSSAI-r15,

S-TMSI,

SatelliteId-r18,

SatelliteInfoList-r17,

SatelliteInfoList-v1800,

ServingSatelliteInfo-r17,

ServingSatelliteInfo-v1820,

SetupRelease,

ShortMAC-I,

SystemInformationBlockType16-r11,

SystemInfoValueTagSI-r13,

T-Reordering,

T-ReorderingExt-r17,

TimeAlignmentTimer,

TimeSinceFailure-r11,

TimeOffsetUTC-r17,

TMGI-r9,

TrackingAreaCode,

TrackingAreaCode-5GC-r15,

UAC-AC1-SelectAssistInfo-r15,

DataInactivityTimer-r14

FROM EUTRA-RRC-Definitions;

-- ASN1STOP

#### – *BCCH-BCH-Message-NB*

The *BCCH-BCH-Message-NB* class is the set of RRC messages that may be sent from the E‑UTRAN to the UE via BCH on the BCCH logical channel in FDD.

-- ASN1START

BCCH-BCH-Message-NB ::= SEQUENCE {

message BCCH-BCH-MessageType-NB

}

BCCH-BCH-MessageType-NB::= MasterInformationBlock-NB

-- ASN1STOP

#### – *BCCH-BCH-Message-TDD-NB*

The *BCCH-BCH-Message-TDD-NB* class is the set of RRC messages that may be sent from the E‑UTRAN to the UE via BCH on the BCCH logical channel in TDD.

-- ASN1START

BCCH-BCH-Message-TDD-NB ::= SEQUENCE {

message BCCH-BCH-MessageType-TDD-NB-r15

}

BCCH-BCH-MessageType-TDD-NB-r15 ::= MasterInformationBlock-TDD-NB-r15

-- ASN1STOP

#### – *BCCH-DL-SCH-Message-NB*

The *BCCH-DL-SCH-Message-NB* class is the set of RRC messages that may be sent from the E‑UTRAN to the UE via DL‑SCH on the BCCH logical channel.

-- ASN1START

BCCH-DL-SCH-Message-NB ::= SEQUENCE {

message BCCH-DL-SCH-MessageType-NB

}

BCCH-DL-SCH-MessageType-NB ::= CHOICE {

c1 CHOICE {

systemInformation-r13 SystemInformation-NB,

systemInformationBlockType1-r13 SystemInformationBlockType1-NB

},

messageClassExtension SEQUENCE {}

}

-- ASN1STOP

#### – *PCCH-Message-NB*

The *PCCH-Message-NB* class is the set of RRC messages that may be sent from the E‑UTRAN to the UE on the PCCH logical channel.

-- ASN1START

PCCH-Message-NB ::= SEQUENCE {

message PCCH-MessageType-NB

}

PCCH-MessageType-NB ::= CHOICE {

c1 CHOICE {

paging-r13 Paging-NB

},

messageClassExtension SEQUENCE {}

}

-- ASN1STOP

#### – *DL-CCCH-Message-NB*

The *DL-CCCH-Message-NB* class is the set of RRC messages that may be sent from the E‑UTRAN to the UE on the downlink CCCH logical channel.

-- ASN1START

DL-CCCH-Message-NB ::= SEQUENCE {

message DL-CCCH-MessageType-NB

}

DL-CCCH-MessageType-NB ::= CHOICE {

c1 CHOICE {

rrcConnectionReestablishment-r13 RRCConnectionReestablishment-NB,

rrcConnectionReestablishmentReject-r13 RRCConnectionReestablishmentReject,

rrcConnectionReject-r13 RRCConnectionReject-NB,

rrcConnectionSetup-r13 RRCConnectionSetup-NB,

rrcEarlyDataComplete-r15 RRCEarlyDataComplete-NB-r15,

spare3 NULL, spare2 NULL, spare1 NULL

},

messageClassExtension SEQUENCE {}

}

-- ASN1STOP

#### – *DL-DCCH-Message-NB*

The *DL-DCCH-Message-NB* class is the set of RRC messages that may be sent from the E‑UTRAN to the UE on the downlink DCCH logical channel.

-- ASN1START

DL-DCCH-Message-NB ::= SEQUENCE {

message DL-DCCH-MessageType-NB

}

DL-DCCH-MessageType-NB ::= CHOICE {

c1 CHOICE {

dlInformationTransfer-r13 DLInformationTransfer-NB,

rrcConnectionReconfiguration-r13 RRCConnectionReconfiguration-NB,

rrcConnectionRelease-r13 RRCConnectionRelease-NB,

securityModeCommand-r13 SecurityModeCommand,

ueCapabilityEnquiry-r13 UECapabilityEnquiry-NB,

rrcConnectionResume-r13 RRCConnectionResume-NB,

ueInformationRequest-r16 UEInformationRequest-NB-r16,

spare1 NULL

},

messageClassExtension SEQUENCE {}

}

-- ASN1STOP

#### – *UL-CCCH-Message-NB*

The *UL-CCCH-Message-NB* class is the set of RRC messages that may be sent from the UE to the E‑UTRAN on the uplink CCCH logical channel.

-- ASN1START

UL-CCCH-Message-NB ::= SEQUENCE {

message UL-CCCH-MessageType-NB

}

UL-CCCH-MessageType-NB ::= CHOICE {

c1 CHOICE {

rrcConnectionReestablishmentRequest-r13 RRCConnectionReestablishmentRequest-NB,

rrcConnectionRequest-r13 RRCConnectionRequest-NB,

rrcConnectionResumeRequest-r13 RRCConnectionResumeRequest-NB,

rrcEarlyDataRequest-r15 RRCEarlyDataRequest-NB-r15

},

messageClassExtension SEQUENCE {}

}

-- ASN1STOP

#### – *SC-MCCH-Message-NB*

The *SC-MCCH-Message-NB* class is the set of RRC messages that may be sent from the E‑UTRAN to the NB-IoT UE on the SC-MCCH logical channel.

-- ASN1START

SC-MCCH-Message-NB ::= SEQUENCE {

message SC-MCCH-MessageType-NB

}

SC-MCCH-MessageType-NB ::= CHOICE {

c1 CHOICE {

scptmConfiguration-r14 SCPTMConfiguration-NB-r14

},

messageClassExtension SEQUENCE {}

}

-- ASN1STOP

#### – *UL-DCCH-Message-NB*

The *UL-DCCH-Message-NB* class is the set of RRC messages that may be sent from the UE to the E‑UTRAN on the uplink DCCH logical channel.

-- ASN1START

UL-DCCH-Message-NB ::= SEQUENCE {

message UL-DCCH-MessageType-NB

}

UL-DCCH-MessageType-NB ::= CHOICE {

c1 CHOICE {

rrcConnectionReconfigurationComplete-r13 RRCConnectionReconfigurationComplete-NB,

rrcConnectionReestablishmentComplete-r13 RRCConnectionReestablishmentComplete-NB,

rrcConnectionSetupComplete-r13 RRCConnectionSetupComplete-NB,

securityModeComplete-r13 SecurityModeComplete,

securityModeFailure-r13 SecurityModeFailure,

ueCapabilityInformation-r13 UECapabilityInformation-NB,

ulInformationTransfer-r13 ULInformationTransfer-NB,

rrcConnectionResumeComplete-r13 RRCConnectionResumeComplete-NB,

ueInformationResponse-r16 UEInformationResponse-NB-r16,

purConfigurationRequest-r16 PURConfigurationRequest-NB-r16,

spare6 NULL, spare5 NULL, spare4 NULL,

spare3 NULL, spare2 NULL, spare1 NULL

},

messageClassExtension SEQUENCE {}

}

-- ASN1STOP

### 6.7.2 NB-IoT Message definitions

#### – *DLInformationTransfer-NB*

The *DLInformationTransfer-NB* message is used for the downlink transfer of NAS dedicated information.

Signalling radio bearer: SRB1or SRB1bis

RLC-SAP: AM

Logical channel: DCCH

Direction: E‑UTRAN to UE

*DLInformationTransfer-NB* message

-- ASN1START

DLInformationTransfer-NB ::= SEQUENCE {

rrc-TransactionIdentifier RRC-TransactionIdentifier,

criticalExtensions CHOICE {

c1 CHOICE {

dlInformationTransfer-r13 DLInformationTransfer-NB-r13-IEs,

spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

DLInformationTransfer-NB-r13-IEs ::= SEQUENCE {

dedicatedInfoNAS-r13 DedicatedInfoNAS,

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

#### – *MasterInformationBlock-NB*

The *MasterInformationBlock-NB* includes the system information transmitted on BCH in FDD.

Signalling radio bearer: N/A

RLC-SAP: TM

Logical channel: BCCH

Direction: E‑UTRAN to UE

*MasterInformationBlock-NB*

-- ASN1START

MasterInformationBlock-NB ::= SEQUENCE {

systemFrameNumber-MSB-r13 BIT STRING (SIZE (4)),

hyperSFN-LSB-r13 BIT STRING (SIZE (2)),

schedulingInfoSIB1-r13 INTEGER (0..15),

systemInfoValueTag-r13 INTEGER (0..31),

ab-Enabled-r13 BOOLEAN,

operationModeInfo-r13 CHOICE {

inband-SamePCI-r13 Inband-SamePCI-NB-r13,

inband-DifferentPCI-r13 Inband-DifferentPCI-NB-r13,

guardband-r13 Guardband-NB-r13,

standalone-r13 Standalone-NB-r13

},

additionalTransmissionSIB1-r15 BOOLEAN,

ab-Enabled-5GC-r16 BOOLEAN,

partEARFCN-r17 CHOICE {

spare BIT STRING (SIZE (2)),

earfcn-LSB BIT STRING (SIZE (2))

},

spare BIT STRING (SIZE (6))

}

Guardband-NB-r13 ::= SEQUENCE {

rasterOffset-r13 ChannelRasterOffset-NB-r13,

spare BIT STRING (SIZE (3))

}

Inband-SamePCI-NB-r13 ::= SEQUENCE {

eutra-CRS-SequenceInfo-r13 INTEGER (0..31)

}

Inband-DifferentPCI-NB-r13 ::= SEQUENCE {

eutra-NumCRS-Ports-r13 ENUMERATED {same, four},

rasterOffset-r13 ChannelRasterOffset-NB-r13,

spare BIT STRING (SIZE (2))

}

Standalone-NB-r13 ::= SEQUENCE {

spare BIT STRING (SIZE (5))

}

-- ASN1STOP

| *MasterInformationBlock-NB* field descriptions |
| --- |
| ***ab-Enabled***  Value TRUE indicates that access barring is enabled for UEs connected to EPC. |
| ***ab-Enabled-5GC***  Value TRUE indicates that access barring is enabled for UEs connected to 5GC. |
| ***additionalTransmissionSIB1***  Value TRUE indicates that additional SIB1-NB transmissions are present. See TS 36.211 [21] and TS 36.213 [23].  E-UTRAN only configures *additionalTransmissionSIB1* to *TRUE* if *schedulingInfoSIB1* indicates that the number of NPDSCH repetitions is 16, see TS 36.213 [23], Table 16.4.1.3-3. |
| ***earfcn-LSB***  Indicates the 2 least significant bits of the EARFCN for NTN bands where 100 kHz raster is used, see TS 36.102 [113]. |
| ***eutra-CRS-SequenceInfo***  Information of the carrier containing NPSS/NSSS/NPBCH.  Each value is associated with an E-UTRA PRB index as an offset from the middle of the LTE system sorted out by channel raster offset. See TS 36.211[21] and TS 36.213 [23]. |
| ***eutra-NumCRS-Ports***  Number of E-UTRA CRS antenna ports, either the same number of ports as NRS or 4 antenna ports. See TS 36.211 [21], TS 36.212 [22], and TS 36.213 [23]. |
| ***hyperSFN-LSB***  Indicates the 2 least significant bits of hyper SFN. The remaining bits are present in *SystemInformationBlockType1-NB.* |
| ***operationModeInfo***  Deployment scenario (in-band/guard-band/standalone) and related information. See TS 36.211 [21] and TS 36.213 [23].  *Inband-SamePCI* indicates an in-band deployment and that the NB-IoT and LTE cell share the same physical cell id and have the same number of NRS and CRS ports.  *Inband-DifferentPCI* indicates an in-band deployment and that the NB-IoT and LTE cell have different physical cell id.  *guardband* indicatesa guard-band deployment.  *standalone* indicates a standalone deployment. |
| ***schedulingInfoSIB1***  This field contains an index to a table specified in TS 36.213 [23], Table 16.4.1.3-3, that defines *SystemInformationBlockType1-NB* scheduling information. |
| ***systemFrameNumber-MSB***  Defines the 4 most significant bits of the SFN. As indicated in TS 36.211 [21], the 6 least significant bits of the SFN are acquired implicitly by decoding the NPBCH. |
| ***systemInfoValueTag***  Common for all SIBs other than MIB-NB, SIB14-NB, SIB16-NB, SIB31-NB and SIB33-NB. |

#### *– MasterInformationBlock-TDD-NB*

The *MasterInformationBlock-TDD-NB* includes the system information transmitted on BCH in TDD.

Signalling radio bearer: N/A

RLC-SAP: TM

Logical channel: BCCH

Direction: E‑UTRAN to UE

*MasterInformationBlock-TDD-NB*

-- ASN1START

MasterInformationBlock-TDD-NB-r15 ::= SEQUENCE {

systemFrameNumber-MSB-r15 BIT STRING (SIZE (4)),

hyperSFN-LSB-r15 BIT STRING (SIZE (2)),

schedulingInfoSIB1-r15 INTEGER (0..15),

systemInfoValueTag-r15 INTEGER (0..31),

ab-Enabled-r15 BOOLEAN,

operationModeInfo-r15 CHOICE {

inband-SamePCI-r15 Inband-SamePCI-TDD-NB-r15,

inband-DifferentPCI-r15 Inband-DifferentPCI-TDD-NB-r15,

guardband-r15 GuardbandTDD-NB-r15,

standalone-r15 StandaloneTDD-NB-r15

},

sib1-CarrierInfo-r15 ENUMERATED {anchor, non-anchor},

ab-Enabled-5GC-r16 BOOLEAN,

spare BIT STRING (SIZE (8))

}

GuardbandTDD-NB-r15 ::= SEQUENCE {

rasterOffset-r15 ChannelRasterOffset-NB-r13,

sib-GuardbandInfo-r15 CHOICE {

sib-GuardbandAnchor-r15 SIB-GuardbandAnchorTDD-NB-r15,

sib-GuardbandGuardband-r15 SIB-GuardbandGuardbandTDD-NB-r15,

sib-GuardbandInbandSamePCI-r15 SIB-GuardbandInbandSamePCI-TDD-NB-r15,

sib-GuardbandinbandDiffPCI-r15 SIB-GuardbandInbandDiffPCI-TDD-NB-r15

},

eutra-Bandwitdh-r15 ENUMERATED {bw5or10, bw15or20}

}

Inband-SamePCI-TDD-NB-r15 ::= SEQUENCE {

eutra-CRS-SequenceInfo-r15 INTEGER (0..31),

sib-InbandLocation-r15 ENUMERATED {lower, higher}

}

Inband-DifferentPCI-TDD-NB-r15 ::= SEQUENCE {

eutra-NumCRS-Ports-r15 ENUMERATED {same, four},

rasterOffset-r15 ChannelRasterOffset-NB-r13,

sib-InbandLocation-r15 ENUMERATED {lower, higher},

spare BIT STRING (SIZE (2))

}

StandaloneTDD-NB-r15 ::= SEQUENCE {

sib-StandaloneLocation-r15 ENUMERATED {lower, higher},

spare BIT STRING (SIZE (5))

}

SIB-GuardbandAnchorTDD-NB-r15 ::= SEQUENCE {

spare BIT STRING (SIZE (1))

}

SIB-GuardbandGuardbandTDD-NB-r15 ::= SEQUENCE {

sib-GuardbandGuardbandLocation-r15 ENUMERATED {same, opposite}

}

SIB-GuardbandInbandSamePCI-TDD-NB-r15 ::= SEQUENCE {

spare BIT STRING (SIZE (1))

}

SIB-GuardbandInbandDiffPCI-TDD-NB-r15 ::= SEQUENCE {

sib-EUTRA-NumCRS-Ports-r15 ENUMERATED {same, four}

}

-- ASN1STOP

| ***MasterInformationBlock-TDD-NB* field descriptions** |
| --- |
| ***ab-Enabled***  Value TRUE indicates that access barring is enabled for UEs connected to EPC. |
| ***ab-Enabled-5GC***  Value TRUE indicates that access barring is enabled for UEs connected to 5GC. |
| ***eutra-Bandwidth***  EUTRA system bandwidth. Value *bw5or10* corresponds to bandwidth 5 or 10 MHz, value *bw15or20* corresponds to bandwidth 15 or 20 MHz.  If the value of *eutra-Bandwidth* is *bw5or10* and *rasterOffset* is set to *khz7dot5*or *khz-7dot5*, the E-UTRA system bandwidth is 5 MHz.  If the value of *eutra-Bandwidth* is *bw5or10* and *rasterOffset* is set to *khz2dot5* or *khz-2dot5*, the E-UTRA system bandwidth is 10 MHz.  If the value of *eutra-Bandwidth* is *bw15or20* and *rasterOffset* is set to *khz7dot5* or *khz-7dot5*, the E-UTRA system bandwidth is 15 MHz.  If the value of *eutra-Bandwidth* is *bw15or20* and *rasterOffset* is set to *khz2dot5* or *khz-2dot5*, the E-UTRA system bandwidth is 20 MHz.  When the E-UTRA system bandwidth is 5 MHz or 15 MHz, if the value of *sib-GuardbandInfo* is *sib-GuardbandInbandSamePCI* or *sib-GuardbandinbandDiffPCI*, the offset between the anchor carrier and the non-anchor carrier used for SIB1 and/or SI transmission is 45 kHz. |
| ***eutra-CRS-SequenceInfo***  Information of the carrier containing NPSS/NSSS/NPBCH.  Each value is associated with an E-UTRA PRB index as an offset from the middle of the LTE system sorted out by channel raster offset. See TS 36.211 [21] and TS 36.213 [23]. |
| ***eutra-NumCRS-Ports, sib-eutra-NumCRS-Ports***  Number of E-UTRA CRS antenna ports, either the same number of ports as NRS or 4 antenna ports. See TS 36.211 [21], TS 36.212 [22], and TS 36.213 [23]. |
| ***hyperSFN-LSB***  Indicates the 2 least significant bits of hyper SFN. The remaining bits are present in *SystemInformationBlockType1-NB.* |
| ***operationModeInfo***  Deployment scenario (in-band/guard-band/standalone) and related information. See TS 36.211 [21] and TS 36.213 [23].  *Inband-SamePCI* indicates an in-band deployment and that the NB-IoT and LTE cell share the same physical cell id and have the same number of NRS and CRS ports.  *Inband-DifferentPCI* indicates an in-band deployment and that the NB-IoT and LTE cell have different physical cell id.  *guardband* indicatesa guard-band deployment.  *standalone* indicates a standalone deployment.  When *operationmodeInfo* is set to *guardband,* if *rasterOffset* is set to *khz-7dot5* or *khz-2dot5,* the guardband anchor carrier is at the higher edge of the LTE carrier. If *rasterOffset* is set to *khz7dot5* or *khz2dot5*, the guardband anchor carrier is at the lower edge of the LTE carrier |
| ***schedulingInfoSIB1***  This field contains an index to a table specified in TS 36.213 [23], Table 16.4.1.3-5 or Table 16.4.1.3-7 when *sib1-CarrierInfo* is set to *anchor* or to *non-anchor* respectively, that defines *SystemInformationBlockType1-NB* scheduling information.  If *sib1-CarrierInfo* is set to non-anchor, E-UTRAN configures a value between 0 and 7. |
| ***sib-GuardbandGuardbandLocation***  Location of the non-anchor carrier used for SIB1 and/or SI transmission when *operationmodeInfo* is set to *guardband* and the non-anchor carrier is in guardband. See TS 36.213 [23].  Value *same* corresponds to the carrier adjacent to the anchor carrier on the outer side of the guardband, value *opposite* corresponds to the carrier closest to the edge of the LTE carrier in the opposite guardband. |
| ***sib-GuardbandInfo***  Information of the carrier used for SIB1 and/or SI transmission when *operationmodeInfo* is set to *guardband*. See TS 36.213 [23].  *sib-GuardbandAnchor* indicates the anchor carrier.  *sib-GuardbandGuardband* indicates a non-anchor carrier in guardband mode.  *sib-GuardbandInbandSamePCI* or *sib-GuardbandinbandDiffPCI* indicates a non-anchor carrier in inband mode, and at the edge of the LTE carrier and on the same side as the anchor carrier. |
| ***sib-InbandLocation***  Location of the non-anchor carrier used for SIB1 and/or SI transmission when *operationmodeInfo* is set to *inband-SamePCI* or *inband-DifferentPCI*,and *sib1-CarrierInfo* value and/or *tdd-SI-CarrierInfo* in SIB1-NB is set to *non-anchor*. See TS 36.213 [23].  Value *lower* corresponds to the lower adjacent carrier relative to the anchor carrier and value *higher* corresponds to the higher adjacent carrier relative to the anchor carrier.  If both *sib1-CarrierInfo* value and *tdd-SI-CarrierInfo* value in SIB1-NB are set to *anchor,* the UE ignores *sib-InbandLocation*. |
| ***sib-StandaloneLocation***  Location of the non-anchor carrier used for SIB1 and/or SI transmission when *operationmodeInfo* is set to *standalone*,and *sib1-CarrierInfo* value and/or *tdd-SI-CarrierInfo* in SIB1-NB is set to *non-anchor*. See TS 36.213 [23].  Value *lower* corresponds to the lower adjacent carrier relative to the anchor carrier and value *higher* corresponds to the higher adjacent carrier relative to the anchor carrier.  If both *sib1-CarrierInfo* value and *tdd-SI-CarrierInfo* value in SIB1-NB are set to *anchor,* the UE ignores *sib-StandaloneLocation*. |
| ***sib1-CarrierInfo***  Carrier used for SIB1 transmission. See TS 36.213 [23], clause 16.4.1.3. Value *anchor* corresponds to anchor carrier, value *non-anchor* corresponds to non-anchor carrier. |
| ***systemFrameNumber-MSB***  Defines the 4 most significant bits of the SFN. As indicated in TS 36.211 [21], the 6 least significant bits of the SFN are acquired implicitly by decoding the NPBCH. |
| ***systemInfoValueTag***  Common for all SIBs other than MIB-NB, SIB14-NB and SIB16-NB. |

#### – *Paging-NB*

The *Paging-NB* message is used for the notification of one or more UEs.

Signalling radio bearer: N/A

RLC-SAP: TM

Logical channel: PCCH

Direction: E‑UTRAN to UE

*Paging-NB* message

-- ASN1START

Paging-NB ::= SEQUENCE {

pagingRecordList-r13 PagingRecordList-NB-r13 OPTIONAL, -- Need ON

systemInfoModification-r13 ENUMERATED {true} OPTIONAL, -- Need ON

systemInfoModification-eDRX-r13 ENUMERATED {true} OPTIONAL, -- Need ON

nonCriticalExtension Paging-NB-v1610-IEs OPTIONAL

}

Paging-NB-v1610-IEs ::= SEQUENCE {

pagingRecordList-v1610 PagingRecordList-NB-v1610 OPTIONAL, -- Need ON

nonCriticalExtension SEQUENCE {} OPTIONAL

}

PagingRecordList-NB-r13 ::= SEQUENCE (SIZE (1..maxPageRec)) OF PagingRecord-NB-r13

PagingRecordList-NB-v1610 ::= SEQUENCE (SIZE (1..maxPageRec)) OF PagingRecord-NB-v1610

PagingRecord-NB-r13 ::= SEQUENCE {

ue-Identity-r13 PagingUE-Identity,

...

}

PagingRecord-NB-v1610 ::= SEQUENCE {

mt-EDT-r16 ENUMERATED {true} OPTIONAL -- Need ON

}

-- ASN1STOP

| *Paging-NB* field descriptions |
| --- |
| ***mt-EDT***  Indication of mobile-terminated EDT. |
| ***pagingRecordList***  If E-UTRAN includes *pagingRecordList-v1610*,it includes the same number of entries, and listed in the same order, as in *pagingRecordList* (i.e. without suffix). |
| ***systemInfoModification***  If present: indication of a BCCH modification other than for *SystemInformationBlockType14-NB* (SIB14-NB), *SystemInformationBlockType16-NB* (SIB16-NB), *SystemInformationBlockType31-NB* (SIB31-NB) and *SystemInformationBlockType33-NB* (SIB33-NB). This indication does not apply to UEs using eDRX cycle longer than the BCCH modification period. |
| ***systemInfoModification-eDRX***  If present: indication of a BCCH modification other than for *SystemInformationBlockType14-NB* (SIB14-NB), *SystemInformationBlockType16-NB* (SIB16-NB), *SystemInformationBlockType31-NB* (SIB31-NB) and *SystemInformationBlockType33-NB* (SIB33-NB). This indication applies only to UEs using eDRX cycle longer than the BCCH modification period. |
| ***ue-Identity***  Provides the NAS identity of the UE that is being paged. |

#### – *PURConfigurationRequest-NB*

The *PURConfigurationRequest-NB* message is used by the UE to transfer PUR related information to the E-UTRAN.

Signalling radio bearer: SRB1 or SRB1bis

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to E-UTRAN

*PURConfigurationRequest-NB message*

-- ASN1START

PURConfigurationRequest-NB-r16 ::= SEQUENCE {

criticalExtensions CHOICE {

purConfigurationRequest-r16 PURConfigurationRequest-NB-r16-IEs,

criticalExtensionsFuture SEQUENCE {}

}

}

PURConfigurationRequest-NB-r16-IEs ::= SEQUENCE {

pur-ConfigRequest-r16 PUR-ConfigRequest-NB-r16 OPTIONAL,

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

PUR-ConfigRequest-NB-r16 ::= CHOICE{

pur-ReleaseRequest NULL,

pur-SetupRequest SEQUENCE {

requestedNumOccasions-r16 ENUMERATED {one, infinite},

requestedPeriodicityAndOffset-r16 PUR-PeriodicityAndOffset-NB-r16,

requestedTBS-r16 ENUMERATED {b328, b376, b424, b472, b504, b552, b584,

b616, b680, b744, b776, b808, b872, b904,

b936, b968, b1000, b1032, b1096, b1128,

b1192, b1224, b1256, b1352, b1384, b1544,

b1608, b1736, b1800, b2024, b2280, b2536},

rrc-ACK-r16 ENUMERATED {true} OPTIONAL

}

}

-- ASN1STOP

| *PURConfigurationRequest-NB* field descriptions |
| --- |
| ***requestedNumOccasions***  Indicates the requested number of PUR occasions. Value *one* corresponds to one occasion and value *infinite* corresponds to infinite occasions. |
| ***requestedPeriodicityAndOffset***  Indicates the requested periodicity of the PUR occasions and time offset until the first PUR occasion. |
| ***requestedTBS***  Indicates the requested TBS. Value *b328* corresponds to 328 bits, value *b376* corresponds to 376 bits, and so on. |
| ***rrc-ACK***  Indicates RRC response message is prefered by the UE for acknowledging the reception of a transmission using PUR. |

#### – *RRCConnectionReconfiguration-NB*

The *RRCConnectionReconfiguration-NB* message is the command to modify an RRC connection. It may convey information for resource configuration (including RBs, MAC main configuration and physical channel configuration) including any associated dedicated NAS information.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: E‑UTRAN to UE

*RRCConnectionReconfiguration-NB* message

-- ASN1START

RRCConnectionReconfiguration-NB ::= SEQUENCE {

rrc-TransactionIdentifier RRC-TransactionIdentifier,

criticalExtensions CHOICE {

c1 CHOICE{

rrcConnectionReconfiguration-r13 RRCConnectionReconfiguration-NB-r13-IEs,

spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

RRCConnectionReconfiguration-NB-r13-IEs ::= SEQUENCE {

dedicatedInfoNASList-r13 SEQUENCE (SIZE(1..maxDRB-NB-r13)) OF

DedicatedInfoNAS OPTIONAL, -- Need ON

radioResourceConfigDedicated-r13 RadioResourceConfigDedicated-NB-r13 OPTIONAL, -- Need ON

fullConfig-r13 ENUMERATED {true} OPTIONAL, -- Cond Reestab

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension RRCConnectionReconfiguration-NB-v16f0-IEs OPTIONAL

}

RRCConnectionReconfiguration-NB-v16f0-IEs ::= SEQUENCE {

obtainLocationNB-r16 ENUMERATED {setup} OPTIONAL, -- Need OR

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *RRCConnectionReconfiguration-NB* field descriptions |
| --- |
| ***dedicatedInfoNASList***  This field is used to transfer UE specific NAS layer information between the network and the UE. The RRC layer is transparent for each PDU in the list. |
| ***fullConfig***  Indicates the full configuration option is applicable for the RRC Connection Reconfiguration message. |

| Conditional presence | Explanation |
| --- | --- |
| *Reestab* | This field is optionally present, need ON upon the first reconfiguration after RRC connection re-establishment; otherwise the field is not present. |

#### – *RRCConnectionReconfigurationComplete-NB*

The *RRCConnectionReconfigurationComplete-NB* message is used to confirm the successful completion of an RRC connection reconfiguration.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to E‑UTRAN

*RRCConnectionReconfigurationComplete-NB* message

-- ASN1START

RRCConnectionReconfigurationComplete-NB ::= SEQUENCE {

rrc-TransactionIdentifier RRC-TransactionIdentifier,

criticalExtensions CHOICE {

rrcConnectionReconfigurationComplete-r13 RRCConnectionReconfigurationComplete-NB-r13-IEs,

criticalExtensionsFuture SEQUENCE {}

}

}

RRCConnectionReconfigurationComplete-NB-r13-IEs ::= SEQUENCE {

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

#### – *RRCConnectionReestablishment-NB*

The *RRCConnectionReestablishment-NB* message is used to re-establish SRB1.

Signalling radio bearer: SRB0

RLC-SAP: TM

Logical channel: CCCH

Direction: E‑UTRAN to UE

*RRCConnectionReestablishment-NB* message

-- ASN1START

RRCConnectionReestablishment-NB ::= SEQUENCE {

rrc-TransactionIdentifier RRC-TransactionIdentifier,

criticalExtensions CHOICE {

c1 CHOICE{

rrcConnectionReestablishment-r13 RRCConnectionReestablishment-NB-r13-IEs,

spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

RRCConnectionReestablishment-NB-r13-IEs ::= SEQUENCE {

radioResourceConfigDedicated-r13 RadioResourceConfigDedicated-NB-r13,

nextHopChainingCount-r13 NextHopChainingCount,

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension RRCConnectionReestablishment-NB-v1430-IEs OPTIONAL

}

RRCConnectionReestablishment-NB-v1430-IEs ::= SEQUENCE {

dl-NAS-MAC BIT STRING (SIZE (16)) OPTIONAL, -- Cond Reestablish-CP

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *RRCConnectionReestablishment-NB* field descriptions |
| --- |
| ***dl-NAS-MAC***  Downlink authentication token, see TS 33.401 [32]. If this field is present, the UE shall ignore the field *nextHopChainingCount*. |

| Conditional presence | Explanation |
| --- | --- |
| *Reestablish-CP* | This field is mandatory present for NB-IoT UE using the Control Plane CIoT EPS/5GS optimisation; otherwise the field is not present. |

#### – *RRCConnectionReestablishmentComplete-NB*

The *RRCConnectionReestablishmentComplete-NB* message is used to confirm the successful completion of an RRC connection re-establishment.

Signalling radio bearer: SRB1 or SRB1bis

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to E‑UTRAN

*RRCConnectionReestablishmentComplete-NB* message

-- ASN1START

RRCConnectionReestablishmentComplete-NB ::= SEQUENCE {

rrc-TransactionIdentifier RRC-TransactionIdentifier,

criticalExtensions CHOICE {

rrcConnectionReestablishmentComplete-r13 RRCConnectionReestablishmentComplete-NB-r13-IEs,

criticalExtensionsFuture SEQUENCE {}

}

}

RRCConnectionReestablishmentComplete-NB-r13-IEs ::= SEQUENCE {

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension RRCConnectionReestablishmentComplete-NB-v1470-IEs OPTIONAL

}

RRCConnectionReestablishmentComplete-NB-v1470-IEs ::= SEQUENCE {

measResultServCell-r14 MeasResultServCell-NB-r14 OPTIONAL,

nonCriticalExtension RRCConnectionReestablishmentComplete-NB-v1610-IEs OPTIONAL

}

RRCConnectionReestablishmentComplete-NB-v1610-IEs ::= SEQUENCE {

rlf-InfoAvailable-r16 ENUMERATED {true} OPTIONAL,

anr-InfoAvailable-r16 ENUMERATED {true} OPTIONAL,

nonCriticalExtension RRCConnectionReestablishmentComplete-NB-v1710-IEs OPTIONAL

}

RRCConnectionReestablishmentComplete-NB-v1710-IEs ::= SEQUENCE {

gnss-ValidityDuration-r17 GNSS-ValidityDuration-r17 OPTIONAL,

nonCriticalExtension RRCConnectionReestablishmentComplete-NB-v1800-IEs OPTIONAL

}

RRCConnectionReestablishmentComplete-NB-v1800-IEs ::= SEQUENCE {

gnss-PositionFixDuration-r18 GNSS-PositionFixDuration-r18 OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *RRCConnectionReestablishmentComplete-NB field descriptions* |
| --- |
| ***anr-InfoAvailable***  Indicates the availability of ANR measurement information. |
| ***measResultServCell***  This field refers to the last idle mode measurement results taken of the serving cell. |
| ***rlf-InfoAvailable***  Indicates the availability of radio link failure related information. |

#### – *RRCConnectionReestablishmentRequest-NB*

The *RRCConnectionReestablishmentRequest-NB* message is used to request the reestablishment of an RRC connection.

Signalling radio bearer: SRB0

RLC-SAP: TM

Logical channel: CCCH

Direction: UE to E‑UTRAN

*RRCConnectionReestablishmentRequest-NB* message

-- ASN1START

RRCConnectionReestablishmentRequest-NB ::= SEQUENCE {

criticalExtensions CHOICE {

rrcConnectionReestablishmentRequest-r13

RRCConnectionReestablishmentRequest-NB-r13-IEs,

later CHOICE {

rrcConnectionReestablishmentRequest-r14

RRCConnectionReestablishmentRequest-NB-r14-IEs,

later CHOICE {

rrcConnectionReestablishmentRequest-r16

RRCConnectionReestablishmentRequest-5GC-NB-r16-IEs,

criticalExtensionsFuture SEQUENCE {}

}

}

}

}

RRCConnectionReestablishmentRequest-NB-r13-IEs ::= SEQUENCE {

ue-Identity-r13 ReestabUE-Identity,

reestablishmentCause-r13 ReestablishmentCause-NB-r13,

cqi-NPDCCH-r14 CQI-NPDCCH-NB-r14,

earlyContentionResolution-r14 BOOLEAN,

spare BIT STRING (SIZE (20))

}

RRCConnectionReestablishmentRequest-NB-r14-IEs ::= SEQUENCE {

ue-Identity-r14 ReestabUE-Identity-CP-NB-r14,

reestablishmentCause-r14 ReestablishmentCause-NB-r13,

cqi-NPDCCH-r14 CQI-NPDCCH-Short-NB-r14,

earlyContentionResolution-r14 BOOLEAN,

spare BIT STRING (SIZE (1))

}

RRCConnectionReestablishmentRequest-5GC-NB-r16-IEs ::= SEQUENCE {

ue-Identity-r16 ReestabUE-Identity-CP-5GC-NB-r16,

reestablishmentCause-r16 ReestablishmentCause-NB-r13,

cqi-NPDCCH-r16 CQI-NPDCCH-Short-NB-r14,

spare BIT STRING (SIZE (1))

}

ReestablishmentCause-NB-r13 ::= ENUMERATED {

reconfigurationFailure, otherFailure,

spare2, spare1}

ReestabUE-Identity-CP-NB-r14 ::= SEQUENCE {

s-TMSI-r14 S-TMSI,

ul-NAS-MAC-r14 BIT STRING (SIZE (16)),

ul-NAS-Count-r14 BIT STRING (SIZE (5))

}

ReestabUE-Identity-CP-5GC-NB-r16 ::= SEQUENCE {

truncated5G-S-TMSI-r16 BIT STRING (SIZE (40)),

ul-NAS-MAC-r16 BIT STRING (SIZE (16)),

ul-NAS-Count-r16 BIT STRING (SIZE (5))

}

-- ASN1STOP

| *RRCConnectionReestablishmentRequest-NB* field descriptions |
| --- |
| ***earlyContentionResolution***  Value TRUE indicates UE supports MAC PDU containing the UE contention resolution identity MAC control element without RRC response message. This field is always set to TRUE in this version of the specification. |
| ***reestablishmentCause***  Indicates the failure cause that triggered the re-establishment procedure.  eNB is not expected to reject a *RRCConnectionReestablishmentRequest* due to unknown cause value being used by the UE. |
| ***truncated5G-S-TMSI***  For description of this field see TS 23.003 [27]. |
| ***ue-Identity***  UE identity included to retrieve UE context and to facilitate contention resolution by lower layers. |
| ***ul-NAS-Count***  For description of this field see TS 33.401 [32] for EPC, and TS 33.501 [86] for 5GC. |
| ***ul-NAS-MAC***  For description of this field see TS 33.401 [32] for EPC, and TS 33.501 [86] for 5GC. |

#### – *RRCConnectionReject-NB*

The *RRCConnectionReject-NB* message is used to reject the RRC connection establishment or RRC connection resume or to reject the EDT procedure.

Signalling radio bearer: SRB0

RLC-SAP: TM

Logical channel: CCCH

Direction: E‑UTRAN to UE

*RRCConnectionReject-NB* message

-- ASN1START

RRCConnectionReject-NB ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE {

rrcConnectionReject-r13 RRCConnectionReject-NB-r13-IEs,

spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

RRCConnectionReject-NB-r13-IEs ::= SEQUENCE {

extendedWaitTime-r13 INTEGER (1..1800),

rrc-SuspendIndication-r13 ENUMERATED {true} OPTIONAL, -- Need ON

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *RRCConnectionReject-NB* field descriptions |
| --- |
| ***extendedWaitTime***  Value in seconds. |
| ***rrc-SuspendIndication***  If present, this field indicates that the UE should remain suspended and not release its stored context. |

#### – *RRCConnectionRelease-NB*

The *RRCConnectionRelease-NB* message is used to command the release of an RRC connection, or to complete an UP-EDT procedure.

Signalling radio bearer: SRB1 or SRB1bis

RLC-SAP: AM

Logical channel: DCCH

Direction: E‑UTRAN to UE

*RRCConnectionRelease-NB* message

-- ASN1START

RRCConnectionRelease-NB ::= SEQUENCE {

rrc-TransactionIdentifier RRC-TransactionIdentifier,

criticalExtensions CHOICE {

c1 CHOICE {

rrcConnectionRelease-r13 RRCConnectionRelease-NB-r13-IEs,

spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

RRCConnectionRelease-NB-r13-IEs ::= SEQUENCE {

releaseCause-r13 ReleaseCause-NB-r13,

resumeIdentity-r13 ResumeIdentity-r13 OPTIONAL, -- Need OR

extendedWaitTime-r13 INTEGER (1..1800) OPTIONAL, -- Need ON

redirectedCarrierInfo-r13 RedirectedCarrierInfo-NB-r13 OPTIONAL, -- Need ON

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension RRCConnectionRelease-NB-v1430-IEs OPTIONAL

}

RRCConnectionRelease-NB-v1430-IEs ::= SEQUENCE {

redirectedCarrierInfo-v1430 RedirectedCarrierInfo-NB-v1430 OPTIONAL, -- Cond Redirection

extendedWaitTime-CPdata-r14 INTEGER (1..1800) OPTIONAL, -- Cond NoExtendedWaitTime

nonCriticalExtension RRCConnectionRelease-NB-v1530-IEs OPTIONAL

}

RRCConnectionRelease-NB-v1530-IEs ::= SEQUENCE {

drb-ContinueROHC-r15 ENUMERATED {true} OPTIONAL, -- Cond UP-EDT

nextHopChainingCount-r15 NextHopChainingCount OPTIONAL, -- Cond EarlySec

nonCriticalExtension RRCConnectionRelease-NB-v1550-IEs OPTIONAL

}

RRCConnectionRelease-NB-v1550-IEs ::= SEQUENCE {

redirectedCarrierInfo-v1550 RedirectedCarrierInfo-NB-v1550 OPTIONAL, -- Cond Redirection-TDD

nonCriticalExtension RRCConnectionRelease-NB-v15b0-IEs OPTIONAL

}

RRCConnectionRelease-NB-v15b0-IEs ::= SEQUENCE {

noLastCellUpdate-r15 ENUMERATED {true} OPTIONAL, -- Need OP

nonCriticalExtension RRCConnectionRelease-NB-v1610-IEs OPTIONAL

}

RRCConnectionRelease-NB-v1610-IEs ::= SEQUENCE {

resumeIdentity-r16 I-RNTI-r15 OPTIONAL, -- Need OR

anr-MeasConfig-r16 ANR-MeasConfig-NB-r16 OPTIONAL, -- Need OP

pur-Config-r16 SetupRelease {PUR-Config-NB-r16}

OPTIONAL, -- Need ON

nonCriticalExtension RRCConnectionRelease-NB-v1700-IEs OPTIONAL

}

RRCConnectionRelease-NB-v1700-IEs ::= SEQUENCE {

cbp-Index-r17 INTEGER (1..2) OPTIONAL, -- Need OR

nonCriticalExtension SEQUENCE {} OPTIONAL

}

ReleaseCause-NB-r13 ::= ENUMERATED {loadBalancingTAUrequired, other,

rrc-Suspend, spare1}

RedirectedCarrierInfo-NB-r13::= CarrierFreq-NB-r13

RedirectedCarrierInfo-NB-v1430 ::= SEQUENCE {

redirectedCarrierOffsetDedicated-r14 ENUMERATED{

dB1, dB2, dB3, dB4, dB5, dB6, dB8, dB10,

dB12, dB14, dB16, dB18, dB20, dB22, dB24, dB26},

t322-r14 ENUMERATED{

min5, min10, min20, min30, min60, min120, min180,

spare1}

}

RedirectedCarrierInfo-NB-v1550::= CarrierFreq-NB-v1550

-- ASN1STOP

| *RRCConnectionRelease-NB* field descriptions |
| --- |
| ***cbp-Index***  Index to the coverage-based paging configuration. Value 1 corresponds to the first entry in *cbp-ConfigList* and value 2 corresponds to the second entry in *cbp-ConfigList* in *SystemInformationBlockType22-NB*. |
| ***drb-ContinueROHC***  This field indicates whether to continue or reset the header compression protocol context for the DRBs configured with the header compression protocol. Presence of the field indicates that the header compression protocol context continues when UE initiates UP-EDT in the same cell, while absence indicates that the header compression protocol context is reset. |
| ***extendedWaitTime***  Value in seconds. |
| ***extendedWaitTime-CPdata***  Wait time for data transfer using the Control Plane CIoT EPS optimisation. Value in seconds. See TS 24.301 [35]. |
| ***noLastCellUpdate***  Presence of the field indicates that the last used cell for (G)WUS shall not be updated. |
| ***redirectedCarrierInfo***  The r*edirectedCarrierInfo* indicates a carrier frequency (downlink for FDD) and is used to redirect the UE to a NB-IoT carrier frequency, by means of the cell selection upon leaving RRC\_CONNECTED as specified in TS 36.304 [4]. |
| ***redirectedCarrierOffsetDedicated***  Parameter "Qoffsetdedicatedfrequency" in TS 36.304 [4]. For NB-IoT carrier frequencies, a UE that supports multi-band cells considers the *redirectedCarrierOffsetDedicated* to be common for all overlapping bands (i.e. regardless of the EARFCN that is used). |
| ***releaseCause***  The *releaseCause* is used to indicate the reason for releasing the RRC Connection.  E-UTRAN should not set the *releaseCause* to *loadBalancingTAURequired* if the *extendedWaitTime* is present and/or if the UE is connected to 5GC. |
| ***resumeIdentity***  UE identity to facilitate UE context retrieval at eNB. E-UTRAN configures *resumeIdentity-r13* only when the UE is connected to EPC and configures *resumeIdentity-r16* only when the UE is connected to 5GC. |
| ***t322***  Timer T322 as described in clause 7.3. Value minN corresponds to N minutes. |

| Conditional presence | Explanation |
| --- | --- |
| *NoExtendedWaitTime* | The field is optionally present, Need ON, if the *extendedWaitTime* is not included; otherwise the field is not present. |
| *Redirection* | The field is optionally present, Need ON, if *redirectedCarrierInfo* is included; otherwise the field is not present. |
| *Redirection-TDD* | The field is optionally present, Need ON, if *redirectedCarrierInfo* is included in TDD mode. Otherwise, the field is not present. |
| *UP-EDT* | The field is optionally present, Need ON, if the UE supports UP-EDT or UP transmission using PUR and *releaseCause* is set to *rrc-Suspend*; otherwise the field is not present. |
| *EarlySec* | For EPC, the field is optionally present, Need ON, if the UE supports early security reactivation or UP-EDT or UP transmission using PUR and *releaseCause* is set to *rrc-Suspend*; otherwise the field is not present.  For 5GC, the field is mandatory present if *releaseCause* is set to *rrc-Suspend*; otherwise the field is not present. |

#### – *RRCConnectionRequest-NB*

The *RRCConnectionRequest-NB* message is used to request the establishment of an RRC connection.

Signalling radio bearer: SRB0

RLC-SAP: TM

Logical channel: CCCH

Direction: UE to E‑UTRAN

*RRCConnectionRequest-NB* message

-- ASN1START

RRCConnectionRequest-NB ::= SEQUENCE {

criticalExtensions CHOICE {

rrcConnectionRequest-r13 RRCConnectionRequest-NB-r13-IEs,

later CHOICE {

rrcConnectionRequest-r16 RRCConnectionRequest-5GC-NB-r16-IEs,

criticalExtensionsFuture SEQUENCE {}

}

}

}

RRCConnectionRequest-NB-r13-IEs ::= SEQUENCE {

ue-Identity-r13 InitialUE-Identity,

establishmentCause-r13 EstablishmentCause-NB-r13,

multiToneSupport-r13 ENUMERATED {true} OPTIONAL,

multiCarrierSupport-r13 ENUMERATED {true} OPTIONAL,

earlyContentionResolution-r14 BOOLEAN,

cqi-NPDCCH-r14 CQI-NPDCCH-NB-r14,

spare BIT STRING (SIZE (17))

}

RRCConnectionRequest-5GC-NB-r16-IEs ::= SEQUENCE {

ue-Identity-r16 InitialUE-Identity-5GC-NB-r16,

establishmentCause-r16 ENUMERATED {

mt-Access, mo-Signalling, mo-Data, mo-ExceptionData,

spare4, spare3, spare2, spare1},

cqi-NPDCCH-r16 CQI-NPDCCH-NB-r14,

spare BIT STRING (SIZE (11))

}

InitialUE-Identity-5GC-NB-r16 ::= CHOICE {

ng-5G-S-TMSI-r16 NG-5G-S-TMSI-r15,

randomValue BIT STRING (SIZE (48))

}

-- ASN1STOP

| *RRCConnectionRequest-NB* field descriptions |
| --- |
| ***earlyContentionResolution***  Value TRUE indicates UE supports MAC PDU containing the UE contention resolution identity MAC control element without RRC response message. This field is always set to TRUE in this version of the specification. |
| ***establishmentCause***  Provides the establishment cause for the RRC connection request as provided by the upper layers.  eNB is not expected to reject a *RRCConnectionRequest* due to unknown cause value being used by the UE. |
| ***multiCarrierSupport***  If present, this field indicates that the UE supports multi-carrier operation in the mode, FDD or TDD, used for access. |
| ***multiToneSupport***  If present, this field indicates that the UE supports UL multi-tone transmissions on NPUSCH in the mode, FDD or TDD, used for access. |
| ***randomValue***  Integer value in the range 0 to 248 − 1. |
| ***ue-Identity***  UE identity included to facilitate contention resolution by lower layers. |

#### – *RRCConnectionResume-NB*

The *RRCConnectionResume-NB* message is used to resume the suspended RRC connection.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: E‑UTRAN to UE

*RRCConnectionResume-NB* message

-- ASN1START

RRCConnectionResume-NB ::= SEQUENCE {

rrc-TransactionIdentifier RRC-TransactionIdentifier,

criticalExtensions CHOICE {

c1 CHOICE {

rrcConnectionResume-r13 RRCConnectionResume-NB-r13-IEs,

spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

RRCConnectionResume-NB-r13-IEs ::= SEQUENCE {

radioResourceConfigDedicated-r13 RadioResourceConfigDedicated-NB-r13 OPTIONAL, -- Need ON

nextHopChainingCount-r13 NextHopChainingCount,

drb-ContinueROHC-r13 ENUMERATED {true} OPTIONAL, -- Need OP

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension RRCConnectionResume-NB-v1610-IEs OPTIONAL

}

RRCConnectionResume-NB-v1610-IEs ::= SEQUENCE {

fullConfig-r16 ENUMERATED {true} OPTIONAL, -- Cond 5GC

nonCriticalExtension RRCConnectionResume-NB-v16f0-IEs OPTIONAL

}

RRCConnectionResume-NB-v16f0-IEs ::= SEQUENCE {

obtainLocationNB-r16 ENUMERATED {setup} OPTIONAL, -- Need OR

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *RRCConnectionResume-NB* field descriptions |
| --- |
| ***drb-ContinueROHC***  This field indicates whether to continue or reset the header compression protocol context for the DRBs configured with the header compression protocol. Presence of the field indicates that the header compression protocol context continues while absence indicates that the header compression protocol context is reset. |
| ***fullConfig***  Indicates that the full configuration option is applicable for the *RRCConnectionResume-NB* message. |

| Conditional presence | Explanation |
| --- | --- |
| *5GC* | The field is optionally present, Need ON, if the UE is connected to 5GC; otherwise the field is not present. |

#### – *RRCConnectionResumeComplete-NB*

The *RRCConnectionResumeComplete-NB* message is used to confirm the successful completion of an RRC connection resumption

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to E‑UTRAN

*RRCConnectionResumeComplete-NB* message

-- ASN1START

RRCConnectionResumeComplete-NB ::= SEQUENCE {

rrc-TransactionIdentifier RRC-TransactionIdentifier,

criticalExtensions CHOICE {

rrcConnectionResumeComplete-r13 RRCConnectionResumeComplete-NB-r13-IEs,

criticalExtensionsFuture SEQUENCE {}

}

}

RRCConnectionResumeComplete-NB-r13-IEs ::= SEQUENCE {

selectedPLMN-Identity-r13 INTEGER (1..maxPLMN-r11) OPTIONAL,

dedicatedInfoNAS-r13 DedicatedInfoNAS OPTIONAL,

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension RRCConnectionResumeComplete-NB-v1470-IEs OPTIONAL

}

RRCConnectionResumeComplete-NB-v1470-IEs ::= SEQUENCE {

measResultServCell-r14 MeasResultServCell-NB-r14 OPTIONAL,

nonCriticalExtension RRCConnectionResumeComplete-NB-v1610-IEs OPTIONAL

}

RRCConnectionResumeComplete-NB-v1610-IEs ::= SEQUENCE {

rlf-InfoAvailable-r16 ENUMERATED {true} OPTIONAL,

anr-InfoAvailable-r16 ENUMERATED {true} OPTIONAL,

nonCriticalExtension RRCConnectionResumeComplete-NB-v1710-IEs OPTIONAL

}

RRCConnectionResumeComplete-NB-v1710-IEs ::= SEQUENCE {

gnss-ValidityDuration-r17 GNSS-ValidityDuration-r17 OPTIONAL, nonCriticalExtension RRCConnectionResumeComplete-NB-v1800-IEs OPTIONAL

}

RRCConnectionResumeComplete-NB-v1800-IEs ::= SEQUENCE {

gnss-PositionFixDuration-r18 GNSS-PositionFixDuration-r18 OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *RRCConnectionResumeComplete-NB* field descriptions |
| --- |
| ***anr-InfoAvailable***  Indicates the availability of ANR measurement information. |
| ***measResultServCell***  This field refers to the last idle mode measurement results taken of the serving cell. |
| ***rlf-InfoAvailable***  Indicates the availability of radio link failure related information. |
| ***selectedPLMN-Identity***  Index of the PLMN selected by the UE from the *plmn-IdentityList* included in *SystemInformationBlockType1-NB*. 1 if the 1st PLMN is selected from the *plmn-IdentityList* included in SIB1-NB, 2 if the 2nd PLMN is selected from the *plmn-IdentityList* included in SIB1-NB and so on. |

#### – *RRCConnectionResumeRequest-NB*

The *RRCConnectionResumeRequest-NB* message is used to request the resumption of a suspended RRC connection or to perform UP-EDT.

Signalling radio bearer: SRB0

RLC-SAP: TM

Logical channel: CCCH

Direction: UE to E‑UTRAN

*RRCConnectionResumeRequest-NB* message

-- ASN1START

RRCConnectionResumeRequest-NB ::= SEQUENCE {

criticalExtensions CHOICE {

rrcConnectionResumeRequest-r13 RRCConnectionResumeRequest-NB-r13-IEs,

later CHOICE {

rrcConnectionResumeRequest-r16 RRCConnectionResumeRequest-5GC-NB-r16-IEs,

criticalExtensionsFuture SEQUENCE {}

}

}

}

RRCConnectionResumeRequest-NB-r13-IEs ::= SEQUENCE {

resumeID-r13 ResumeIdentity-r13,

shortResumeMAC-I-r13 ShortMAC-I,

resumeCause-r13 EstablishmentCause-NB-r13,

earlyContentionResolution-r14 BOOLEAN,

cqi-NPDCCH-r14 CQI-NPDCCH-NB-r14,

anr-InfoAvailable-r16 BOOLEAN,

spare BIT STRING (SIZE (3))

}

RRCConnectionResumeRequest-5GC-NB-r16-IEs ::= SEQUENCE {

resumeID-r16 I-RNTI-r15,

shortResumeMAC-I-r16 ShortMAC-I,

resumeCause-r16 EstablishmentCause-NB-r13,

cqi-NPDCCH-r16 CQI-NPDCCH-NB-r14,

spare BIT STRING (SIZE (4))

}

-- ASN1STOP

| *RRCConnectionResumeRequest-NB* field descriptions |
| --- |
| ***anr-InfoAvailable***  Indicates the availability of ANR measurement information when the UE is perfoming UP-EDT. |
| ***earlyContentionResolution***  Value TRUE indicates UE supports MAC PDU containing the UE contention resolution identity MAC control element without RRC response message. This field is always set to TRUE in this version of the specification. |
| ***resumeCause***  Provides the resume cause for the RRC connection resume request as provided by the upper layers.  eNB is not expected to reject a *RRCConnectionResumeRequest* due to unknown cause value being used by the UE. |
| ***resumeID***  UE identity to facilitate UE context retrieval at eNB. |
| ***shortResumeMAC-I***  Authentication token to facilitate UE authentication at eNB. |

#### – *RRCConnectionSetup-NB*

The *RRCConnectionSetup-NB* message is used to establish SRB1 and SRB1bis.

Signalling radio bearer: SRB0

RLC-SAP: TM

Logical channel: CCCH

Direction: E‑UTRAN to UE

*RRCConnectionSetup-NB* message

-- ASN1START

RRCConnectionSetup-NB ::= SEQUENCE {

rrc-TransactionIdentifier RRC-TransactionIdentifier,

criticalExtensions CHOICE {

c1 CHOICE {

rrcConnectionSetup-r13 RRCConnectionSetup-NB-r13-IEs,

spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

RRCConnectionSetup-NB-r13-IEs ::= SEQUENCE {

radioResourceConfigDedicated-r13 RadioResourceConfigDedicated-NB-r13,

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension RRCConnectionSetup-NB-v1610-IEs OPTIONAL

}

RRCConnectionSetup-NB-v1610-IEs ::= SEQUENCE {

dedicatedInfoNAS-r16 DedicatedInfoNAS OPTIONAL, -- Need ON

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *RRCConnectionSetup-NB* field descriptions |
| --- |
| ***dedicatedInfoNAS***  Downlink NAS PDU in case of mobile terminated CP-EDT. E-UTRAN may include this field only if the *RRCConnectionSetup* is in response to *RRCEarlyDataRequest* with establishment cause *mt-Access*. |

#### – *RRCConnectionSetupComplete-NB*

The *RRCConnectionSetupComplete-NB* message is used to confirm the successful completion of an RRC connection establishment.

Signalling radio bearer: SRB1bis

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to E‑UTRAN

*RRCConnectionSetupComplete-NB* message

-- ASN1START

RRCConnectionSetupComplete-NB ::= SEQUENCE {

rrc-TransactionIdentifier RRC-TransactionIdentifier,

criticalExtensions CHOICE{

rrcConnectionSetupComplete-r13 RRCConnectionSetupComplete-NB-r13-IEs,

criticalExtensionsFuture SEQUENCE {}

}

}

RRCConnectionSetupComplete-NB-r13-IEs ::= SEQUENCE {

selectedPLMN-Identity-r13 INTEGER (1..maxPLMN-r11),

s-TMSI-r13 S-TMSI OPTIONAL,

registeredMME-r13 RegisteredMME OPTIONAL,

dedicatedInfoNAS-r13 DedicatedInfoNAS,

attachWithoutPDN-Connectivity-r13 ENUMERATED {true} OPTIONAL,

up-CIoT-EPS-Optimisation-r13 ENUMERATED {true} OPTIONAL,

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension RRCConnectionSetupComplete-NB-v1430-IEs OPTIONAL

}

RRCConnectionSetupComplete-NB-v1430-IEs ::= SEQUENCE {

gummei-Type-r14 ENUMERATED { mapped} OPTIONAL,

dcn-ID-r14 INTEGER (0..65535) OPTIONAL,

nonCriticalExtension RRCConnectionSetupComplete-NB-v1470-IEs OPTIONAL

}

RRCConnectionSetupComplete-NB-v1470-IEs ::= SEQUENCE {

measResultServCell-r14 MeasResultServCell-NB-r14 OPTIONAL,

nonCriticalExtension RRCConnectionSetupComplete-NB-v1610-IEs OPTIONAL

}

RRCConnectionSetupComplete-NB-v1610-IEs ::= SEQUENCE {

ng-5G-S-TMSI-r16 NG-5G-S-TMSI-r15 OPTIONAL,

registeredAMF-r16 RegisteredAMF-r15 OPTIONAL,

gummei-Type-v1610 ENUMERATED {mappedFrom5G} OPTIONAL,

guami-Type-r16 ENUMERATED {native, mapped} OPTIONAL,

s-NSSAI-list-r16 SEQUENCE(SIZE (1..maxNrofS-NSSAI-r15)) OF

S-NSSAI-r15 OPTIONAL,

ng-U-DataTransfer-r16 ENUMERATED {true} OPTIONAL,

up-CIoT-5GS-Optimisation-r16 ENUMERATED {true} OPTIONAL,

rlf-InfoAvailable-r16 ENUMERATED {true} OPTIONAL,

anr-InfoAvailable-r16 ENUMERATED {true} OPTIONAL,

pur-ConfigID-r16 PUR-ConfigID-NB-r16 OPTIONAL,

nonCriticalExtension RRCConnectionSetupComplete-NB-v1710-IEs OPTIONAL

}

RRCConnectionSetupComplete-NB-v1710-IEs ::= SEQUENCE {

gnss-ValidityDuration-r17 GNSS-ValidityDuration-r17 OPTIONAL, nonCriticalExtension RRCConnectionSetupComplete-NB-v1800-IEs OPTIONAL

}

RRCConnectionSetupComplete-NB-v1800-IEs ::= SEQUENCE {

gnss-PositionFixDuration-r18 GNSS-PositionFixDuration-r18 OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *RRCConnectionSetupComplete-NB* field descriptions |
| --- |
| ***anr-InfoAvailable***  This field is used to indicate the availability of ANR measurement information. |
| ***attachWithoutPDN-Connectivity***  This field is used to indicate that the UE performs an Attach without PDN connectivity procedure, as indicated by the upper layers, TS 24.301 [35]. |
| ***dcn-ID***  The Dedicated Core Network Identity, see TS 23.401 [41]. |
| ***guami-Type***  This field is used to indicate whether the GUAMI included is native (derived from native 5G-GUTI) or mapped (from EPS, derived from EPS GUTI) as specified in TS 24.501 [95]. |
| ***gummei-Type***  This field is used to indicate that the GUMMEI included is mapped (from 2G/3G identifiers or 5G identifiers) as indicated by the upper layers, TS 24.301 [35] and TS 24.501 [95]. The value *mapped* indicates the GUMMEI is mapped from 2G/3G identifiers, and *mappedFrom5G* indicates the GUMMEI is mapped from 5G identifiers. A UE shall not include both *gummei-Type-r14* and *gummei-Type-v1610*. |
| ***measResultServCell***  This field refers to the last idle mode measurement results taken of the serving cell. |
| ***ng-U-DataTransfer***  This field is included when the UE supports NG-U data transfer, as indicated by the upper layers, see TS 24.501 [95]. |
| ***registeredAMF***  This field is used to transfer the GUAMI of the AMF where the UE is registered, as provided by upper layers, see TS 23.003 [27]. |
| ***registeredMME***  This field is used to transfer the GUMMEI of the MME where the UE is registered, as provided by upper layers. |
| ***rlf-InfoAvailable***  This field is used to indicate the availability of radio link failure related information. |
| ***selectedPLMN-Identity***  Index of the PLMN selected by the UE from the *plmn-IdentityList* included in *SystemInformationBlockType1-NB*. 1 if the 1st PLMN is selected from the *plmn-IdentityList* included in SIB1, 2 if the 2nd PLMN is selected from the *plmn-IdentityList* included in SIB1 and so on. |
| ***s-NSSAI-List***  This field is a list of S-NSSAI as indicated by the upper layers. The UE can report up to eight S-NSSAI per NSSAI, see TS 23.003 [27]. |
| ***up-CIoT-5GS-Optimisation***  This field is included when the UE supports User plane CIoT 5GS Optimisation, as indicated by the upper layers, see TS 24.501 [95]. |
| ***up-CIoT-EPS-Optimisation***  This field is included when the UE supports S1-U data transfer or the User plane CIoT EPS Optimisation, as indicated by the upper layers, see TS 24.301 [35]. |

#### – *RRCEarlyDataComplete-NB*

The *RRCEarlyDataComplete-NB* message is used to confirm the successful completion of the CP-EDT procedure.

Signalling radio bearer: SRB0

RLC-SAP: TM

Logical channel: CCCH

Direction: E‑UTRAN to UE

*RRCEarlyDataComplete-NB* message

-- ASN1START

RRCEarlyDataComplete-NB-r15 ::= SEQUENCE {

criticalExtensions CHOICE {

rrcEarlyDataComplete-r15 RRCEarlyDataComplete-NB-r15-IEs,

criticalExtensionsFuture SEQUENCE {}

}

}

RRCEarlyDataComplete-NB-r15-IEs ::= SEQUENCE {

dedicatedInfoNAS-r15 DedicatedInfoNAS OPTIONAL, -- Need ON

extendedWaitTime-r15 INTEGER (1..1800) OPTIONAL, -- Need ON

redirectedCarrierInfo-r15 RedirectedCarrierInfo-NB-r13 OPTIONAL, -- Need ON

redirectedCarrierInfoExt-r15 RedirectedCarrierInfo-NB-v1430 OPTIONAL, -- Cond Redirection

nonCriticalExtension RRCEarlyDataComplete-NB-v1590-IEs OPTIONAL

}

RRCEarlyDataComplete-NB-v1590-IEs ::= SEQUENCE {

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension RRCEarlyDataComplete-NB-v1700-IEs OPTIONAL

}

RRCEarlyDataComplete-NB-v1700-IEs ::= SEQUENCE {

cbp-Index-r17 INTEGER (1..2) OPTIONAL, -- Need OR

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *RRCEarlyDataComplete-NB* field descriptions |
| --- |
| ***cbp-Index***  Index to the coverage-based paging configuration. Value 1 corresponds to the first entry in *cbp-ConfigList* and value 2 corresponds to the second entry in *cbp-ConfigList* in *SystemInformationBlockType22-NB*. |
| ***extendedWaitTime***  Value in seconds. |

| Conditional presence | Explanation |
| --- | --- |
| *Redirection* | The field is optionally present, Need ON, if *redirectedCarrierInfo* is included; otherwise the field is not present. |

#### – *RRCEarlyDataRequest-NB*

The *RRCEarlyDataRequest-NB* message is used to initiate CP-EDT.

Signalling radio bearer: SRB0

RLC-SAP: TM

Logical channel: CCCH

Direction: UE to E‑UTRAN

*RRCEarlyDataRequest-NB* message

-- ASN1START

RRCEarlyDataRequest-NB-r15 ::= SEQUENCE {

criticalExtensions CHOICE {

rrcEarlyDataRequest-r15 RRCEarlyDataRequest-NB-r15-IEs,

later CHOICE {

rrcEarlyDataRequest-r16 RRCEarlyDataRequest-5GC-NB-r16-IEs,

criticalExtensionsFuture SEQUENCE {}

}

}

}

RRCEarlyDataRequest-NB-r15-IEs ::= SEQUENCE {

s-TMSI-r15 S-TMSI,

establishmentCause-r15 ENUMERATED {mo-Data, mo-ExceptionData, delayTolerantAccess, mt-Access-v1610},

cqi-NPDCCH-r15 CQI-NPDCCH-NB-r14 OPTIONAL,

dedicatedInfoNAS-r15 DedicatedInfoNAS,

nonCriticalExtension RRCEarlyDataRequest-NB-v1590-IEs OPTIONAL

}

RRCEarlyDataRequest-NB-v1590-IEs ::= SEQUENCE {

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

RRCEarlyDataRequest-5GC-NB-r16-IEs ::= SEQUENCE {

ng-5G-S-TMSI-r16 NG-5G-S-TMSI-r15,

establishmentCause-r16 ENUMERATED {mo-Data, mo-ExceptionData, mt-Access, spare1},

cqi-NPDCCH-r16 CQI-NPDCCH-NB-r14 OPTIONAL,

dedicatedInfoNAS-r16 DedicatedInfoNAS,

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *RRCEarlyDataRequest-NB* field descriptions |
| --- |
| ***establishmentCause***  Provides the establishment cause for the RRC early data request as provided by the upper layers.  eNB is not expected to reject a *RRCEarlyDataRequest* due to unknown cause value being used by the UE. |

#### – *SCPTMConfiguration-NB*

The *SCPTMConfiguration-NB* message contains the control information applicable for MBMS services transmitted via SC-MRB.

Signalling radio bearer: N/A

RLC-SAP: UM

Logical channel: SC-MCCH

Direction: E‑UTRAN to UE

*SCPTMConfiguration-NB message*

-- ASN1START

SCPTMConfiguration-NB-r14 ::= SEQUENCE {

sc-mtch-InfoList-r14 SC-MTCH-InfoList-NB-r14,

scptm-NeighbourCellList-r14 SCPTM-NeighbourCellList-NB-r14 OPTIONAL, -- Need OP

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension SCPTMConfiguration-NB-v1610 OPTIONAL

}

SCPTMConfiguration-NB-v1610 ::= SEQUENCE {

sc-mtch-InfoListMultiTB-r16 SC-MTCH-InfoList-NB-r14,

multiTB-Gap-r16 ENUMERATED {sf16, sf32, sf64, sf128} OPTIONAL, -- Need OR

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| ***SCPTMConfiguration-NB* field descriptions** |
| --- |
| ***multiTB-Gap***  Indicates the scheduling gap for SC-MTCH using multiple TB scheduling, see TS 36.211 [21] and TS 36.213 [23]. Value *sf16* corresponds to 16 subframes, *sf32* corresponds to 32 subframes, and so on. If the field is absent, there is no scheduling gap. |
| ***sc-mtch-InfoList***  Provides the configuration of each SC-MTCH not using multiple TB scheduling in the current cell. |
| ***sc-mtch-InfoListMultiTB***  Provides the configuration of each SC-MTCH using multiple TB scheduling in the current cell.  The total number of signalled SC-MTCH configuration in *sc-mtch-InfoList* and *sc-mtch-InfoListMultiTB* cannot be more than *maxSC-MTCH-NB-r14*. |
| ***scptm-NeighbourCellList***  List of neighbour cells providing MBMS services via SC-MRB. When absent, the UE shall assume that MBMS services listed in the *SCPTMConfiguration-NB* message are not provided via SC-MRB in any neighbour cell. |

#### – *SystemInformation-NB*

The *SystemInformation-NB* message is used to convey one or more System Information Blocks. All the SIBs included are transmitted with the same periodicity.

Signalling radio bearer: N/A

RLC-SAP: TM

Logical channel: BCCH

Direction: E‑UTRAN to UE

*SystemInformation-NB* message

-- ASN1START

SystemInformation-NB ::= SEQUENCE {

criticalExtensions CHOICE {

systemInformation-r13 SystemInformation-NB-r13-IEs,

criticalExtensionsFuture SEQUENCE {}

}

}

SystemInformation-NB-r13-IEs ::= SEQUENCE {

sib-TypeAndInfo-r13 SEQUENCE (SIZE (1..maxSIB)) OF CHOICE {

sib2-r13 SystemInformationBlockType2-NB-r13,

sib3-r13 SystemInformationBlockType3-NB-r13,

sib4-r13 SystemInformationBlockType4-NB-r13,

sib5-r13 SystemInformationBlockType5-NB-r13,

sib14-r13 SystemInformationBlockType14-NB-r13,

sib16-r13 SystemInformationBlockType16-NB-r13,

...,

sib15-v1430 SystemInformationBlockType15-NB-r14,

sib20-v1430 SystemInformationBlockType20-NB-r14,

sib22-v1430 SystemInformationBlockType22-NB-r14,

sib23-v1530 SystemInformationBlockType23-NB-r15,

sib27-v1610 SystemInformationBlockType27-NB-r16,

sib31-v1700 SystemInformationBlockType31-NB-r17,

sib32-v1700 SystemInformationBlockType32-NB-r17,

sib33-v1800 SystemInformationBlockType33-NB-r18

},

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

#### – *SystemInformationBlockType1-NB*

The *SystemInformationBlockType1-NB* messagecontains information relevant when evaluating if a UE is allowed to access a cell and defines the scheduling of other system information.

Signalling radio bearer: N/A

RLC-SAP: TM

Logical channel: BCCH

Direction: E‑UTRAN to UE

*SystemInformationBlockType1-NB* message

-- ASN1START

SystemInformationBlockType1-NB ::= SEQUENCE {

hyperSFN-MSB-r13 BIT STRING (SIZE (8)),

cellAccessRelatedInfo-r13 SEQUENCE {

plmn-IdentityList-r13 PLMN-IdentityList-NB-r13,

trackingAreaCode-r13 TrackingAreaCode,

cellIdentity-r13 CellIdentity,

cellBarred-r13 ENUMERATED {barred, notBarred},

intraFreqReselection-r13 ENUMERATED {allowed, notAllowed}

},

cellSelectionInfo-r13 SEQUENCE {

q-RxLevMin-r13 Q-RxLevMin,

q-QualMin-r13 Q-QualMin-r9

},

p-Max-r13 P-Max OPTIONAL, -- Need OP

freqBandIndicator-r13 FreqBandIndicator-NB-r13,

freqBandInfo-r13 NS-PmaxList-NB-r13 OPTIONAL, -- Need OR

multiBandInfoList-r13 MultiBandInfoList-NB-r13 OPTIONAL, -- Need OR

downlinkBitmap-r13 DL-Bitmap-NB-r13 OPTIONAL, -- Cond SIB1

eutraControlRegionSize-r13 ENUMERATED {n1, n2, n3} OPTIONAL, -- Cond inband

nrs-CRS-PowerOffset-r13 ENUMERATED {dB-6, dB-4dot77, dB-3,

dB-1dot77, dB0, dB1,

dB1dot23, dB2, dB3,

dB4, dB4dot23, dB5,

dB6, dB7, dB8,

dB9} OPTIONAL, -- Cond inband-SamePCI

schedulingInfoList-r13 SchedulingInfoList-NB-r13,

si-WindowLength-r13 ENUMERATED {ms160, ms320, ms480, ms640,

ms960, ms1280, ms1600, spare1},

si-RadioFrameOffset-r13 INTEGER (1..15) OPTIONAL, -- Need OP

systemInfoValueTagList-r13 SystemInfoValueTagList-NB-r13 OPTIONAL, -- Need OR

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension SystemInformationBlockType1-NB-v1350 OPTIONAL

}

SystemInformationBlockType1-NB-v1350 ::= SEQUENCE {

cellSelectionInfo-v1350 CellSelectionInfo-NB-v1350 OPTIONAL, -- Cond Qrxlevmin

nonCriticalExtension SystemInformationBlockType1-NB-v1430 OPTIONAL

}

SystemInformationBlockType1-NB-v1430 ::= SEQUENCE {

cellSelectionInfo-v1430 CellSelectionInfo-NB-v1430 OPTIONAL, -- Need OR

nonCriticalExtension SystemInformationBlockType1-NB-v1450 OPTIONAL

}

SystemInformationBlockType1-NB-v1450 ::= SEQUENCE {

nrs-CRS-PowerOffset-v1450 ENUMERATED {dB-6, dB-4dot77, dB-3,

dB-1dot77, dB0, dB1,

dB1dot23, dB2, dB3,

dB4, dB4dot23, dB5,

dB6, dB7, dB8,

dB9} OPTIONAL, -- Cond inband-SamePCI-ExceptAnchor

nonCriticalExtension SystemInformationBlockType1-NB-v1530 OPTIONAL

}

SystemInformationBlockType1-NB-v1530 ::= SEQUENCE {

tdd-Parameters-r15 SEQUENCE {

tdd-Config-r15 TDD-Config-NB-r15,

tdd-SI-CarrierInfo-r15 ENUMERATED {anchor, non-anchor},

tdd-SI-SubframesBitmap-r15 DL-Bitmap-NB-r13 OPTIONAL -- Cond TDD-SI-NonAnchor

} OPTIONAL, -- Cond TDD

schedulingInfoList-v1530 SchedulingInfoList-NB-v1530 OPTIONAL, -- Need OR

nonCriticalExtension SystemInformationBlockType1-NB-v1610 OPTIONAL

}

SystemInformationBlockType1-NB-v1610 ::= SEQUENCE {

cellAccessRelatedInfo-5GC-r16 SEQUENCE {

plmn-IdentityList-r16 PLMN-IdentityList-5GC-NB-r16,

trackingAreaCode-5GC-r16 TrackingAreaCode-5GC-r15,

cellIdentity-r16 CellIdentity OPTIONAL, -- Need OP

cellBarred-5GC-r16 ENUMERATED {barred, notBarred}

} OPTIONAL, -- Need OR

nonCriticalExtension SystemInformationBlockType1-NB-v1700 OPTIONAL

}

SystemInformationBlockType1-NB-v1700 ::= SEQUENCE {

cellAccessRelatedInfo-NTN-r17 SEQUENCE {

cellBarred-NTN-r17 ENUMERATED {barred, notBarred},

plmn-IdentityList-v1700 PLMN-IdentityList-NB-v1700 OPTIONAL -- Need OR

} OPTIONAL, -- Need OR

nonCriticalExtension SEQUENCE {} OPTIONAL

}

PLMN-IdentityList-NB-r13 ::= SEQUENCE (SIZE (1..maxPLMN-r11)) OF PLMN-IdentityInfo-NB-r13

PLMN-IdentityList-5GC-NB-r16 ::= SEQUENCE (SIZE (1..maxPLMN-r11)) OF PLMN-IdentityInfo-5GC-NB-r16

PLMN-IdentityList-NB-v1700::= SEQUENCE (SIZE (1..maxPLMN-r11)) OF PLMN-IdentityInfo-NB-v1700

PLMN-IdentityInfo-NB-r13 ::= SEQUENCE {

plmn-Identity-r13 PLMN-Identity,

cellReservedForOperatorUse-r13 ENUMERATED {reserved, notReserved},

attachWithoutPDN-Connectivity-r13 ENUMERATED {true} OPTIONAL -- Need OP

}

PLMN-IdentityInfo-5GC-NB-r16 ::= SEQUENCE {

plmn-Identity-5GC-r16 CHOICE {

plmn-Identity-r16 PLMN-Identity,

plmn-Index-r16 INTEGER (1..maxPLMN-r11)

},

cellReservedForOperatorUse-r16 ENUMERATED {reserved, notReserved},

ng-U-DataTransfer-r16 ENUMERATED {true} OPTIONAL, -- Need OR

up-CIoT-5GS-Optimisation-r16 ENUMERATED {true} OPTIONAL -- Need OR

}

PLMN-IdentityInfo-NB-v1700 ::= SEQUENCE {

trackingAreaList-r17 TrackingAreaList-NB-r17 OPTIONAL -- Need OP

}

TrackingAreaList-NB-r17 ::= SEQUENCE (SIZE (1..maxTAC-NB-r17)) OF TrackingAreaCode

SchedulingInfoList-NB-r13 ::= SEQUENCE (SIZE (1..maxSI-Message-NB-r13)) OF SchedulingInfo-NB-r13

SchedulingInfoList-NB-v1530 ::= SEQUENCE (SIZE (1..maxSI-Message-NB-r13)) OF SchedulingInfo-NB-v1530

SchedulingInfo-NB-r13::= SEQUENCE {

si-Periodicity-r13 ENUMERATED {rf64, rf128, rf256, rf512,

rf1024, rf2048, rf4096, spare},

si-RepetitionPattern-r13 ENUMERATED {every2ndRF, every4thRF, every8thRF, every16thRF},

sib-MappingInfo-r13 SIB-MappingInfo-NB-r13,

si-TB-r13 ENUMERATED {b56, b120, b208, b256, b328, b440, b552, b680}

}

SchedulingInfo-NB-v1530::= SEQUENCE {

sib-MappingInfo-v1530 SIB-MappingInfo-NB-v1530 OPTIONAL -- Need OR

}

SystemInfoValueTagList-NB-r13 ::= SEQUENCE (SIZE (1.. maxSI-Message-NB-r13)) OF

SystemInfoValueTagSI-r13

SIB-MappingInfo-NB-r13 ::= SEQUENCE (SIZE (0..maxSIB-1)) OF SIB-Type-NB-r13

SIB-MappingInfo-NB-v1530 ::= SEQUENCE (SIZE (1..8)) OF SIB-Type-NB-v1530

SIB-Type-NB-r13 ::= ENUMERATED {

sibType3-NB-r13, sibType4-NB-r13, sibType5-NB-r13,

sibType14-NB-r13, sibType16-NB-r13, sibType15-NB-r14,

sibType20-NB-r14, sibType22-NB-r14}

SIB-Type-NB-v1530 ::= ENUMERATED {

sibType23-NB-r15, sibType27-NB-r16, sibType31-NB-r17,

sibType32-NB-r17, sibType33-NB-r18, spare3, spare2,

spare1

}

CellSelectionInfo-NB-v1350 ::= SEQUENCE {

delta-RxLevMin-v1350 INTEGER (-8..-1)

}

CellSelectionInfo-NB-v1430 ::= SEQUENCE {

powerClass14dBm-Offset-r14 ENUMERATED {dB-6, dB-3, dB3, dB6, dB9, dB12} OPTIONAL, -- Need OP

ce-authorisationOffset-r14 ENUMERATED {dB5, dB10, dB15, dB20, dB25, dB30, dB35} OPTIONAL -- Need OP

}

-- ASN1STOP

| *SystemInformationBlockType1-NB* field descriptions |
| --- |
| ***attachWithoutPDN-Connectivity***  If present, the field indicates that attach without PDN connectivity as specified in TS 24.301 [35] is supported for this PLMN. |
| ***ce-authorisationOffset***  Parameter "Qoffsetauthorization" in TS 36.304 [4]. Value in dB. Value dB5 corresponds to 5 dB, dB10 corresponds to 10 dB and so on.  If the field is absent, the value of 0 dB shall be used for "Qoffsetauthorization". |
| ***cellBarred***  Barred means the cell is barred for connectivity to EPC, as defined in TS 36.304 [4]. |
| ***cellBarred-5GC***  Barred means the cell is barred for connectivity to 5GC, as defined in TS 36.304 [4]. |
| ***cellBarred-NTN***  Barred means the cell is barred for connectivity to NTN, as defined in TS 36.304 [4].  E-UTRAN always includes *cellBarred-NTN* and sets *cellBarred* to 'barred' in an NTN cell. |
| ***cellIdentity***  Indicates the cell identity.  If the field is absent in *cellAccessRelatedInfo-5GC*, the cell identity indicated by the *cellIdentity* field included in *cellAccessRelatedInfo* for EPC is used when connected to 5GC. |
| ***cellReservedForOperatorUse***  As defined in TS 36.304 [4]. |
| ***cellSelectionInfo***  Cell selection information as specified in TS 36.304 [4]. |
| ***downlinkBitmap***  For FDD, NB-IoT downlink subframe configuration for downlink transmission as specified in TS 36.213 [23], clause 16.4.  For TDD, NB-IoT downlink, uplink and special subframes configuration for transmission on the anchor carrier as specified in TS 36.213 [23], clause 16.4. If the bitmap is not present, the UE shall assume that all subframes are valid (except for subframes carrying NPSS/NSSS/NPBCH/SIB1-NB) as specified in TS 36.213 [23], clause 16.4. |
| ***eutraControlRegionSize***  Indicates the control region size of the E-UTRA cell for the in-band operation mode, see TS 36.213 [23]. Unit is in number of OFDM symbols. |
| ***freqBandInfo***  A list of *additionalPmax* and *additionalSpectrumEmission* values as defined in TS 36.101 [42], clause 6.2.4F and TS 36.102 [113], clause 6.2B.3 for the NTN capable UE, for the frequency band in *freqBandIndicator*. |
| ***hyperSFN-MSB***  Indicates the 8 most significant bits of hyper-SFN. Together with hyperSFN-LSB in MIB-NB, the complete hyper-SFN is built up. hyper-SFN is incremented by one when the SFN wraps around. |
| ***intraFreqReselection***  Used to control cell reselection to intra-frequency cells when the highest ranked cell is barred, or treated as barred by the UE, as specified in TS 36.304 [4]. |
| ***multiBandInfoList***  A list of additional frequency band indicators, *additionalPmax* and *additionalSpectrumEmission* values, as defined in TS 36.101 [42], table 5.5-1 and TS 36.102 [113], table 5.2-1 for the NTN capable UE. If the UE supports the frequency band in the *freqBandIndicator* IE it shall apply that frequency band. Otherwise, the UE shall apply the first listed band which it supports in the *multiBandInfoList* IE. |
| ***ng-U-DataTransfer***  Indicates whether the NG-U data transfer as specified in TS 24.501 [95] is supported. |
| ***nrs-CRS-PowerOffset***  NRS power offset between NRS and E-UTRA CRS, see TS 36.213 [23], clause 16.2.2. Unit in dB. Default value of 0. |
| ***plmn-IdentityList***  List of PLMN identities. The first listed PLMN-Identity is the primary PLMN. If *plmn-IdentityList-v1700* is included, E-UTRAN includes the same number of entries, and listed in the same order, as in *plmn-IdentityList-r13*. |
| ***plmn-Index***  Index of the PLMN in the *plmn-IdentityList* field included in *cellAccessRelatedInfo* for EPC, indicating the same PLMN ID is used when connected to 5GC. |
| ***powerClass14dBm-Offset***  Parameter "Poffset" in TS 36.304 [4]. Only applicable for UE supporting *powerClassNB-14dBm*. Value in dB. Value dB-6 corresponds to -6 dB, dB-3 corresponds to -3 dB and so on. If the fied is absent, the UE applies the (default) value of 0 dB for "Poffset" in TS 36.304 [4]. |
| ***p-Max***  Value applicable for the cell. If absent the UE applies the maximum power according to the UE capability. |
| ***q-QualMin***  Parameter "Qqualmin" in TS 36.304 [4]. |
| ***q-RxLevMin, delta-RxLevMin***  Parameter Qrxlevmin in TS 36.304 [4]. If *delta-RxLevMin* is not included, actual value Qrxlevmin = *q-RxLevMin* \* 2 [dBm]. If *delta-RxLevMin* is included, actual value Qrxlevmin = (*q-RxLevMin* + *delta-RxLevMin*) \* 2 [dBm]. |
| ***schedulingInfoList***  Indicates additional scheduling information of SI messages. The *schedulingInfoList-v1530* (if present) provides additional SIBs mapped into the SI message scheduled via *schedulingInfoList-r13*. If E-UTRAN includes *schedulingInfoList-v1530*, it includes the same number of entries, and listed in the same order, as in *schedulingInfoList-r13*. |
| ***si-Periodicity***  Periodicity of the SI-message in radio frames, such that rf256 denotes 256 radio frames, rf512 denotes 512 radio frames, and so on. |
| ***si-RadioFrameOffset***  Offset in number of radio frames to calculate the start of the SI window.  If the field is absent, no offset is applied. |
| ***si-RepetitionPattern***  Indicates the starting radio frames within the SI window used for SI message transmission. Value every2ndRF corresponds to every 2 radio frames, value every4thRF corresponds to every 4 radio frames and so on. The first transmission of the SI message is transmitted from the first radio frame of the SI window. |
| ***si-TB***  This field indicates the transport block size in number of bits and the corresponding number of consecutive NB-IoT downlink subframes that are used to broadcast the SI message. Value b56 corresponds to 56 bits, b120 corresponds to 120 bits and so on. TBS of 56 bits and 120 bits are transmitted over 2 sub-frames, other TBS are transmitted over 8 sub-frames, see TS 36.213 [23], Table 16.4.1.5.1-1. |
| ***si-WindowLength***  Common SI scheduling window for all SIs. Unit in milliseconds, where ms160 denotes 160 milliseconds, ms320 denotes 320 milliseconds and so on. |
| ***sib-MappingInfo***  List of the SIBs mapped to this *SystemInformation* message. There is no mapping information of SIB2-NB; it is always present in the first *SystemInformation* message listed in the *schedulingInfoList-r13* list. If present, *sib-MappingInfo-v1530* indicates one or more additional SIBs mapped to the concerned SI message listed in the *schedulingInfoList-r13* list. If *schedulingInfoList-v1530* is present, E-UTRAN ensures that the total number of entries of this field plus *sib-MappingInfo-r13* shall not exceed the value of *maxSIB-1*. |
| ***systemInfoValueTagList***  Indicates SI message specific value tags. It includes the same number of entries, and listed in the same order, as in SchedulingInfoList. |
| ***systemInfoValueTagSI***  SI message specific value tag as specified in Clause 5.2.1.3. Common for all SIBs within the SI message other than SIB14-NB, SIB31-NB, and SIB33-NB. |
| ***tdd-Config***  Indicates the the TDD specific physical channel configuration. |
| ***tdd-SI-CarrierInfo***  Carrier used for SI message transmission. Value *anchor* corresponds to anchor carrier, value *non-anchor* corresponds to non-anchor carrier. See TS 36.213 [23].  When *tdd-SI-CarrierInfo* set to value *non-anchor* then *sib-GuardbandInfo* in MIB-TDD-NB (in case of *operationmodeInfo* is set to *guardband*) or *sib-InbandLocation* in MIB-TDD-NB (in case of *operationmodeInfo* is set to *inband-SamePCI* or *inband-DifferentPCI*) or *sib-StandaloneLocation* in MIB-TDD-NB (in case of *operationmodeInfo* is set to *standalone)* defines which non-anchor carrier is used (see MIB-NB-TDD). |
| ***tdd-SI-SubframesBitmap***  NB-IoT downlink, uplink and special subframes configuration for transmission on the carrier carrying the SI message as specified in TS 36.213 [23], clause 16.4. |
| ***trackingAreaCode, trackingAreaCode-5GC***  A *trackingAreaCode* that is common for all the PLMNs listed in *plmn-IdentityList-r13* or *plmn-IdentityList-r16 respectively*. |
| ***trackingAreaList***  A list of tracking area codes for the PLMN listed.  For the first entry in *plmn-IdentityList-v1700*: If this field is present, the list of tracking area codes include the tracking area code in *trackingAreaCode-r13* and the tracking area codes in *trackingAreaList*. If this field is absent, only *trackingAreaCode-r13* applies.  For other entries in *plmn-IdentityList-v1700*: If this field is present, the list of tracking area codes include the tracking area codes in *trackingAreaList*. If this field is absent, the list of tracking area codes of the preceding entry in *plmn-IdentityList-v1700* applies.  The total number of signalled tracking area codes across all PLMNs cannot be more than *maxTAC-NB-r17*. |
| ***up-CIoT-5GS-Optimisation***  Indicates whether the UE is allowed to resume the connection with User plane CIoT 5GS Optimisation, see TS24.501 [95]. |

| Conditional presence | Explanation |
| --- | --- |
| *inband* | In FDD: The field is mandatory present if IE *operationModeInfo* in MIB-NB is set to *inband-SamePCI* or *inband-DifferentPCI*. Otherwise the field is not present.  In TDD: The field is mandatory present if:  - IE *operationModeInfo* in MIB-TDD-NB is set to *inband-SamePCI* or *inband-DifferentPCI* or  - IE *operationModeInfo* in MIB-TDD-NB is set to *guardband* and IE *sib-GuardbandInfo* in MIB-TDD-NB is set to *sib-GuardbandInbandSamePCI* or *sib-GuardbandinbandDiffPCI* and IE *tdd-SI-CarrierInfo* is set to non-anchor |
| *inband-SamePCI* | The field is mandatory present, if IE *operationModeInfo* in MIB-NB is set *to inband-SamePCI.* Otherwise the field is not present. |
| *inband-SamePCI-ExceptAnchor* | The field is optionally present if IE *operationModeInfo* in MIB-NB is set toavalue other than *inband-SamePCI*, and at least one non-anchor carrier is inband carrier and uses the same PCI as the E-UTRA carrier*.* Otherwise the field is not present. |
| *Qrxlevmin* | This field is optionally present, Need OR, if *q-RxLevMin* is set to the minimum value. Otherwise the field is not present. |
| *SIB1* | The field is not present in IoT NTN TDD mode. In FDD and TDD, the field is mandatory present if IE *additionalTransmissionSIB1* in MIB-NB is set to *TRUE*. Otherwise the field is optionally present, Need OP. |
| *TDD* | The field is mandatory present for TDD; otherwise the field is not present and the UE shall delete any existing value for this field. |
| *TDD-SI-NonAnchor* | The field is mandatory present for TDD if *si-CarrierInfo* is set to *non-anchor*; otherwise the field is not present and the UE shall delete any existing value for this field. |

#### – *UECapabilityEnquiry-NB*

The *UECapabilityEnquiry-NB* message is used to request the transfer of UE radio access capabilities for NB-IoT.

Signalling radio bearer: SRB1 or SRB1bis

RLC-SAP: AM

Logical channel: DCCH

Direction: E‑UTRAN to UE

*UECapabilityEnquiry-NB* message

-- ASN1START

UECapabilityEnquiry-NB ::= SEQUENCE {

rrc-TransactionIdentifier RRC-TransactionIdentifier,

criticalExtensions CHOICE {

c1 CHOICE {

ueCapabilityEnquiry-r13 UECapabilityEnquiry-NB-r13-IEs,

spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

UECapabilityEnquiry-NB-r13-IEs ::= SEQUENCE {

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

#### – *UECapabilityInformation-NB*

The *UECapabilityInformation-NB* message is used to transfer of UE radio access capabilities requested by the E‑UTRAN.

Signalling radio bearer: SRB1 or SRB1bis

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to E‑UTRAN

*UECapabilityInformation-NB* message

-- ASN1START

UECapabilityInformation-NB ::= SEQUENCE {

rrc-TransactionIdentifier RRC-TransactionIdentifier,

criticalExtensions CHOICE{

ueCapabilityInformation-r13 UECapabilityInformation-NB-r13-IEs,

criticalExtensionsFuture SEQUENCE {}

}

}

UECapabilityInformation-NB-r13-IEs ::= SEQUENCE {

ue-Capability-r13 UE-Capability-NB-r13,

ue-RadioPagingInfo-r13 UE-RadioPagingInfo-NB-r13,

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension UECapabilityInformation-NB-Ext-r14-IEs OPTIONAL

}

UECapabilityInformation-NB-Ext-r14-IEs ::= SEQUENCE {

ue-Capability-ContainerExt-r14 OCTET STRING (CONTAINING UE-Capability-NB-Ext-r14-IEs),

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *UECapabilityInformation-NB* field descriptions |
| --- |
| ***ue-RadioPagingInfo***  This field contains UE capability information used for paging. |

#### – *UEInformationRequest-NB*

The *UEInformationRequest-NB* is the command used by E-UTRAN to retrieve information from the UE.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: E‑UTRAN to UE

*UEInformationRequest-NB message*

-- ASN1START

UEInformationRequest-NB-r16 ::= SEQUENCE {

rrc-TransactionIdentifier RRC-TransactionIdentifier,

criticalExtensions CHOICE {

ueInformationRequest-r16 UEInformationRequest-NB-r16-IEs,

criticalExtensionsFuture SEQUENCE {}

}

}

UEInformationRequest-NB-r16-IEs ::= SEQUENCE {

rach-ReportReq-r16 BOOLEAN,

rlf-ReportReq-r16 BOOLEAN,

anr-ReportReq-r16 BOOLEAN,

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *UEInformationRequest-NB* field descriptions |
| --- |
| ***anr-ReportReq***  Indicates whether the UE shall report, if available, ANR measurement information. |
| ***rach-ReportReq***  Indicates whether the UE shall report, if available, information about the random access procedure. |
| ***rlf-ReportReq***  Indicates whether the UE shall report, if available, information about radio link failure. |

#### – *UEInformationResponse-NB*

The *UEInformationResponse-NB* message is used by the UE to transfer the information requested by the E-UTRAN.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to E-UTRAN

*UEInformationResponse-NB message*

-- ASN1START

UEInformationResponse-NB-r16 ::= SEQUENCE {

rrc-TransactionIdentifier RRC-TransactionIdentifier,

criticalExtensions CHOICE {

ueInformationResponse-r16 UEInformationResponse-NB-r16-IEs,

criticalExtensionsFuture SEQUENCE {}

}

}

UEInformationResponse-NB-r16-IEs ::= SEQUENCE {

rach-Report-r16 RACH-Report-NB-r16 OPTIONAL,

rlf-Report-r16 RLF-Report-NB-r16 OPTIONAL,

anr-MeasReport-r16 ANR-MeasReport-NB-r16 OPTIONAL,

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

RACH-Report-NB-r16 ::= SEQUENCE {

numberOfPreamblesSent-r16 INTEGER (1..64),

contentionDetected-r16 BOOLEAN,

initialNRSRP-Level-r16 INTEGER (0..2),

edt-Fallback-r16 BOOLEAN

}

RLF-Report-NB-r16 ::= SEQUENCE {

failedPCellId-r16 CellGlobalIdEUTRA,

reestablishmentCellId-r16 CellGlobalIdEUTRA OPTIONAL,

locationInfo-r16 LocationInfo-r10 OPTIONAL,

measResultLastServCell-r16 SEQUENCE {

nrsrpResult-r16 NRSRP-Range-NB-r14,

nrsrqResult-r16 NRSRQ-Range-NB-r14 OPTIONAL

},

timeSinceFailure-r16 TimeSinceFailure-r11 OPTIONAL

}

-- ASN1STOP

| *UEInformationResponse-NB* field descriptions |
| --- |
| ***anr-MeasReport***  Indicates the ANR measurement information. |
| ***contentionDetected***  Value TRUE indicates that contention was detected for at least one of the transmitted preambles, see TS 36.321 [6]. |
| ***edt-Fallback***  Value TRUE indicates that EDT fallback indication was received from the lower layers, see TS 36.321 [6]. |
| ***failedPCellId***  Indicates the PCell in which RLF is detected. |
| ***initialNRSRP-Level***  Indicates the NRSRP level of the NPRACH resource selected for the first preamble transmission. |
| ***measResultLastServCell***  Refers to the last measurement results taken in the PCell, where radio link failure happened. |
| ***numberOfPreamblesSent***  Indicates the number of RACH preambles that were transmitted. Corresponds to parameter PREAMBLE\_TRANSMISSION\_COUNTER in TS 36.321 [6]. |
| ***reestablishmentCellId***  Indicates the cell in which the re-establishment attempt was made after connection failure. |
| ***timeSinceFailure***  Indicates the time that elapsed since the connection failure. Value in seconds. The maximum value 172800 means 172800s or longer. |

#### – *ULInformationTransfer-NB*

The *ULInformationTransfer-NB* message is used for the uplink transfer of NAS information.

Signalling radio bearer: SRB1 or SRB1bis

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to E‑UTRAN

*ULInformationTransfer-NB* message

-- ASN1START

ULInformationTransfer-NB ::= SEQUENCE {

criticalExtensions CHOICE {

ulInformationTransfer-r13 ULInformationTransfer-NB-r13-IEs,

criticalExtensionsFuture SEQUENCE {}

}

}

ULInformationTransfer-NB-r13-IEs ::= SEQUENCE {

dedicatedInfoNAS-r13 DedicatedInfoNAS,

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

### 6.7.3 NB-IoT information elements

#### 6.7.3.1 NB-IoT System information blocks

#### – *SystemInformationBlockType2-NB*

The IE *SystemInformationBlockType2-NB* contains radio resource configuration information that is common for all UEs.

NOTE: UE timers and constants related to functionality for which parameters are provided in another SIB are included in the corresponding SIB.

*SystemInformationBlockType2-NB* information element

-- ASN1START

SystemInformationBlockType2-NB-r13 ::= SEQUENCE {

radioResourceConfigCommon-r13 RadioResourceConfigCommonSIB-NB-r13,

ue-TimersAndConstants-r13 UE-TimersAndConstants-NB-r13,

freqInfo-r13 SEQUENCE {

ul-CarrierFreq-r13 CarrierFreq-NB-r13 OPTIONAL, -- Need OP

additionalSpectrumEmission-r13 AdditionalSpectrumEmission

},

timeAlignmentTimerCommon-r13 TimeAlignmentTimer,

multiBandInfoList-r13 SEQUENCE (SIZE (1..maxMultiBands)) OF AdditionalSpectrumEmission OPTIONAL, -- Need OR

lateNonCriticalExtension OCTET STRING OPTIONAL,

...,

[[ cp-Reestablishment-r14 ENUMERATED {true} OPTIONAL -- Need OP

]],

[[ servingCellMeasInfo-r14 ENUMERATED {true} OPTIONAL, -- Need OR

cqi-Reporting-r14 ENUMERATED {true} OPTIONAL -- Need OR

]],

[[ enhancedPHR-r15 ENUMERATED {true} OPTIONAL, -- Need OR

freqInfo-v1530 SEQUENCE {

tdd-UL-DL-AlignmentOffset-r15 TDD-UL-DL-AlignmentOffset-NB-r15

} OPTIONAL, -- Cond TDD

cp-EDT-r15 ENUMERATED {true} OPTIONAL, -- Need OR

up-EDT-r15 ENUMERATED {true} OPTIONAL -- Need OR

]],

[[ earlySecurityReactivation-r16 ENUMERATED {true} OPTIONAL, -- Need OR

cp-EDT-5GC-r16 ENUMERATED {true} OPTIONAL, -- Need OR

up-EDT-5GC-r16 ENUMERATED {true} OPTIONAL, -- Need OR

cp-PUR-EPC-r16 ENUMERATED {true} OPTIONAL, -- Need OR

up-PUR-EPC-r16 ENUMERATED {true} OPTIONAL, -- Need OR

cp-PUR-5GC-r16 ENUMERATED {true} OPTIONAL, -- Need OR

up-PUR-5GC-r16 ENUMERATED {true} OPTIONAL, -- Need OR

rai-ActivationEnh-r16 ENUMERATED {true} OPTIONAL -- Need OR

]],

[[ gnss-PositionFixDurationReporting-r18 ENUMERATED {true} OPTIONAL -- Need OR

]]

}

-- ASN1STOP

| *SystemInformationBlockType2-NB* field descriptions |
| --- |
| ***additionalSpectrumEmission***  The UE requirements related to IE *AdditionalSpectrumEmission* are defined in TS 36.101 [42], clause 6.2.4F and TS 36.102 [113], clause 6.2B.3 for NTN capable UE. |
| ***cp-EDT***  For FDD: This field indicates whether the UE is allowed to initiate CP-EDT when connected to EPC, see 5.3.3.1b. |
| ***cp-EDT-5GC***  For FDD: This field indicates whether the UE is allowed to initiate CP-EDT when connected to 5GC, see 5.3.3.1b. |
| ***cp-PUR-5GC***  For FDD: Indicates whether CP transmission using PUR is allowed in the cell when connected to 5GC, see 5.3.3.1c. |
| ***cp-PUR-EPC***  For FDD: Indicates whether CP transmission using PUR is allowed in the cell when connected to EPC, see 5.3.3.1c. |
| ***cp-Reestablishment***  This field indicates if the NB-IoT UE is allowed to trigger RRC connection re-establishment when AS security has not been activated. |
| ***cqi-Reporting***  For FDD: This field indicates if downlink channel quality reporting in *RRCConnectionReestablishmentRequest-NB, RRCConnectionRequest-NB, RRCConnectionResumeRequest-NB* and *RRCEarlyDataRequest-NB message* is allowed. |
| ***earlySecurityReactivation***  Indicates that early security reactivation when resuming a suspended RRC connection as specified in 5.3.3.18 is supported. |
| ***enhancedPHR***  For FDD: This field indicates if the NB-IoT UE is allowed to report enhanced PHR in MSG3 as specified in TS 36.321 [6]. |
| ***gnss-PositionFixDurationReporting***  If present, this field indicates that UEs capable of performing GNSS position fix in RRC\_CONNECTED are configured to include the time duration required to acquire a GNSS position in *RRCConnectionSetupComplete-NB*, *RRCConnectionResumeComplete-NB*, and *RRCConnectionReestablishmentComplete-NB*. |
| ***multiBandInfoList***  A list of *additionalSpectrumEmission* i.e. one for each additional frequency band included in *multiBandInfoList* in *SystemInformationBlockType1-NB,* listed in the same order*.* |
| ***rai-ActivationEnh***  Indicates whether the UE is allowed to report the AS Release Assistance Indication using the DCQR and AS RAI MAC CE as specified in TS 36.321 [6] when connected to EPC. |
| ***servingCellMeasInfo***  This field indicates if serving cell idle mode measurement reporting in *RRCConnectionReestablishmentComplete-NB*, *RRCConnectionResumeComplete-NB* and *RRCConnectionSetupComplete-NB* is allowed. |
| ***tdd-UL-DL-AlignmentOffset***  Indicates the offset between the UL carrier frequency center with respect to DL carrier frequency center for the anchor carrier. |
| ***ul-CarrierFreq***  For FDD: Uplink carrier frequency as defined in TS 36.101 [42], clause 5.7.3F and TS 36.102 [113], clause 5.4B.2. If *operationModeInfo* in the MIB-NB is set to *standalone* and the field is absent*,* thevalue of the carrier frequency is determined by the TX-RX frequency separation defined in TS 36.101 [42], table 5.7.4-1, and the value of the carrier frequency offset is 0. If *operationModeInfo* in the MIB-NB is not set to *standalone,* thefield is mandatory present.  For TDD: This field is absent and the uplink carrier frequency is same as the downlink frequency. |
| ***up-EDT***  For FDD: This field indicates whether the UE is allowed to initiate UP-EDT when connected to EPC, see 5.3.3.1b. |
| ***up-EDT-5GC***  For FDD: This field indicates whether the UE is allowed to initiate UP-EDT when connected to 5GC, see 5.3.3.1b. |
| ***up-PUR-5GC***  For FDD: Indicates whether UP transmission using PUR is allowed in the cell when connected to 5GC, see 5.3.3.1c. |
| ***up-PUR-EPC***  For FDD: Indicates whether UP transmission using PUR is allowed in the cell when connected to EPC, see 5.3.3.1c. |

| Conditional presence | Explanation |
| --- | --- |
| *TDD* | The field is mandatory present for TDD; otherwise the field is not present and the UE shall delete any existing value for this field. |

#### – *SystemInformationBlockType3-NB*

The IE *SystemInformationBlockType3-NB* contains cell re-selection information common for intra-frequency, and inter-frequency cell re-selection as well as intra-frequency cell re-selection information other than neighbouring cell related.

*SystemInformationBlockType3-NB* information element

-- ASN1START

SystemInformationBlockType3-NB-r13 ::= SEQUENCE {

cellReselectionInfoCommon-r13 SEQUENCE {

q-Hyst-r13 ENUMERATED {

dB0, dB1, dB2, dB3, dB4, dB5, dB6, dB8, dB10,

dB12, dB14, dB16, dB18, dB20, dB22, dB24

}

},

cellReselectionServingFreqInfo-r13 SEQUENCE {

s-NonIntraSearch-r13 ReselectionThreshold

},

intraFreqCellReselectionInfo-r13 SEQUENCE {

q-RxLevMin-r13 Q-RxLevMin,

q-QualMin-r13 Q-QualMin-r9 OPTIONAL, -- Need OP

p-Max-r13 P-Max OPTIONAL, -- Need OP

s-IntraSearchP-r13 ReselectionThreshold,

t-Reselection-r13 T-Reselection-NB-r13

},

freqBandInfo-r13 NS-PmaxList-NB-r13 OPTIONAL, -- Need OR

multiBandInfoList-r13 SEQUENCE (SIZE (1..maxMultiBands)) OF

NS-PmaxList-NB-r13 OPTIONAL, -- Need OR

lateNonCriticalExtension OCTET STRING OPTIONAL,

...,

[[ intraFreqCellReselectionInfo-v1350 IntraFreqCellReselectionInfo-NB-v1350 OPTIONAL -- Cond Qrxlevmin

]],

[[ intraFreqCellReselectionInfo-v1360 IntraFreqCellReselectionInfo-NB-v1360 OPTIONAL -- Need OR

]],

[[ intraFreqCellReselectionInfo-v1430 IntraFreqCellReselectionInfo-NB-v1430 OPTIONAL -- Need OR

]],

[[ cellReselectionInfoCommon-v1450 CellReselectionInfoCommon-NB-v1450 OPTIONAL -- Need OR

]],

[[ nsss-RRM-Config-r15 NSSS-RRM-Config-NB-r15 OPTIONAL, -- Need OR

npbch-RRM-Config-r15 ENUMERATED {enabled} OPTIONAL -- Need OR

]],

[[ connMeasConfig-r17 ConnMeasConfig-NB-r17 OPTIONAL, -- Need OR

t-Service-r17 TimeOffsetUTC-r17 OPTIONAL -- Need OR

]],

[[ satelliteAssistanceInfo-r18 SEQUENCE (SIZE(1..maxSat-r17)) OF SatelliteId-r18 OPTIONAL -- Need OR

]]

}

IntraFreqCellReselectionInfo-NB-v1350 ::= SEQUENCE {

delta-RxLevMin-v1350 INTEGER (-8..-1)

}

IntraFreqCellReselectionInfo-NB-v1360 ::= SEQUENCE {

s-IntraSearchP-v1360 ReselectionThreshold-NB-v1360

}

IntraFreqCellReselectionInfo-NB-v1430 ::= SEQUENCE {

powerClass14dBm-Offset-r14 ENUMERATED {dB-6, dB-3, dB3, dB6, dB9, dB12} OPTIONAL, -- Need OP

ce-AuthorisationOffset-r14 ENUMERATED {dB5, dB10, dB15, dB20, dB25, dB30, dB35} OPTIONAL -- Need OP

}

CellReselectionInfoCommon-NB-v1450 ::= SEQUENCE {

s-SearchDeltaP-r14 ENUMERATED {dB6, dB9, dB12, dB15}

}

ConnMeasConfig-NB-r17 ::= SEQUENCE {

s-MeasureIntra-r17 NRSRP-Range-NB-r14,

s-MeasureInter-r17 NRSRP-Range-NB-r14 OPTIONAL, -- Need OP

neighCellMeasCriteria-r17 SEQUENCE {

s-MeasureDeltaP-r17 ENUMERATED {dB6, dB9, dB12, dB15},

t-MeasureDeltaP-r17 ENUMERATED {s15, s30, s45, s60}

} OPTIONAL -- Need OR

}

-- ASN1STOP

| *SystemInformationBlockType3-NB* field descriptions |
| --- |
| ***ce-AuthorisationOffset***  Parameter "Qoffsetauthorization" in TS 36.304 [4]. Value in dB. Value dB5 corresponds to 5 dB, dB10 corresponds to 10 dB and so on.  If the field is absent, the UE applies the value of ce-*authorisationOffset* in *SystemInformationBlockType1-NB*. |
| ***multiBandInfoList***  A list of *additionalPmax* and *additionalSpectrumEmission* values as defined in TS 36.101 [42], clause 6.2.4F and TS 36.102 [113], clause 6.2B.3 for NTN capable UE, applicable for the intra-frequency neighbouring NB-IoT cells if the UE selects the frequency band from *freqBandIndicator* in *SystemInformationBlockType1-NB*. |
| ***npbch-RRM-Config***  For FDD: Configuration for NPBCH-based RRM measurements. See TS 36.214 [24].  If enabled, NPBCH can be used in addition to NRS for RRM measurements for serving cell. |
| ***nsss-RRM-Config***  For FDD: Configuration for NSSS-based RRM measurements for the serving cell. |
| ***powerClass14dBm-Offset***  Parameter "Poffset" in TS 36.304 [4], only applicable for UE supporting *powerClassNB-14dBm*. Value in dB. Value dB-6 corresponds to -6 dB, dB-3 corresponds to -3 dB and so on. If the field is absent, the UE applies the (default) value of 0 dB for "Poffset" in TS 36.304 [4]. |
| ***p-Max***  Value applicable for the intra-frequency neighbouring E-UTRA cells. If absent the UE applies the maximum power according to the UE capability. |
| ***q-Hyst***  Parameter *Qhyst* in TS 36.304 [4], Value in dB. Value dB1 corresponds to 1 dB, dB2 corresponds to 2 dB and so on. |
| ***q-QualMin***  Parameter "Qqualmin" in TS 36.304 [4], applicable for intra-frequency neighbour cells. If the field is not present, the UE applies the (default) value of negative infinity for Qqualmin. |
| ***q-RxLevMin, delta-RxLevMin***  Parameter "Qrxlevmin" in TS 36.304 [4], applicable for intra-frequency neighbour cells. If *delta-RxLevMin* is not included, actual value Qrxlevmin = *q-RxLevMin* \* 2 [dBm]. If *delta-RxLevMin* is included, actual value Qrxlevmin = (*q-RxLevMin* + *delta-RxLevMin*) \* 2 [dBm]. |
| ***s-IntraSearchP***  Parameter "SIntraSearchP" in TS 36.304 [4].  In case *s-IntraSearchP-v1360* is included, the UE shall ignore *s-IntraSearchP* (i.e. without suffix). |
| ***s-MeasureDeltaP***  Threshold of change in serving cell NRSRP to trigger neighbour cell measurement in RRC\_CONNECTED state. |
| ***s-MeasureInter***  NRSRP threshold to trigger inter-frequency neighbour cell measurement in RRC\_CONNECTED state. If the field is absent in *connMeasConfig*, the UE applies the value of *s-MeasureIntra*. |
| ***s-MeasureIntra***  NRSRP threshold to trigger intra-frequency neighbour cell measurement in RRC\_CONNECTED state. |
| ***s-NonIntraSearch***  Parameter "SnonIntraSearchP" in TS 36.304 [4]. |
| ***s-SearchDeltaP***  Parameter "SSearchDeltaP" in TS 36.304 [4]. This parameter is only applicable for UEs supporting relaxed monitoring as specified in TS 36.306 [5]. Value dB6 corresponds to 6 dB, dB9 corresponds to 9 dB and so on. |
| ***satelliteAssistanceInfo***  List of satellite ID(s), used to associate with the satellite assistance information in *SystemInformationBlockType31-NB* and *SystemInformationBlockType33-NB* for intra-frequency neighbour cell measurements. |
| ***t-MeasureDeltaP***  Duration after which the UE is not required to perfom neighbour cell measurement in RRC\_CONNECTED when *s-MeasureDeltaP* criterion is fulfilled. |
| ***t-Reselection***  Parameter "TreselectionNB-IoT\_Intra" in TS 36.304 [4]. |
| ***t-Service***  Time information on when an NTN cell is going to stop serving the area it is currently covering. This field applies for service link switches in NTN quasi-Earth fixed cells and feeder link switches for both NTN quasi-Earth fixed and earth-moving cells. |

| Conditional presence | Explanation |
| --- | --- |
| Qrxlevmin | This field is optionally present, Need OR, if *q-RxLevMin* is set to the minimum value. Otherwise the field is not present. |

#### – *SystemInformationBlockType4-NB*

The IE *SystemInformationBlockType4-NB* contains neighbouring cell related information relevant only for intra-frequency cell re-selection. The IE includes cells with specific re-selection parameters.

*SystemInformationBlockType4-NB* information element

-- ASN1START

SystemInformationBlockType4-NB-r13 ::= SEQUENCE {

intraFreqNeighCellList-r13 IntraFreqNeighCellList OPTIONAL, -- Need OR

intraFreqExcludedCellList-r13 IntraFreqExcludedCellList OPTIONAL, -- Need OR

lateNonCriticalExtension OCTET STRING OPTIONAL,

...,

[[ nsss-RRM-Config-r15 NSSS-RRM-Config-NB-r15 OPTIONAL, -- Need OR

intraFreqNeighCellList-v1530 IntraFreqNeighCellList-NB-v1530 OPTIONAL -- Need OR

]]

}

IntraFreqNeighCellList-NB-v1530 ::= SEQUENCE (SIZE (1..maxCellIntra)) OF IntraFreqNeighCellInfo-NB-v1530

IntraFreqNeighCellInfo-NB-v1530 ::= SEQUENCE {

nsss-RRM-Config-r15 NSSS-RRM-Config-NB-r15 OPTIONAL -- Cond NSSS-RRM

}

-- ASN1STOP

| *SystemInformationBlockType4-NB* field descriptions |
| --- |
| ***intraFreqExcludedCellList***  List of exclude-listed intra-frequency neighbouring cells. |
| ***intraFreqNeighCellList***  List of intra-frequency neighbouring cells with specific cell re-selection parameters. |
| ***nsss-RRM-Config***  For FDD: Configuration for NSSS-based RRM measurements.  If *intraFreqNeighCellList-NB-v1530* is present then for a cell which is included in *intraFreqNeighCellList*, the UE applies the *nsss-RRM-Config* configured in the corresponding entry of *IntraFreqNeighCellList-NB-v1530*. Otherwise, the UE applies the *nsss-RRM-Config* configured in *SystemInformationBlockType4-NB-r13*. |

| Conditional presence | Explanation |
| --- | --- |
| *NSSS-RRM* | This field is optionally present, Need OR, when *nsss-RRM-Config* is present in *SystemInformationBlockType4-NB*. Otherwise, the field is not present, and the UE shall delete any existing value for this field. |

#### – *SystemInformationBlockType5-NB*

The IE *SystemInformationBlockType5-NB* contains information relevant only for inter-frequency cell re-selection i.e. information about other NB-IoT frequencies and inter-frequency neighbouring cells relevant for cell re-selection. The IE includes cell re-selection parameters common for a frequency as well as cell specific re-selection parameters.

*SystemInformationBlockType5-NB* information element

-- ASN1START

SystemInformationBlockType5-NB-r13 ::= SEQUENCE {

interFreqCarrierFreqList-r13 InterFreqCarrierFreqList-NB-r13,

t-Reselection-r13 T-Reselection-NB-r13,

lateNonCriticalExtension OCTET STRING OPTIONAL,

...,

[[ scptm-FreqOffset-r14 INTEGER (1..8) OPTIONAL -- Need OP

]],

[[ interFreqCarrierFreqList-v1820 InterFreqCarrierFreqList-NB-v1820 OPTIONAL -- Need OR

]]

}

InterFreqCarrierFreqList-NB-r13 ::= SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo-NB-r13

InterFreqCarrierFreqList-NB-v1820 ::= SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo-NB-v1820

InterFreqCarrierFreqInfo-NB-r13 ::= SEQUENCE {

dl-CarrierFreq-r13 CarrierFreq-NB-r13,

q-RxLevMin-r13 Q-RxLevMin,

q-QualMin-r13 Q-QualMin-r9 OPTIONAL, -- Need OP

p-Max-r13 P-Max OPTIONAL, -- Need OP

q-OffsetFreq-r13 Q-OffsetRange DEFAULT dB0,

interFreqNeighCellList-r13 InterFreqNeighCellList-NB-r13 OPTIONAL, -- Need OR

interFreqExcludedCellList-r13 InterFreqExcludedCellList-NB-r13 OPTIONAL, -- Need OR

multiBandInfoList-r13 MultiBandInfoList-NB-r13 OPTIONAL, -- Need OR

...,

[[ delta-RxLevMin-v1350 INTEGER (-8..-1) OPTIONAL -- Cond Qrxlevmin

]],

[[ powerClass14dBm-Offset-r14 ENUMERATED {dB-6, dB-3, dB3, dB6, dB9, dB12}

OPTIONAL, -- Need OP

ce-AuthorisationOffset-r14 ENUMERATED {dB5, dB10, dB15, dB20, dB25, dB30, dB35} OPTIONAL -- Need OP

]],

[[ nsss-RRM-Config-r15 NSSS-RRM-Config-NB-r15 OPTIONAL, -- Need OR

interFreqNeighCellList-v1530 InterFreqNeighCellList-NB-v1530 OPTIONAL -- Need OR

]],

[[ dl-CarrierFreq-v1550 CarrierFreq-NB-v1550 OPTIONAL -- Cond TDD

]]

}

InterFreqCarrierFreqInfo-NB-v1820 ::= SEQUENCE {

satelliteAssistanceInfo-r18 SEQUENCE (SIZE(1..maxSat-r17)) OF SatelliteId-r18 OPTIONAL -- Need OP

}

InterFreqNeighCellList-NB-r13 ::= SEQUENCE (SIZE (1..maxCellInter)) OF PhysCellId

InterFreqNeighCellList-NB-v1530 ::= SEQUENCE (SIZE (1..maxCellInter)) OF InterFreqNeighCellInfo-NB-v1530

InterFreqNeighCellInfo-NB-v1530 ::= SEQUENCE {

nsss-RRM-Config-r15 NSSS-RRM-Config-NB-r15 OPTIONAL -- Cond NSSS-RRM

}

InterFreqExcludedCellList-NB-r13 ::= SEQUENCE (SIZE (1..maxExcludedCell)) OF PhysCellId

-- ASN1STOP

| *SystemInformationBlockType5-NB* field descriptions |
| --- |
| ***ce-AuthorisationOffset***  Parameter "Qoffsetauthorization" in TS 36.304 [4]. Value in dB. Value dB5 corresponds to 5 dB, dB10 corresponds to 10 dB and so on. If the field is absent, the UE applies the value of ce-*authorisationOffset* in *SystemInformationBlockType1-NB*. |
| ***interFreqExcludedCellList***  List of exclude-listed inter-frequency neighbouring cells. |
| ***interFreqCarrierFreqList***  List of neighbouring inter-frequencies. E-UTRAN does not configure more than one entry for the same physical frequency regardless of the E-ARFCN used to indicate this. |
| ***interFreqNeighCellList***  List of inter-frequency neighbouring cells. E-UTRAN may include *interFreqNeighCellList* when including *InterFreqNeighCellList-NB-v1530* to provide cell specific NSSS-based measurement configuration. The UE that does not support NSSS-based RRM measurements shall ignore this field in this version of the specification. |
| ***multiBandInfoList***  Indicates the list of frequency bands, with the associated *additionalPmax* and *additionalSpectrumEmission* values as defined in TS 36.101 [42], clause 6.2.4, in addition to the band represented by dl-CarrierFreq for which cell reselection parameters are common. |
| ***nsss-RRM-Config***  For FDD: Configuration for NSSS-based RRM measurements.  If *InterFreqNeighCellList-NB-v1530* is present then for a cell which is included in *interFreqNeighCellList*, the UE applies the *nsss-RRM-Config* configured in the corresponding entry of *InterFreqNeighCellList-NB-v1530*. Otherwise, the UE applies the *nsss-RRM-Config* configured in *InterFreqCarrierFreqInfo*. |
| ***p-Max***  Value applicable for the neighbouring NB-IoT cells on this carrier frequency. If absent the UE applies the maximum power according to the UE capability. |
| ***powerClass14dBm-Offset***  Parameter "Poffset" in TS 36.304 [4], only applicable for UE supporting *powerClassNB-14dBm*. Value in dB. Value dB-6 corresponds to -6 dB, dB-3 corresponds to -3 dB and so on. If the field is absent, the UE applies the (default) value of 0 dB for "Poffset" in TS 36.304 [4] |
| ***q-OffsetFreq***  Parameter "Qoffsetfrequency" in TS 36.304 [4]. |
| ***q-QualMin***  Parameter "Qqualmin" in TS 36.304 [4]. If the field is not present, the UE applies the (default) value of negative infinity for Qqualmin. |
| ***q-RxlevMin, delta-RxLevMin***  Parameter "QRxLevmin" in TS 36.304 [4]. If *delta-RxLevMin* is not included, actual value Qrxlevmin = *q-RxLevMin* \* 2 [dBm]. If *delta-RxLevMin* is included, actual value Qrxlevmin = (*q-RxLevMin* + *delta-RxLevMin*) \* 2 [dBm]. |
| ***satelliteAssistanceInfo***  List of satellite ID(s), used to associate with the satellite assistance information in *SystemInformationBlockType31-NB* and *SystemInformationBlockType33-NB* for neighbour cell measurements on this frequency. If the field is not present for a frequency and *SystemInformationBlockType33-NB* is broadcast, the UE considers the cells on the frequency to be terrestrial cells and UE shall delete any existing value for this field. |
| ***scptm-FreqOffset***  Parameter QoffsetSCPTM in TS 36.304 [4]. Actual value QoffsetSCPTM = field value \* 2 [dB].  If the field is absent, the UE uses infinite dBs for the SC-PTM frequency offset with cell ranking as specified in TS 36.304 [4]. |
| ***t-Reselection***  Parameter "TreselectionNB-IoT\_Inter" in TS 36.304 [4]. |

| Conditional presence | Explanation |
| --- | --- |
| *NSSS-RRM* | This field is optionally present, Need OR, when *nsss-RRM-Config* is present in *InterFreqCarrierFreqInfo*. Otherwise, the field is not present, and the UE shall delete any existing value for this field. |
| *Qrxlevmin* | This field is optionally present, Need OR, if *q-RxLevMin* is set to the minimum value. Otherwise the field is not present. |
| *TDD* | The field is optionally present, Need OR, in TDD. Otherwise, the field is not present. |

#### – *SystemInformationBlockType14-NB*

The IE *SystemInformationBlockType14-NB* contains the AB parameters for EPC and 5GC.

*SystemInformationBlockType14-NB* information element

-- ASN1START

SystemInformationBlockType14-NB-r13 ::= SEQUENCE {

ab-Param-r13 CHOICE {

ab-Common-r13 AB-Config-NB-r13,

ab-PerPLMN-List-r13 SEQUENCE (SIZE (1..maxPLMN-r11)) OF AB-ConfigPLMN-NB-r13

} OPTIONAL, -- Need OR

lateNonCriticalExtension OCTET STRING OPTIONAL,

...,

[[ ab-PerNRSRP-r15 ENUMERATED {thresh1, thresh2} OPTIONAL -- Need OR

]],

[[ uac-Param-r16 UAC-Param-NB-r16 OPTIONAL -- Need OR

]]

}

AB-ConfigPLMN-NB-r13 ::= SEQUENCE {

ab-Config-r13 AB-Config-NB-r13 OPTIONAL -- Need OR

}

AB-Config-NB-r13 ::= SEQUENCE {

ab-Category-r13 ENUMERATED {a, b, c},

ab-BarringBitmap-r13 BIT STRING (SIZE(10)),

ab-BarringForExceptionData-r13 ENUMERATED {true} OPTIONAL, -- Need OP

ab-BarringForSpecialAC-r13 BIT STRING (SIZE(5))

}

UAC-Param-NB-r16 ::= CHOICE {

uac-BarringCommon UAC-Barring-NB-r16,

uac-BarringPerPLMN-List SEQUENCE (SIZE (1..maxPLMN-r11)) OF UAC-Barring-NB-r16

}

UAC-Barring-NB-r16 ::= SEQUENCE {

uac-BarringPerCatList-r16 UAC-BarringPerCatList-NB-r16 OPTIONAL, -- Need OR

uac-AC1-SelectAssistInfo-r16 UAC-AC1-SelectAssistInfo-r15 OPTIONAL, -- Need OR

uac-BarringForAccessIdentity-r16 BIT STRING (SIZE(7))

}

UAC-BarringPerCatList-NB-r16 ::= SEQUENCE (SIZE (1..maxAccessCat-1-r15)) OF UAC-BarringPerCat-NB-r16

UAC-BarringPerCat-NB-r16 ::= SEQUENCE {

uac-accessCategory-r16 INTEGER (1..maxAccessCat-1-r15),

uac-BarringFactor-r16 ENUMERATED {p00, p05, p10, p15, p20, p25, p30, p40,

p50, p60, p70, p75, p80, p85, p90, p95},

uac-BarringTime-r16 ENUMERATED {s4, s8, s16, s32, s64, s128, s256, s512}

}

-- ASN1STOP

| *SystemInformationBlockType14-NB* field descriptions |
| --- |
| ***ab-BarringBitmap***  Access class barring for AC 0-9. The first/ leftmost bit is for AC 0, the second bit is for AC 1, and so on. |
| ***ab-BarringForExceptionData***  Indicates whether ExceptionData is subject to access barring. |
| ***ab-BarringForSpecialAC***  Access class barring for AC 11-15. The first/ leftmost bit is for AC 11, the second bit is for AC 12, and so on. |
| ***ab-Category***  Indicates the category of UEs for which AB applies. Value *a* corresponds to all UEs, value *b* corresponds to the UEs that are neither in their HPLMN nor in a PLMN that is equivalent to it, and value *c* corresponds to the UEs that are neither in the PLMN listed as most preferred PLMN of the country where the UEs are roaming in the operator-defined PLMN selector list on the USIM, nor in their HPLMN nor in a PLMN that is equivalent to their HPLMN, see TS 22.011 [10]. |
| ***ab-Common***  The AB parameters applicable for all PLMN(s). |
| ***ab-Param***  The AB parameters for connectivity to EPC |
| ***ab-PerNRSRP***  Access barring per NRSRP. Value *thresh1* corresponds to the first entry configured in *rsrp-ThresholdsPrachInfoList,* value *thresh2* corresponds to the second entry configured in *rsrp-ThresholdsPrachInfoList*. |
| ***ab-PerPLMN-List***  The AB parameters per PLMN, listed in the same order as the PLMN(s) occur in *plmn-IdentityList* in *SystemInformationBlockType1-NB*. |
| ***uac-AC1-SelectAssistInfo***  Information used to determine whether Access Category 1 applies to the UE, as defined in TS 22.261 [96]. The field is forwarded to upper layers, if present. |
| ***uac-accessCategory***  The Access Category according to TS 22.261 [96]. |
| ***uac-BarringCommon***  The UAC parameters applicable for all PLMN(s). |
| ***uac-BarringFactor***  Represents the probability that access attempt would be allowed during access barring check. |
| ***uac-BarringForAccessIdentity***  Indicates whether access attempt is allowed for each Access Identity. The leftmost bit, bit 0 in the bit string corresponds to Access Identity 1, bit 1 in the bit string corresponds to Access Identity 2, bit 2 in the bit string corresponds to Access Identity 11, bit 3 in the bit string corresponds to Access Identity 12, and so on. Value 0 means that access attempt is allowed for the corresponding access identity. |
| ***uac-BarringPerCatList***  Access control parameters for each access category for the specific PLMN. |
| ***uac-BarringPerPLMN-List***  The UAC parameters per PLMN, listed in the same order as the PLMN(s) occur in *plmn-IdentityList* in *SystemInformationBlockType1-NB*. |
| ***uac-BarringTime***  The average time in seconds before a new access attempt is to be performed after an access attempt was barred at access barring check for the same access category, see 5.3.16.5. |
| ***uac-Param***  The UAC parameters for connectivity to 5GC. |

#### – *SystemInformationBlockType15-NB*

The IE *SystemInformationBlockType15-NB* contains the MBMS Service Area Identities (SAI) of the current and/ or neighbouring carrier frequencies.

*SystemInformationBlockType15-NB* information element

-- ASN1START

SystemInformationBlockType15-NB-r14 ::= SEQUENCE {

mbms-SAI-IntraFreq-r14 MBMS-SAI-List-r11 OPTIONAL, -- Need OR

mbms-SAI-InterFreqList-r14 MBMS-SAI-InterFreqList-NB-r14 OPTIONAL, -- Need OR

lateNonCriticalExtension OCTET STRING OPTIONAL,

...

}

MBMS-SAI-InterFreqList-NB-r14 ::= SEQUENCE (SIZE (1..maxFreq)) OF MBMS-SAI-InterFreq-NB-r14

MBMS-SAI-InterFreq-NB-r14 ::= SEQUENCE {

dl-CarrierFreq-r14 CarrierFreq-NB-r13,

mbms-SAI-List-r14 MBMS-SAI-List-r11,

multiBandInfoList-r14 AdditionalBandInfoList-NB-r14 OPTIONAL -- Need OR

}

-- ASN1STOP

| *SystemInformationBlockType15-NB* field descriptions |
| --- |
| ***mbms-SAI-InterFreqList***  Contains a list of neighboring frequencies including additional frequency bands, if any, that provide MBMS services and the corresponding MBMS SAIs. |
| ***mbms-SAI-IntraFreq***  Contains the list of MBMS SAIs for the current frequency. A duplicate MBMS SAI indicates that this and all following SAIs are not offered by this cell but only by neighbour cells on the current frequency. For MBMS service continuity, the UE shall use all MBMS SAIs listed in *mbms-SAI-IntraFreq* to derive the MBMS frequencies of interest. |
| ***mbms-SAI-List***  Contains a list of MBMS SAIs for a specific frequency. |
| ***multiBandInfoList***  A list of additional frequency bands applicable for the cells participating in the SC-PTM transmission. |

#### – *SystemInformationBlockType16-NB*

The IE *SystemInformationBlockType16-NB* contains information related to GPS time and Coordinated Universal Time (UTC). The UE may use the parameters provided in this system information block to obtain the UTC, the GPS and the local time.

-- ASN1START

SystemInformationBlockType16-NB-r13 ::= SystemInformationBlockType16-r11

-- ASN1STOP

#### – *SystemInformationBlockType20-NB*

For FDD, the IE *SystemInformationBlockType20-NB* contains the information required to acquire the control information associated with transmission of MBMS using SC-PTM.

*SystemInformationBlockType20-NB* information element

-- ASN1START

SystemInformationBlockType20-NB-r14 ::= SEQUENCE {

npdcch-SC-MCCH-Config-r14 NPDCCH-SC-MCCH-Config-NB-r14,

sc-mcch-CarrierConfig-r14 CHOICE {

dl-CarrierConfig-r14 DL-CarrierConfigCommon-NB-r14,

dl-CarrierIndex-r14 INTEGER (0.. maxNonAnchorCarriers-NB-r14)

},

sc-mcch-RepetitionPeriod-r14 ENUMERATED {rf32, rf128, rf512, rf1024,

rf2048, rf4096, rf8192, rf16384},

sc-mcch-Offset-r14 INTEGER (0..10),

sc-mcch-ModificationPeriod-r14 ENUMERATED { rf32, rf128, rf256, rf512, rf1024,

rf2048, rf4096, rf8192, rf16384, rf32768,

rf65536, rf131072, rf262144, rf524288,

rf1048576, spare1},

sc-mcch-SchedulingInfo-r14 SC-MCCH-SchedulingInfo-NB-r14 OPTIONAL, -- Need OP

lateNonCriticalExtension OCTET STRING OPTIONAL,

...

}

NPDCCH-SC-MCCH-Config-NB-r14 ::= SEQUENCE {

npdcch-NumRepetitions-SC-MCCH-r14 ENUMERATED {r1, r2, r4, r8, r16,

r32, r64, r128, r256,

r512, r1024, r2048},

npdcch-StartSF-SC-MCCH-r14 ENUMERATED {v1dot5, v2, v4, v8,

v16, v32, v48, v64},

npdcch-Offset-SC-MCCH-r14 ENUMERATED {zero, oneEighth, oneQuarter,

threeEighth, oneHalf, fiveEighth,

threeQuarter, sevenEighth}

}

SC-MCCH-SchedulingInfo-NB-r14::= SEQUENCE {

onDurationTimerSCPTM-r14 ENUMERATED {

pp1, pp2, pp3, pp4,

pp8, pp16, pp32, spare},

drx-InactivityTimerSCPTM-r14 ENUMERATED {

pp0, pp1, pp2, pp3,

pp4, pp8, pp16, pp32},

schedulingPeriodStartOffsetSCPTM-r14 CHOICE {

sf10 INTEGER(0..9),

sf20 INTEGER(0..19),

sf32 INTEGER(0..31),

sf40 INTEGER(0..39),

sf64 INTEGER(0..63),

sf80 INTEGER(0..79),

sf128 INTEGER(0..127),

sf160 INTEGER(0..159),

sf256 INTEGER(0..255),

sf320 INTEGER(0..319),

sf512 INTEGER(0..511),

sf640 INTEGER(0..639),

sf1024 INTEGER(0..1023),

sf2048 INTEGER(0..2047),

sf4096 INTEGER(0..4095),

sf8192 INTEGER(0..8191)

},

...

}

-- ASN1STOP

| ***SystemInformationBlockType20-NB* field descriptions** |
| --- |
| ***dl-CarrierConfig***  Downlink carrier used for SC-MCCH. E-UTRAN cannot configure a downlink carrier operating in mixed operation mode. |
| ***dl-CarrierIndex***  Index to a downlink carrier signalled in system information. Value '0' corresponds to the anchor carrier, value '1' corresponds to the first entry in *dl-ConfigList* in *SystemInformationBlockType22-NB,* value'2' corresponds to the second entry in *dl-ConfigList* and so on. |
| ***drx-InactivityTimerSCPTM***  Timer for SC-MCCH reception in TS 36.321 [6]. Value in number of NPDCCH periods. Value pp1 corresponds to 1 NPDCCH period, pp2 corresponds to 2 NPDCCH periods and so on. |
| ***npdcch-NumRepetitions-SC-MCCH***  The maximum number of NPDCCH repetitions the UE needs to monitor for SC-MCCH multicast search space, see TS 36.213 [23]. |
| ***npdcch-Offset-SC-MCCH***  Fractional period offset of starting subframe for NPDCCH multicast search space for SC-MCCH, see TS 36.213 [23]. |
| ***npdcch-StartSF-SC-MCCH***  Starting subframes configuration of the NPDCCH multicast search space for SC-MCCH, see TS 36.213 [23].  For IoT NTN TDD mode, value of 4 and value of 8 are not supported: if value *v4* is signalled, it is interpreted as 4\*11.25 and if value *v8* is signalled, it is interpreted as 8\*11.25. [RIL]: N021, IoTTDD |
| ***onDurationTimerSCPTM***  Timer for SC-MCCH reception in TS 36.321 [6]. Value in number of NPDCCH periods. Value pp1 corresponds to 1 NPDCCH period, pp2 corresponds to 2 NPDCCH periods and so on. |
| ***schedulingPeriodStartOffsetSCPTM***  *SCPTM-SchedulingCycle* and *SCPTM-SchedulingOffset* in TS 36.321 [6]. The value of *SCPTM-SchedulingCycle* is in number of sub-frames. Value sf10 corresponds to 10 sub-frames, sf20 corresponds to 20 sub-frames and so on. The value of *SCPTM-SchedulingOffset* is in number of sub-frames. |
| ***sc-mcch-CarrierConfig***  Downlink carrier that is used for SC-MCCH. |
| ***sc-mcch-ModificationPeriod***  Defines periodically appearing boundaries, i.e. radio frames for which (H-SFN \* 1024 +SFN) mod *sc-mcch-ModificationPeriod* = 0. The contents of different transmissions of SC-MCCH information can only be different if there is at least one such boundary in-between them. Value rf32 corresponds to 32 radio frames, value rf128 corresponds to 128 radio frames and so on. |
| ***sc-mcch-Offset***  Indicates, together with the sc-mcch-RepetitionPeriod, the boundary of the repetition period: (H-SFN \* 1024 +SFN) mod *sc-mcch-RepetitionPeriod* = sc-mcch-Offset. |
| ***sc-mcch-RepetitionPeriod***  Defines the interval between transmissions of SC-MCCH information, in radio frames. Value rf32 corresponds to 32 radio frames, rf128 corresponds to 128 radio frames and so on. |
| ***sc-mcch-SchedulingInfo***  DRX information for the SC-MCCH. If the field is absent, DRX is not used for SC-MCCH reception. |

#### – *SystemInformationBlockType22-NB*

The IE *SystemInformationBlockType22-NB* contains radio resource configuration for paging and random access procedure on non-anchor carriers.

*SystemInformationBlockType22-NB* information element

-- ASN1START

SystemInformationBlockType22-NB-r14 ::= SEQUENCE {

dl-ConfigList-r14 DL-ConfigCommonList-NB-r14 OPTIONAL, -- Need OR

ul-ConfigList-r14 UL-ConfigCommonList-NB-r14 OPTIONAL, -- Need OR

pagingWeightAnchor-r14 PagingWeight-NB-r14 OPTIONAL, -- Cond pcch-config

nprach-ProbabilityAnchorList-r14 NPRACH-ProbabilityAnchorList-NB-r14 OPTIONAL, -- Cond nprach-config

lateNonCriticalExtension OCTET STRING OPTIONAL,

...,

[[ mixedOperationModeConfig-r15 SEQUENCE {

dl-ConfigListMixed-r15 DL-ConfigCommonList-NB-r14 OPTIONAL, -- Cond dl-ConfigList

ul-ConfigListMixed-r15 UL-ConfigCommonList-NB-r14 OPTIONAL, -- Cond ul-ConfigList

pagingDistribution-r15 ENUMERATED {true} OPTIONAL, -- Need OR

nprach-Distribution-r15 ENUMERATED {true} OPTIONAL -- Need OR

} OPTIONAL, -- Need OR

ul-ConfigList-r15 UL-ConfigCommonListTDD-NB-r15 OPTIONAL -- Cond TDD

]],

[[ coverageBasedPagingConfig-r17 CoverageBasedPagingConfig-NB-r17 OPTIONAL -- Need OR

]]

}

DL-ConfigCommonList-NB-r14 ::= SEQUENCE (SIZE (1.. maxNonAnchorCarriers-NB-r14)) OF

DL-ConfigCommon-NB-r14

UL-ConfigCommonList-NB-r14 ::= SEQUENCE (SIZE (1.. maxNonAnchorCarriers-NB-r14)) OF

UL-ConfigCommon-NB-r14

UL-ConfigCommonListTDD-NB-r15 ::= SEQUENCE (SIZE (1.. maxNonAnchorCarriers-NB-r14)) OF

UL-ConfigCommonTDD-NB-r15

CoverageBasedPagingConfig-NB-r17 ::= SEQUENCE {

cbp-HystTimer-r17 ENUMERATED {ms2560, ms7680, ms12800, ms17920, ms23040, ms28160, ms33280, ms40960},

cbp-ConfigList-r17 SEQUENCE (SIZE (1.. 2)) OF CBP-Config-NB-r17

}

CBP-Config-NB-r17 ::= SEQUENCE {

nrsrpMin-r17 RSRP-Range,

nB-r17 ENUMERATED {fourT, twoT, oneT, halfT, quarterT, one8thT, one16thT, one32ndT,

one64thT, one128thT, one256thT, one512thT, one1024thT, spare3,

spare2, spare1} OPTIONAL, -- Need OP

ue-SpecificDRX-CycleMin-r17 ENUMERATED {rf32, rf64, rf128, rf256} OPTIONAL -- Need OR

}

DL-ConfigCommon-NB-r14 ::= SEQUENCE {

dl-CarrierConfig-r14 DL-CarrierConfigCommon-NB-r14,

pcch-Config-r14 PCCH-Config-NB-r14 OPTIONAL, -- Need OR

...,

[[ wus-Config-r15 WUS-ConfigPerCarrier-NB-r15 OPTIONAL -- Cond WUS

]],

[[ gwus-Config-r16 WUS-ConfigPerCarrier-NB-r15 OPTIONAL -- Cond GWUS

]],

[[ pcch-Config-r17 PCCH-Config-NB-r17 OPTIONAL -- Cond pcch-config2

]]

}

PCCH-Config-NB-r14 ::= SEQUENCE {

npdcch-NumRepetitionPaging-r14 ENUMERATED {

r1, r2, r4, r8, r16, r32, r64, r128,

r256, r512, r1024, r2048,

spare4, spare3, spare2, spare1} OPTIONAL, -- Need OP

pagingWeight-r14 PagingWeight-NB-r14 DEFAULT w1,

...

}

PCCH-Config-NB-r17 ::= SEQUENCE {

cbp-Index-r17 INTEGER (1..2),

npdcch-NumRepetitionPaging-r17 ENUMERATED {r1, r2, r4, r8, r16, r32, r64, r128},

pagingWeight-r17 PagingWeight-NB-r14 DEFAULT w1,

...

}

PagingWeight-NB-r14 ::= ENUMERATED {w1, w2, w3, w4, w5, w6, w7, w8,

w9, w10, w11, w12, w13, w14, w15, w16}

UL-ConfigCommon-NB-r14 ::= SEQUENCE {

ul-CarrierFreq-r14 CarrierFreq-NB-r13,

nprach-ParametersList-r14 NPRACH-ParametersList-NB-r14 OPTIONAL, -- Need OR

...,

[[ nprach-ParametersListEDT-r15 NPRACH-ParametersList-NB-r14 OPTIONAL -- Cond EDT

]],

[[ rsrp-ThresholdsPrachInfoList-r16 RSRP-ThresholdsNPRACH-InfoList-NB-r13 OPTIONAL -- Need OR

]]

}

UL-ConfigCommonTDD-NB-r15 ::= SEQUENCE {

tdd-UL-DL-AlignmentOffset-r15 TDD-UL-DL-AlignmentOffset-NB-r15,

nprach-ParametersListTDD-r15 NPRACH-ParametersListTDD-NB-r15 OPTIONAL, -- Need OR

...

}

NPRACH-ProbabilityAnchorList-NB-r14 ::= SEQUENCE (SIZE (1.. maxNPRACH-Resources-NB-r13)) OF

NPRACH-ProbabilityAnchor-NB-r14

NPRACH-ProbabilityAnchor-NB-r14 ::= SEQUENCE {

nprach-ProbabilityAnchor-r14 ENUMERATED {

zero, oneSixteenth, oneFifteenth, oneFourteenth,

oneThirteenth, oneTwelfth, oneEleventh, oneTenth,

oneNinth, oneEighth, oneSeventh, oneSixth,

oneFifth, oneFourth, oneThird, oneHalf}

OPTIONAL -- Need OP

}

-- ASN1STOP

| *SystemInformationBlockType22-NB* field descriptions |
| --- |
| ***cbp-ConfigList***  List of coverage-based paging configurations. |
| ***cbp-HystTimer***  The minimum duration, in milliseconds, a UE configured with coverage-based paging uses the same carrier for paging, see TS 36.304 [4]. Value *ms2560* corresponds to 2560ms, value *ms7680* corresponds to 7680ms, and so on. |
| ***cbp-Index***  Index to the coverage-based paging configuration associated with the downlink carrier. Value 1 corresponds to the first entry in *cbp-ConfigList*, and value 2 corresponds to the second entry in the *cbp-ConfigList*. |
| ***dl-CarrierConfig***  For FDD: Provides the configuration of the DL non-anchor carrier.  For TDD: Provides the configuration of the non-anchor carrier. |
| ***dl-ConfigList, dl-ConfigListMixed***  For FDD: List of DL non-anchor carriers and associated configuration that can be used for paging and/or random access. E-UTRAN configures DL non-anchor carriers operating in mixed operation mode only in *dl-ConfigListMixed* and only a UE that supports mixed operation mode uses the carriers in *dl-ConfigListMixed*. A given carrier is either signalled in the *dl-ConfigList* or in *dl-ConfigListMixed*.  If *dl-ConfigListMixed* is present and at least one of the carriers in *dl-ConfigListMixed* is configured for paging:  - If *pagingDistribution* is present, the UE supporting mixed operation mode creates a combined list of DL carriers for paging by appending *dl-ConfigListMixed* to the *dl-ConfigList* while maintaining the order among *dl-ConfigList* and *dl-ConfigListMixed*; the total number of signalled DL non-anchor carriers cannot be more than *maxNonAnchorCarriers-NB-r14*.  - If *pagingDistribution* is absent, the UE supporting mixed operation mode uses the list of DL carriers for paging provided in *dl-ConfigListMixed* and considers *pagingWeightAncho*r being set to w0, i.e. the anchor carrier is not used*.*  Otherwise, the *pagingDistribution* field is not applicable and the UE shall ignore the value.  For TDD: List of non-anchor carriers and associated configuration that can be used for paging and/or random access. |
| ***gwus-Config***  For FDD: Carrier specific GWUS Configuration.  If both *gwus-Config* and *wus-Config* are present for the carrier, E-UTRAN configures the same value for both fields. |
| ***mixedOperationModeConfig***  For FDD: Provides the configuration of DL and UL non-anchor carriers that can be used for paging and random access by a UE that supports mixed operation mode.  For TDD: This parameter is absent. |
| ***nB***  Parameter: nB is used as one of parameters to derive the Paging Frame and Paging Occasion according to TS 36.304 [4]. Value in multiples of 'T' as defined in TS 36.304 [4]. A value of fourT corresponds to 4 \* T, a value of twoT corresponds to 2 \* T and so on.  If the field is absent, the value *of nB* configured in *SystemInformationBlockType2-NB* in IE *pcch-Config* applies. |
| ***npdcch-NumRepetitionPaging***  Maximum number of repetitions for NPDCCH common search space (CSS) for paging, see TS 36.213 [23], clause 16.6.  If the field is absent, the value *of npdcch-NumRepetitionPaging* configured in *SystemInformationBlockType2-NB* in IE *pcch-Config* applies. |
| ***nprach-Distribution***  Indicates which UL carriers a UE supporting mixed operation mode uses for random access as defined in description of *ul-ConfigList, ul-ConfigListMixed*. |
| ***nprach-ParametersList, nprach-ParametersList-EDT***  Configure NPRACH parameters for each NPRACH resource on one non-anchor UL carrier. Up to three NPRACH resources can be configured on one non-anchor UL carrier. Each NPRACH resource is associated with a different number of NPRACH repetitions.  NPRACH resources in *nprach-ParametersListEDT* are used to initiateEDT. Each NPRACH resource is associated with a maximum TBS signalled in the corresponding entry of *edt-TBS-InfoList* in *SystemInformationBlockType2-NB*.  E-UTRAN includes the same number of entries, and listed in the same order, as in *nprach-ParametersList* in *SystemInformationBlockType2-NB*. |
| ***nprach-ParametersListTDD***  For TDD: Configure NPRACH parameters for each NPRACH resource on one non-anchor UL carrier. Up to three NPRACH resources can be configured on one non-anchor UL carrier. Each NPRACH resource is associated with a different number of NPRACH repetitions.  E-UTRAN includes the same number of entries in *nprach-ParametersListTDD*, and listed in the same order, as in *nprach-ParametersListTDD* in *SystemInformationBlockType2-NB*.. |
| ***nprach-ProbabilityAnchor***  Configure the selection probability for the anchor carrier NPRACH resource, see TS 36.321 [6]. Value zero corresponds to a probability of 0, oneSixteenth corresponds to the probability of 1/16, oneFifteenth corresponds to the probability of 1/15, and so on.  If the field is absent, the selection probability of the anchor carrier NPRACH resource is 1.  All non-anchor carriers NPRACH resources have equal probability between them.  If there is no NPRACH resource defined on the anchor carrier for one repetition level in *nprach-ParametersList-EDT*, (respectively *nprach-ParametersListFmt2*, *nprach-ParametersListFmt2-EDT*), the UE shall use the value 'zero' and ignore the signalled value of *nprach-ProbabilityAnchor* for this repetition level for the NPRACH resources defined by *nprach-ParametersList-EDT* (respectively *nprach-ParametersListFmt2*, *nprach-ParametersListFmt2-EDT*). |
| ***nprach-ProbabilityAnchorList***  Configures the selection probability for each NPRACH resource on the anchor carrier.  E-UTRAN includes the same number of entries, and listed in the same order, as in *nprach-ParametersList* in *SystemInformationBlockType2-NB.* |
| ***nrsrpMin***  The minimum serving cell NRSRP applicable to the coverage-based paging carrier configuration, see TS 36.304 [4]. |
| ***pagingDistribution***  Indicates which DL carriers a UE supporting mixed operation mode monitors for paging as defined in description of *dl-ConfigList, dl-ConfigListMixed*. |
| ***pagingWeight***  Weight of the non-anchor paging carrier for uneven paging load distribution across the carriers. Value w1 corresponds to a relative weight of 1, w2 corresponds to a relative weight of 2, and so on.  The paging load for a carrier 'i' is equal to w(i)/W where i is equal to 0 for the anchor carrier and equal to the index of the carrier in the *dl-ConfigList* / *dl-ConfigListMixed* for a non-anchor carrier, W is the sum of the weights of all paging carriers.  To avoid correlation between paging carrier and paging occasion, the weights should be assigned such that: nB \* W <= 16384. |
| ***pagingWeightAnchor***  Weight of the anchor carrier for uneven paging load distribution across the carriers. Value w1 corresponds to a relative weight of 1, w2 corresponds to a relative weight of 2, and so on.  If the field is absent, the (default) value of w0 is applied, i.e. the anchor carrier is not used for paging. |
| ***pcch-Config***  Configure the PCCH parameters for the non-anchor DL carrier. |
| ***rsrp-ThresholdsPrachInfoList***  The criterion for UE to select an NPRACH resource on the non-anchor carrier. The threshold values are related to the anchor carrier NRSRP measurement. See TS 36.321 [6]. E-UTRAN includes the same number of entries, and listed in the same order, as in *rsrp-ThresholdsPrachInfoList* in *SystemInformationBlockType2-NB*.  A UE that supports *powerClassNB-14dBm-r14* shall correct the RSRP threshold values before applying them as follows:  RSRP threshold = Signalled RSRP threshold - min{0, (14-min(23, P-Max))} where P-Max*:*is the value of *p-Max* field in *SystemInformationBlockType1-NB.* |
| ***tdd-UL-DL-AlignmentOffset***  Indicates the offset between the UL carrier frequency center with respect to DL carrier frequency center for the non-anchor carrier. |
| ***ue-SpecificDRX-CycleMin***  Minimum UE specific DRX cycle for the coverage-based paging configuration, see TS 36.304 [4]. Value *rf32* corresponds to 32 radio frames, *rf64* corresponds to 64 radio frames and so on.  If present, E-UTRAN ensures PCCH configuration does not lead to CSS overlap for *ue-SpecificDRX-CycleMin*. |
| ***ul-CarrierFreq***  For FDD: UL carrier frequency of the non-anchor carrier as defined in TS 36.101 [42], clause 5.7.3F and TS 36.108 [114], clause 5.4B.2.  For TDD: This field is absent and the uplink carrier frequency is same as the downlink frequency. |
| ***ul-ConfigList, ul-ConfigListMixed***  For FDD: List of UL non-anchor carriers and associated configuration that can be used for random access. E-UTRAN configures UL non-anchor carriers operating in mixed operation mode only in *ul-ConfigListMixed* and only a UE that supports mixed operation mode uses the carriers in *ul-ConfigListMixed*. A given carrier is either signalled in the *ul-ConfigList* or in *ul-ConfigListMixed*.  If *ul-ConfigListMixed* is present and at least one of the carriers in *ul-ConfigListMixed* is configured for random access:  - If *nprach-Distribution* is present, the UE supporting mixed operation mode creates a combined list of UL carriers for random access by appending *ul-ConfigListMixed* to the *ul-ConfigList* while maintaining the order among both *ul-ConfigList* and *ul-ConfigListMixed*; the total number of signalled UL non-anchor carriers cannot be more than *maxNonAnchorCarriers-NB-r14*.  - If *nprach-Distribution* is absent, the UE supporting mixed operation mode uses the list of UL carriers for random access provided in *ul-ConfigListMixed* and considers *nprach-ProbabiliyAnchor* being set to zero for each NPRACH resource, i.e. the anchor carrier is not used for random access*.*  Otherwise, the *nprach-Distribution* field is not applicable and the UE shall ignore the value.  For TDD: E-UTRAN configures *ul-ConfigList-r15* and includes the same number of entries as in *dl-ConfigList*. The UL carrier frequency of the non-anchor carrier is same as the DL carrier frequency. |
| ***wus-Config***  For FDD: Carrier specific WUS Configuration. |

| Conditional presence | Explanation |
| --- | --- |
| *dl-ConfigList* | This field is optionally present, Need OR, if the field *dl-ConfigList* is present. Otherwise the field is not present. |
| *EDT* | The field is optionally present, Need OR, if *edt-Parameters* in *SystemInformationBlockType2-NB* is present; otherwise the field is not present and the UE shall delete any existing value for this field. |
| *GWUS* | This field is optionally present, Need OR, if g*wus-Config-r16* is present in *SystemInformationBlockType2-NB*. Otherwise the field is not present. |
| *pcch-config* | This field is optionally present, Need OP, if the field *dl-ConfigList* is present and at least one of the carriers in *dl-ConfigList* is configured for paging. Otherwise the field is not present and only the anchor carrier is used for paging. |
| *pcch-config2* | This field is optionally present, need OR, if the field *pcch-Config-r14* is not present for the same carrier and *coverageBasedPagingConfig* is present. Otherwise the field is not present and the UE shall delete any existing value for this field. |
| *nprach-config* | This field is mandatory present, if the field *ul-ConfigList* is present and at least one of the carriers in *ul-ConfigList* is configured for random access. Otherwise the field is not present and only the anchor carrier is used for random access. |
| *TDD* | This field is optionally present, Need OR, for TDD. Otherwise the field is not present. |
| *ul-ConfigList* | This field is optionally present, Need OR, if the field *ul-ConfigList* is present. Otherwise the field is not present. |
| *WUS* | This field is mandatory present, if the field *wus-Config* is present in *SystemInformationBlockType2-NB*. Otherwise the field is not present, Need OR. |

#### – *SystemInformationBlockType23-NB*

For FDD, the IE *SystemInformationBlockType23-NB* contains radio resource configuration for NPRACH resources using preamble format 2 on non-anchor carriers.

*SystemInformationBlockType23-NB* information element

-- ASN1START

SystemInformationBlockType23-NB-r15 ::= SEQUENCE {

ul-ConfigList-v1530 UL-ConfigCommonList-NB-v1530 OPTIONAL, -- Need OR

ul-ConfigListMixed-v1530 UL-ConfigCommonList-NB-v1530 OPTIONAL, -- Need OR

lateNonCriticalExtension OCTET STRING OPTIONAL,

...

}

UL-ConfigCommonList-NB-v1530 ::= SEQUENCE (SIZE (1.. maxNonAnchorCarriers-NB-r14)) OF

UL-ConfigCommon-NB-v1530

UL-ConfigCommon-NB-v1530 ::= SEQUENCE {

nprach-ParametersListFmt2-r15 NPRACH-ParametersListFmt2-NB-r15 OPTIONAL, -- Need OR

nprach-ParametersListFmt2EDT-r15 NPRACH-ParametersListFmt2-NB-r15 OPTIONAL, -- Cond EDT

...

}

-- ASN1STOP

| *SystemInformationBlockType23-NB* field descriptions |
| --- |
| ***nprach-ParametersListFmt2, nprach-ParametersListFmt2EDT***  Configures NPRACH parameters for each NPRACH resource format 2 on one UL carrier. Up to three NPRACH resources can be configured on one carrier. Each NPRACH resource is associated with a different number of NPRACH repetitions.  E-UTRAN includes the same number of entries, and listed in the same order, as in *nprach-ParametersList* in *SystemInformationBlockType2-NB*.  The NPRACH resources in *nprach-ParametersListFmt2EDT* are used to initiateEDT. Each NPRACH resource is associated with a TBS signalled in the corresponding entry of *edt-TBS-InfoList.*  E-UTRAN configures the NPRACH resources format 2 so that they do not overlap in time domain with the NPRACH resources configured in *nprach-ParametersList* and *nprach-ParametersListEDT* on the same UL carrier.  If there is no NPRACH resource in *nprach-ParametersListFmt2* (respectively *nprach-ParametersListFmt2EDT*) on any UL carrier, including the anchor carrier, for one NPRACH repetition level, the UE uses the NPRACH resources in *nprach-ParametersList* (respectively *nprach-ParametersListEDT*) for this NPRACH repetition level. Otherwise, the UE uses only NPRACH resources in *nprach-ParametersListFmt2* (respectively *nprach-ParametersListFmt2EDT*).  If E-UTRAN configures NPRACH resources format 2 in one NPRACH repetition level, the E-UTRAN configures NPRACH resources format 2 in all NPRACH repetition levels upwards. |
| ***ul-ConfigList, ul-ConfigListMixed***  *ul-ConfigList* (respectively *ul-ConfigListMixed*) is parallel to *ul-ConfigList* (respectively *ul-ConfigListMixed*) in *SystemInformationBlockType22-NB*.  E-UTRAN includes the same number of entries and in the same order in *ul-ConfigList* (respectively *ul-ConfigListMixed*) in *SystemInformationBlockType23-NB* as in *ul-ConfigList* (respectively *ul-ConfigListMixed*) in *SystemInformationBlockType22-NB.* The UE combines each entry in *ul-ConfigList* (respectively *ul-ConfigListMixed*) in *SystemInformationBlockType23-NB* with the corresponding entry in *ul-ConfigList* (respectively *ul-ConfigListMixed*) in *SystemInformationBlockType22-NB*. |

| Conditional presence | Explanation |
| --- | --- |
| *EDT* | The field is optionally present, Need OR, if *edt-Parameters* in *SystemInformationBlockType2-NB* is present; otherwise the field is not present and the UE shall delete any existing value for this field. |

#### – *SystemInformationBlockType27-NB*

The IE *SystemInformationBlockType27-NB* contains information relevant only for inter-RAT cell selection i.e. assistance information about E-UTRA frequencies and/ or GERAN frequencies for cell selection.

*SystemInformationBlockType27-NB* information element

-- ASN1START

SystemInformationBlockType27-NB-r16 ::= SEQUENCE {

carrierFreqListEUTRA-r16 CarrierFreqListEUTRA-NB-r16 OPTIONAL, -- Need OR

carrierFreqsListGERAN-r16 CarrierFreqsListGERAN-NB-r16 OPTIONAL, -- Need OR

lateNonCriticalExtension OCTET STRING OPTIONAL,

...

}

CarrierFreqListEUTRA-NB-r16 ::= SEQUENCE (SIZE (1..maxFreqEUTRA-NB-r16)) OF

CarrierFreqEUTRA-NB-r16

CarrierFreqsListGERAN-NB-r16 ::= SEQUENCE (SIZE (1..maxFreqsGERAN-NB-r16)) OF

CarrierFreqsGERAN-NB-r16

CarrierFreqEUTRA-NB-r16 ::= SEQUENCE {

carrierFreq-r16 ARFCN-ValueEUTRA-r9,

sib1-r16 ENUMERATED {supported} OPTIONAL, -- Need OR

sib1-BR-r16 ENUMERATED {supported} OPTIONAL, -- Need OR

...

}

CarrierFreqsGERAN-NB-r16 ::= SEQUENCE {

carrierFreqs-r16 CarrierFreqsGERAN,

ec-GSM-IOT-r16 ENUMERATED {supported} OPTIONAL, -- Need OR

peo-r16 ENUMERATED {supported} OPTIONAL, -- Need OR

...

}

-- ASN1STOP

| *SystemInformationBlockType27-NB* field descriptions |
| --- |
| ***carrierFreq***  E-UTRAN carrier frequency. |
| ***carrierFreqListEUTRA***  Provides a list of neighbouring E-UTRA carrier frequencies, which may be searched for neighbouring E-UTRAN cells. |
| ***carrierFreqs***  The list of GERAN carrier frequencies organised into one group of GERAN carrier frequencies. |
| ***carrierFreqsListGERAN***  Provides a list of neighbouring GERAN carrier frequencies, which may be searched for neighbouring GERAN cells. The GERAN carrier frequencies are organised in groups and the parameters are indicated per group of GERAN carrier frequencies. |
| ***ec-GSM-IOT***  Indicates that the GERAN carrier frequencies support EC-GSM-IOT. |
| ***peo***  Indicates that the GERAN carrier frequencies support Power Efficient Operation (PEO). |
| ***sib1***  Indicates that SIB1 is scheduled in the E-UTRAN cells. |
| ***sib1-BR***  Indicates that SIB1-BR is scheduled in the E-UTRAN cells. |

#### – *SystemInformationBlockType31-NB*

The IE *SystemInformationBlockType31-NB* contains satellite assistance information. *SystemInformationBlockType31-NB* is only signalled in a NTN cell.

***SystemInformationBlockType31-NB* information element**

-- ASN1START

SystemInformationBlockType31-NB-r17 ::= SEQUENCE {

servingSatelliteInfo-r17 ServingSatelliteInfo-r17,

lateNonCriticalExtension OCTET STRING OPTIONAL,

...,

[[ servingSatelliteInfo-v1820 ServingSatelliteInfo-v1820 OPTIONAL -- Need OR

]],

[[ servingSatelliteInfo-v19xy ServingSatelliteInfo-v19xy OPTIONAL -- Need OR

]]

}

ServingSatelliteInfo-v19xy ::= SEQUENCE {

k-Mac-r19 INTEGER (1..1024) OPTIONAL -- Need OP

}

-- ASN1STOP

|  |
| --- |
| *SystemInformationBlockType31-NB* field descriptions |
| ***k-Mac***  Scheduling offset used when downlink and uplink frame timing are not aligned at the eNB, see TS 36.213 [23]. Unit in ms. *k-Mac-r19* is only signalled in IoT NTN TDD mode. If *k-Mac-r19* is present, the UE shall ignore the *k-Mac-r17*.  If both this field and *k-Mac-r17* are absent, the UE uses the (default) value of 0. |

#### – *SystemInformationBlockType32-NB*

The IE *SystemInformationBlockType32-NB* contains satellite assistance information for prediction of discontinuous coverage. *SystemInformationBlockType32-NB* is only signalled in a NTN cell.

***SystemInformationBlockType32-NB* information element**

-- ASN1START

SystemInformationBlockType32-NB-r17 ::= SEQUENCE {

satelliteInfoList-r17 SatelliteInfoList-r17 OPTIONAL, -- Need OR

lateNonCriticalExtension OCTET STRING OPTIONAL,

...,

[[ satelliteInfoList-v1800 SatelliteInfoList-v1800 OPTIONAL -- Need OR

]],

[[ satelliteInfoList-v1830 SatelliteInfoList-NB-v1830 OPTIONAL -- Need OR

]]

}

SatelliteInfoList-NB-v1830 ::= SEQUENCE (SIZE (1..maxSat-r17)) OF CarrierFreqList-NB-r18

CarrierFreqList-NB-r18 ::= SEQUENCE {

carrierFreqList-r18 SEQUENCE (SIZE (1..maxFreq)) OF CarrierFreq-NB-r13

}

-- ASN1STOP

|  |
| --- |
| *SystemInformationBlockType32-NB* field descriptions |
| ***carrierFreqList***  Includes a list of NB-IoT frequencies, see TS 36.304 [4]. |
| ***satelliteInfoList***  List of satellite information. If E-UTRAN includes *satelliteInfoList-v1830*, it includes the same number of entries, and listed in the same order, as in *satelliteInfoList-r17*.  In this version of the specification, E-UTRAN does not include *satelliteInfoList-v1800*. |

#### – *SystemInformationBlockType33-NB*

The IE *SystemInformationBlockType33-NB* contains satellite assistance information for neighbour cells.

*SystemInformationBlockType33-NB* information element

-- ASN1START

SystemInformationBlockType33-NB-r18 ::= SEQUENCE {

neighSatelliteInfoList-r18 NeighSatelliteInfoList-r18 OPTIONAL, -- Need OR

neighValidityDuration-r18 ENUMERATED {s5, s10, s15, s20, s25, s30, s35, s40,

s45, s50, s55, s60, s120, s180, s240, s900}

OPTIONAL, -- Need OP

lateNonCriticalExtension OCTET STRING OPTIONAL,

...,

[[ neighSatelliteInfoList-v19xy NeighSatelliteInfoList-v19xy OPTIONAL -- Need OR

]]

}

NeighSatelliteInfoList-v19xy ::= SEQUENCE (SIZE(1..maxSat-r17)) OF NeighSatelliteInfo-v19xy

NeighSatelliteInfo-v19xy ::= SEQUENCE {

k-Mac-r19 INTEGER (1..1024) OPTIONAL, -- Need OP

radioFrameOffset-r19 INTEGER (-8..8) OPTIONAL -- Need OP [RIL]: X501, IoTTDD [RIL]:V221, IoTTDD [RIL]:Z051, IoTTDD

}

-- ASN1STOP

|  |
| --- |
| *SystemInformationBlockType33-NB* field descriptions |
| ***k-Mac***  Scheduling offset used when downlink and uplink frame timing are not aligned at the eNB, see TS 36.213 [23]. Unit in ms. *k-Mac-r19* is only signalled in IoT NTN TDD mode. If *k-Mac-r19* is present, the UE shall ignore the *k-Mac-r17*.  If both this field and *k-Mac-r17* are absent, the UE uses the (default) value of 0. |
| ***neighSatelliteInfoList***  List of neighbour satellite information. If E-UTRAN includes *neighSatelliteInfoList-v19xy*, it includes the same number of entries, and listed in the same order, as in *neighSatelliteInfoList-r18*. |
| ***radioFrameOffset***  Offset, in number of frames, between the start of IoT NTN TDD pattern of serving cell and the start of the nearest IoT NTN TDD pattern of the neighbor cell, at the uplink time synchronization reference point defined in clause 16.1.2 of TS 36.213 [6]. [RIL]:Z052, IoTTDD |

#### 6.7.3.2 NB-IoT Radio resource control information elements

#### – *CarrierConfigDedicated-NB*

The IE *CarrierConfigDedicated-NB* is used to specify a carrier in NB-IoT.

*CarrierConfigDedicated-NB* information elements

-- ASN1START

CarrierConfigDedicated-NB-r13 ::= SEQUENCE {

dl-CarrierConfig-r13 DL-CarrierConfigDedicated-NB-r13,

ul-CarrierConfig-r13 UL-CarrierConfigDedicated-NB-r13

}

DL-CarrierConfigDedicated-NB-r13 ::= SEQUENCE {

dl-CarrierFreq-r13 CarrierFreq-NB-r13,

downlinkBitmapNonAnchor-r13 CHOICE {

useNoBitmap-r13 NULL,

useAnchorBitmap-r13 NULL,

explicitBitmapConfiguration-r13 DL-Bitmap-NB-r13,

spare NULL

} OPTIONAL, -- Need ON

dl-GapNonAnchor-r13 CHOICE {

useNoGap-r13 NULL,

useAnchorGapConfig-r13 NULL,

explicitGapConfiguration-r13 DL-GapConfig-NB-r13,

spare NULL

} OPTIONAL, -- Need ON

inbandCarrierInfo-r13 SEQUENCE {

samePCI-Indicator-r13 CHOICE {

samePCI-r13 SEQUENCE {

indexToMidPRB-r13 INTEGER (-55..54)

},

differentPCI-r13 SEQUENCE {

eutra-NumCRS-Ports-r13 ENUMERATED {same, four}

}

} OPTIONAL, -- Cond anchor-guardband-or-standalone

eutraControlRegionSize-r13 ENUMERATED {n1, n2, n3}

} OPTIONAL, -- Cond non-anchor-inband

...,

[[ nrs-PowerOffsetNonAnchor-v1330 ENUMERATED {dB-12, dB-10, dB-8, dB-6,

dB-4, dB-2, dB0, dB3}

OPTIONAL -- Need ON

]],

[[ dl-GapNonAnchor-v1530 DL-GapConfig-NB-v1530 OPTIONAL -- Cond TDD1

]],

[[ dl-CarrierFreq-v1550 CarrierFreq-NB-v1550 OPTIONAL -- Cond TDD1

]]

}

UL-CarrierConfigDedicated-NB-r13 ::= SEQUENCE {

ul-CarrierFreq-r13 CarrierFreq-NB-r13 OPTIONAL, -- Need OP

...,

[[ tdd-UL-DL-AlignmentOffset-r15 TDD-UL-DL-AlignmentOffset-NB-r15 OPTIONAL -- Cond TDD

]]

}

-- ASN1STOP

| *CarrierConfigDedicated-NB* field descriptions |
| --- |
| ***dl-CarrierConfig***  Downlink carrier used for all unicast transmissions. |
| ***dl-CarrierFreq***  DL carrier frequency. The downlink carrier is not in a E-UTRA PRB which contains E-UTRA PSS/SSS/PBCH. |
| ***dl-GapNonAnchor***  Downlink transmission gap configuration for the anchor/ non-anchor carrier, see TS 36.211 [21], clause 10.2.3.4.  E-UTRAN may configure *dl-GapNonAnchor-v1530* only if *dl-GapNonAnchor-r13* is set to *explicitGapConfiguration*. |
| ***downlinkBitmapNonAnchor***  For FDD: NB-IoT downlink subframe configuration for downlink transmission on the anchor/ non-anchor carrier. See TS 36.213 [23], clause 16.4.  For TDD: NB-IoT downlink, uplink and special subframes configuration for transmission on the anchor/ non-anchor carrier. See TS 36.213 [23], clause 16.4.  For IoT NTN TDD mode, if this field is signalled, *useNoBitmap-r13* is used.[RIL]:Z053, IoTTDD |
| ***eutraControlRegionSize***  Indicates the control region size of the E-UTRA cell for the in-band operation mode, see TS 36.213 [23]. Unit is in number of OFDM symbols. If *operationModeInfo* in MIB-NB is set to *inband-SamePCI* or *inband-DifferentPCI*, it should be set to the value broadcast in SIB1-NB. |
| ***eutra-NumCRS-Ports***  Number of E-UTRA CRS antenna ports, either the same number of ports as NRS or 4 antenna ports. See TS 36.211 [21], TS 36.212 [22], and TS 36.213 [23]. |
| ***inbandCarrierInfo***  Provides the configuration of the anchor/ non-anchor inband carrier. If *operationModeInfo* is set to standalone in the MIB-NB, E-UTRAN only configures this field if the UE supports mixed operation mode. |
| ***indexToMidPRB***  The PRB index is signaled by offset from the middle of the EUTRA system. |
| ***nrs-PowerOffsetNonAnchor***  Provides the power offset of the downlink narrowband reference-signal EPRE of the anchor/ non-anchor carrier relative to the anchor carrier, unit in dB. Value dB-12 corresponds to -12 dB, dB-10 corresponds to -10 dB and so on. See TS 36.213 [23], clause16.2.2. |
| ***samePCI-Indicator***  This parameter specifies whether the anchor/ non-anchor carrier reuses the same PCI as the EUTRA carrier. |
| ***ul-CarrierConfig***  Uplink anchor/ non-anchor carrier used for all unicast transmissions. |
| ***ul-CarrierFreq***  For FDD: UL carrier frequency as defined in TS 36.101 [42], clause 5.7.3F and TS 36.108 [114], clause 5.4B.2. If absent, the same TX-RX frequency separation and carrier frequency offset as for the anchor carrier applies.  For TDD: This field is absent and the uplink carrier frequency is equal to the downlink frequency. |

| Conditional presence | Explanation |
| --- | --- |
| *non-anchor-inband* | The field is mandatory present if the anchor/ non-anchor carrier is an inband carrier; otherwise it is not present. |
| *anchor-guardband-or-standalone* | The field is mandatory present if *operationModeInfo* is set to *guardband* or *standalone* in the MIB; otherwise it is not present. |
| *TDD* | The field is mandatory present for TDD; otherwise the field is not present and the UE shall delete any existing value for this field. |
| *TDD1* | The field is optionally present, Need OR, for TDD; otherwise the field is not present and the UE shall delete any existing value for this field. |

#### – *CarrierFreq-NB*

The IE *CarrierFreq-NB* is used to provide the NB-IoT carrier frequency, as defined in TS 36.101 [42] and TS 36.108 [114].

*CarrierFreq-NB* information elements

-- ASN1START

CarrierFreq-NB-r13 ::= SEQUENCE {

carrierFreq-r13 ARFCN-ValueEUTRA-r9,

carrierFreqOffset-r13 ENUMERATED {

v-10, v-9, v-8, v-7, v-6, v-5, v-4, v-3, v-2, v-1, v-0dot5,

v0, v1, v2, v3, v4, v5, v6, v7, v8, v9

} OPTIONAL -- Need ON

}

CarrierFreq-NB-v1550 ::= SEQUENCE {

carrierFreqOffset-v1550 ENUMERATED {v-8dot5, v-4dot5, v3dot5, v7dot5}

}

-- ASN1STOP

| *CarrierFreq-NB* field descriptions |
| --- |
| ***carrierFreq***  Provides the ARFCN applicable for the NB-IoT carrier frequency as defined in TS 36.101 [42], Table 5.7.3-1 and TS 36.108 [114], Table 5.4A.2-1. |
| ***carrierFreqOffset***  Offset of the NB-IoT channel number to EARFCN as defined in TS 36.101 [42], clause 5.7.3F and TS 36.108 [114], clause 5.4B.2. Value v-10 means -10, v-9 means -9, and so on. E-UTRAN may configure the values v-8dot5, v-4dot5, v3dot5 and v7dot5 only for a carrier in a TDD band.  For TDD, the UE shall use the value signalled in *carrierFreqOffset-v1550*, if present, and ignore the value signaled in *carrierFreqOffset-r13*. |

#### *– ChannelRasterOffset-NB*

The IE *ChannelRasterOffset-NB* is used to specify the NB-IoT offset from LTE channel raster. Unit in kHz in set { -7.5, -2.5, 2.5, 7.5} See TS 36.211[21] and TS 36.213 [23].

***ChannelRasterOffset-NB* information element**

-- ASN1START

ChannelRasterOffset-NB-r13 ::= ENUMERATED {khz-7dot5, khz-2dot5, khz2dot5, khz7dot5}

-- ASN1STOP

#### – *DL-Bitmap-NB*

The IE *DL-Bitmap-NB* is used to specify the set of NB-IoT downlink subframes for downlink transmission.

*DL-Bitmap-NB* information element

-- ASN1START

DL-Bitmap-NB-r13 ::= CHOICE {

subframePattern10-r13 BIT STRING (SIZE (10)),

subframePattern40-r13 BIT STRING (SIZE (40))

}

-- ASN1STOP

| *DL-Bitmap-NB* field descriptions |
| --- |
| ***subframePattern10, subframePattern40***  For FDD: NB-IoT downlink subframe configuration over 10ms or 40ms for inband and 10ms for standalone/guardband.  For TDD: NB-IoT downlink, uplink and special subframes configuration over 10ms or 40ms for inband and 10ms for standalone/guardband.  The first/leftmost bit corresponds to the subframe #0 of the radio frame satisfying SFN mod x = 0, where x is the size of the bit string divided by 10. Value 0 in the bitmap indicates that the corresponding subframe is invalid for transmission. Value 1 in the bitmap indicates that the corresponding subframe is valid for transmission. |

#### – *DL-CarrierConfigCommon-NB*

The IE *DL-CarrierConfigCommon-NB is* used to specify the common configuration of a DL non-anchor carrier in NB-IoT.

*DL-CarrierConfigCommon-NB* information elements

-- ASN1START

DL-CarrierConfigCommon-NB-r14 ::= SEQUENCE {

dl-CarrierFreq-r14 CarrierFreq-NB-r13,

downlinkBitmapNonAnchor-r14 CHOICE {

useNoBitmap-r14 NULL,

useAnchorBitmap-r14 NULL,

explicitBitmapConfiguration-r14 DL-Bitmap-NB-r13

},

dl-GapNonAnchor-r14 CHOICE {

useNoGap-r14 NULL,

useAnchorGapConfig-r14 NULL,

explicitGapConfiguration-r14 DL-GapConfig-NB-r13

},

inbandCarrierInfo-r14 SEQUENCE {

samePCI-Indicator-r14 CHOICE {

samePCI-r14 SEQUENCE {

indexToMidPRB-r14 INTEGER (-55..54)

},

differentPCI-r14 SEQUENCE {

eutra-NumCRS-Ports-r14 ENUMERATED {same, four}

}

} OPTIONAL, -- Cond anchor-guardband-or-standalone

eutraControlRegionSize-r14 ENUMERATED {n1, n2, n3}

} OPTIONAL, -- Cond non-anchor-inband

nrs-PowerOffsetNonAnchor-r14 ENUMERATED {dB-12, dB-10, dB-8, dB-6,

dB-4, dB-2, dB0, dB3} DEFAULT dB0,

...,

[[ dl-GapNonAnchor-v1530 DL-GapConfig-NB-v1530 OPTIONAL -- Cond TDD

]],

[[ dl-CarrierFreq-v1550 CarrierFreq-NB-v1550 OPTIONAL -- Cond TDD

]]

}

-- ASN1STOP

| *DL-CarrierConfigCommon-NB* field descriptions |
| --- |
| ***dl-CarrierFreq***  DL carrier frequency. The downlink carrier is not in a E-UTRA PRB which contains E-UTRA PSS/SSS/PBCH. |
| ***dl-GapNonAnchor***  Downlink transmission gap configuration for the non-anchor carrier, see TS 36.211 [21], clause 10.2.3.4.  E-UTRAN may configure *dl-GapNonAnchor-v1530* only if *dl-GapNonAnchor-r14* is set to *explicitGapConfiguration*. |
| ***downlinkBitmapNonAnchor***  For FDD: NB-IoT downlink subframe configuration for downlink transmission on the non-anchor carrier. See TS 36.213 [23], clause 16.4.  For TDD: NB-IoT downlink, uplink and special subframes configuration for transmission on the anchor/ non-anchor carrier. See TS 36.213 [23], clause 16.4.  For IoT NTN TDD mode, if this field is signalled, *useNoBitmap-r16* is used.[RIL]:Z054, IoTTDD |
| ***eutraControlRegionSize***  Indicates the control region size of the E-UTRA cell for the in-band operation mode, see TS 36.213 [23]. Unit is in number of OFDM symbols. If *operationModeInfo* in MIB-NB is set to *inband-SamePCI* or *inband-DifferentPCI*, it should be set to the value broadcast in SIB1-NB. |
| ***eutra-NumCRS-Ports***  Number of E-UTRA CRS antenna ports, either the same number of ports as NRS or 4 antenna ports. See TS 36.211 [21], TS 36.212 [22], and TS 36.213 [23]. |
| ***inbandCarrierInfo***  Provides the configuration of a non-anchor inband carrier. |
| ***indexToMidPRB***  The PRB index is signaled by offset from the middle of the EUTRA system. |
| ***nrs-PowerOffsetNonAnchor***  Provides the downlink narrowband reference-signal EPRE offset of the non-anchor carrier relative to the downlink narrowband reference-signal EPRE of the anchor carrier, unit in dB. Value dB-12 corresponds to -12 dB, dB-10 corresponds to -10 dB and so on. See TS 36.213 [23], clause 16.2.2. |
| ***samePCI-Indicator***  This parameter specifies whether the non-anchor carrier reuses the same PCI as the EUTRA carrier. |

| Conditional presence | Explanation |
| --- | --- |
| *non-anchor-inband* | The field is mandatory present if the non-anchor carrier is an inband carrier; otherwise it is not present. |
| *anchor-guardband-or-standalone* | The field is mandatory present, if *operationModeInfo* is set to *guardband* or *standalone* in the MIB; otherwise it is not present. |
| *TDD* | The field is optionally present, Need OR, for TDD; otherwise the field is not present and the UE shall delete any existing value for this field. |

#### – *DL-GapConfig-NB*

The IE *DL-GapConfig-NB* is used to specify the downlink gap configuration for NPDCCH and NPDSCH. Downlink gaps apply to all NPDCCH/NPDSCH transmissions except for BCCH.

*DL-GapConfig-NB* information element

-- ASN1START

DL-GapConfig-NB-r13 ::= SEQUENCE {

dl-GapThreshold-r13 ENUMERATED {n32, n64, n128, n256},

dl-GapPeriodicity-r13 ENUMERATED {sf64, sf128, sf256, sf512},

dl-GapDurationCoeff-r13 ENUMERATED {oneEighth, oneFourth, threeEighth, oneHalf}

}

DL-GapConfig-NB-v1530 ::= SEQUENCE {

dl-GapPeriodicity-v1530 ENUMERATED {sf1024}

}

-- ASN1STOP

| *DL-GapConfig-NB* field descriptions |
| --- |
| ***dl-GapDurationCoeff***  Coefficient to calculate the gap duration of a DL transmission: dl-GapDurationCoeff \* dl-GapPeriodicity, Duration in number of subframes. See TS 36.211 [21], clause 10.2.3.4. |
| ***dl-GapPeriodicity***  Periodicity of a DL transmission gap in number of subframes. See TS 36.211 [21], clause 10.2.3.4.  Value *sf64* corresponds to 64 subframes, value *sf128* corresponds to 128 subframes, value *sf256* corresponds to 256 subframes and so on. E-UTRAN may configure the value *sf64* only in FDD mode and the value *sf1024* only in TDD mode.  For IoT NTN TDD mode, value of 64 subframes is not supported: if value *sf64* is signalled, it is interpreted as 1024 subframes.  The UE shall use the value signalled in *dl-GapPeriodicity-v1530*, if present, and ignore the value signaled in *dl-GapPeriodicity-r13*. |
| ***dl-GapThreshold***  Threshold on the maximum number of repetitions configured for NPDCCH before application of DL transmission gap configuration. See TS 36.211 [21], clause 10.2.3.4. |

#### *– GWUS-Config-NB*

The IE G*WUS-Config-NB* is used to specify the GWUS configuration. For UEs supporting GWUS, E-UTRAN uses GWUS to indicate that the UE shall attempt to receive paging in that cell, see TS 36.304 [4].

*GWUS-Config-NB information element*

-- ASN1START

GWUS-Config-NB-r16 ::= SEQUENCE {

groupAlternation-r16 ENUMERATED {true} OPTIONAL, -- Need OR

commonSequence-r16 ENUMERATED {g0, g126} OPTIONAL, -- Need OR

timeParameters-r16 WUS-Config-NB-r15 OPTIONAL, -- Cond noWUSr15

resourceConfigDRX-r16 GWUS-ResourceConfig-NB-r16,

resourceConfig-eDRX-Short-r16 GWUS-ResourceConfig-NB-r16 OPTIONAL, -- Need OP

resourceConfig-eDRX-Long-r16 GWUS-ResourceConfig-NB-r16 OPTIONAL, -- Cond timeOffset

probThreshList-r16 GWUS-ProbThreshList-NB-r16 OPTIONAL, -- Cond probabilityBased

...

}

GWUS-ResourceConfig-NB-r16 ::= SEQUENCE {

resourcePosition-r16 ENUMERATED {primary, secondary},

numGroupsList-r16 GWUS-NumGroupsList-NB-r16 OPTIONAL, -- Need OP

groupsForServiceList-r16 GWUS-GroupsForServiceList-NB-r16

OPTIONAL -- Cond probabilityBased

}

GWUS-ProbThreshList-NB-r16 ::= SEQUENCE (SIZE (1..maxGWUS-ProbThresholds-NB-r16)) OF

GWUS-Paging-ProbThresh-NB-r16

GWUS-Paging-ProbThresh-NB-r16 ::= ENUMERATED {p20, p30, p40, p50, p60, p70, p80, p90}

GWUS-NumGroupsList-NB-r16 ::= SEQUENCE (SIZE (1..maxGWUS-Resources-NB-r16)) OF

GWUS-NumGroups-NB-r16

GWUS-NumGroups-NB-r16 ::= ENUMERATED {n1, n2, n4, n8}

GWUS-GroupsForServiceList-NB-r16 ::= SEQUENCE (SIZE (1..maxGWUS-ProbThresholds-NB-r16)) OF

INTEGER (1..maxGWUS-Groups-1-NB-r16)

-- ASN1STOP

| *GWUS-Config-NB* field descriptions |
| --- |
| ***commonSequence***  Presence of the field indicates common WUS sequence is configured.  Value *g0* indicates common WUS sequence for the shared WUS resource is g=0, value *g126* indicates common WUS sequence for the shared WUS resource is g=126, see TS 36.211 [21]. |
| ***groupAlternation***  Presence of the field enables WUS group alternation between the two WUS resources for the gap type, see TS 36.304 [4]. |
| ***groupsForServiceList***  Number of WUS groups for each paging probability group, see TS 36.304 [4]. The first entry corresponds to the first paging probability group, second entry corresponds to the second paging probability group, and so on. E-UTRAN includes the same number of entries and in the same order in *groupsForServiceList* and *probThreshList*.  Total number of WUS groups in this list cannot be more than total number of WUS groups in *numGroupsList*. |
| ***numGroupsList***  List of WUS groups for each WUS resource, see TS 36.304 [4]. First entry corresponds to the first resource, the second entry corresponds to the second resource.  *numGroupsList* shall be present in *resourceConfigDRX*.  If *numGroupsList* is not present in *resourceconfig-eDRX-Short*, parameters for DRX WUS resource applies for short eDRX WUS resource.  If *numGroupsList* is not present in *resourceConfig-eDRX-Long*, parameters for short eDRX WUS resource applies for long eDRX WUS resource. |
| ***probThreshList***  Paging probability thresholds corresponding to the paging probability groups, see TS 36.304 [4]. Value *p20* corresponds to 20%, value *p30* corresponds to 30%, and so on. |
| ***resourceConfigDRX, resourceConfig-eDRX-Short, resourceConfig-eDRX-Long***  WUS resource configured for each gap type, see TS 36.304 [4].  If *resourceConfig-eDRX-Short* is not present, DRX WUS parameters apply for short eDRX WUS resource.  If *resourceConfig-eDRX-Long* is not present, short eDRX WUS parameters apply for long eDRX WUS resource. |
| ***resourcePosition***  Indicates the position of the WUS resource corresponding to the first entry in *numGroupsList.*  Value *primary* indicates that the end of the WUS resource is defined by the timeoffset value for the corresponding gap type, value *secondary* indicates that the end of the WUS resource is immediately before the WUS resource configured by *wus-Config*.  E-UTRAN may only configure *secondary* when only one entry exists in *numGroupsList* and *wus-Config* is present in *SystemInformationBlockType2-NB*.  If two entries exist in *numGroupsList*, the position for the second WUS resource corresponds to value *secondary*. |
| ***timeParameters***  Time domain WUS configuration information. For individual field descriptions, see *WUS-Config-NB.* If the field is absent, the parameters in *wus-Config* apply. |

|  |  |
| --- | --- |
| Conditional presence | Explanation |
| *noWUSr15* | The field is mandatory present if *wus-Config-r15* is not present in *SystemInformationBlockType2-NB*; otherwise the field is not present. |
| *probabilityBased* | The field is mandatory present if paging probability based WUS group selection is configured; otherwise the field is not present, and the UE shall delete any existing value for this field. |
| *timeOffset* | The field is optionally present, Need OP, if *timeOffset-eDRX-Long* is present in *timeParameters*; otherwise the field is not present, and the UE shall delete any existing value for this field. |

#### – *LogicalChannelConfig-NB*

The IE *LogicalChannelConfig-NB* is used to configure the logical channel parameters.

*LogicalChannelConfig-NB* information element

-- ASN1START

LogicalChannelConfig-NB-r13 ::= SEQUENCE {

priority-r13 INTEGER (1..16) OPTIONAL, -- Cond UL

logicalChannelSR-Prohibit-r13 BOOLEAN OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| *LogicalChannelConfig-NB* field descriptions |
| --- |
| ***logicalChannelSR-Prohibit***  Value *TRUE* indicates that the *logicalChannelSR-ProhibitTimer* is enabled for the logical channel. If *logicalChannelSR-Prohibit* is configured (i.e. indicates value *TRUE*), E-UTRAN also configures *logicalChannelSR-ProhibitTimer*. See TS 36.321 [6]. |
| ***priority***  Logical channel priority in TS 36.321 [6]. Value is an integer. |

| Conditional presence | Explanation |
| --- | --- |
| *UL* | The field is mandatory present for UL logical channels; otherwise it is not present. |

#### – *MAC-MainConfig-NB*

The IE *MAC-MainConfig-NB* is used to specify the MAC main configuration for signalling and data radio bearers.

*MAC-MainConfig-NB* information element

-- ASN1START

MAC-MainConfig-NB-r13 ::= SEQUENCE {

ul-SCH-Config-r13 SEQUENCE {

periodicBSR-Timer-r13 PeriodicBSR-Timer-NB-r13 OPTIONAL, -- Need ON

retxBSR-Timer-r13 RetxBSR-Timer-NB-r13

} OPTIONAL, -- Need ON

drx-Config-r13 DRX-Config-NB-r13 OPTIONAL, -- Need ON

timeAlignmentTimerDedicated-r13 TimeAlignmentTimer,

logicalChannelSR-Config-r13 CHOICE {

release NULL,

setup SEQUENCE {

logicalChannelSR-ProhibitTimer-r13 ENUMERATED {

pp2, pp8, pp32, pp128, pp512,

pp1024, pp2048, spare}

}

} OPTIONAL, -- Need ON

...,

[[ rai-Activation-r14 ENUMERATED {true} OPTIONAL, -- Need OR

dataInactivityTimerConfig-r14 CHOICE {

release NULL,

setup SEQUENCE {

dataInactivityTimer-r14 DataInactivityTimer-r14

}

} OPTIONAL -- Need ON

]],

[[ drx-Cycle-v1430 ENUMERATED {

sf1280, sf2560, sf5120, sf10240} OPTIONAL -- Need ON

]],

[[ ra-CFRA-Config-r14 ENUMERATED {true} OPTIONAL -- Need ON

]],

[[ offsetThresholdTA-r17 SetupRelease {OffsetThresholdTA-NB-r17}

OPTIONAL -- Need ON

]]

}

PeriodicBSR-Timer-NB-r13 ::= ENUMERATED {

pp2, pp4, pp8, pp16, pp64, pp128, infinity, spare}

RetxBSR-Timer-NB-r13 ::= ENUMERATED {

pp4, pp16, pp64, pp128, pp256, pp512, infinity, spare}

DRX-Config-NB-r13 ::= CHOICE {

release NULL,

setup SEQUENCE {

onDurationTimer-r13 ENUMERATED {

pp1, pp2, pp3, pp4, pp8, pp16, pp32, spare},

drx-InactivityTimer-r13 ENUMERATED {

pp0, pp1, pp2, pp3, pp4, pp8, pp16, pp32},

drx-RetransmissionTimer-r13 ENUMERATED {

pp0, pp1, pp2, pp4, pp6, pp8, pp16, pp24,

pp33, spare7, spare6, spare5,

spare4, spare3, spare2, spare1},

drx-Cycle-r13 ENUMERATED {

sf256, sf512, sf1024, sf1536, sf2048, sf3072,

sf4096, sf4608, sf6144, sf7680, sf8192, sf9216,

spare4, spare3, spare2, spare1},

drx-StartOffset-r13 INTEGER (0..255),

drx-ULRetransmissionTimer-r13 ENUMERATED {

pp0, pp1, pp2, pp4, pp6, pp8, pp16, pp24,

pp33, pp40, pp64, pp80, pp96,

pp112, pp128, pp160, pp320}

}

}

OffsetThresholdTA-NB-r17 ::= ENUMERATED {

ms0dot5, ms1, ms2, ms3, ms4, ms5, ms6 ,ms7,

ms8, ms9, ms10, ms11, ms12, ms13, ms14, ms15}

-- ASN1STOP

| *MAC-MainConfig*-*NB* field descriptions |
| --- |
| ***drx-Config***  Used to configure DRX as specified in TS 36.321 [6]. |
| ***drx-Cycle***  *longDRX-Cycle* in TS 36.321 [6]. The value of l*ongDRX-Cycle* is in number of sub-frames. Value sf256 corresponds to 256 sub-frames, sf512 corresponds to 512 sub-frames and so on. In case *drx-Cycle-v1430* is signalled, the UE shall ignore *drx-Cycle-r13*. |
| ***drx-StartOffset***  *drxStartOffset* in TS 36.321 [6]. Value is in number of sub-frames by step of (*drx-cycle* / 256). |
| ***drx-InactivityTimer***  Timer for DRX in TS 36.321 [6]. Value in number of PDCCH periods. Value pp0 corresponds to 0 PDCCH period and behaviour as specified in 7.3.2 applies, pp1 corresponds to 1 PDCCH period, pp2 corresponds to 2 PDCCH periods and so on. |
| ***drx-RetransmissionTimer***  Timer for DRX in TS 36.321 [6]. Value in number of PDCCH periods. Value pp0 corresponds to 0 PDCCH period and behaviour as specified in 7.3.2 applies, pp1 corresponds to 1 PDCCH period, pp2 corresponds to 2 PDCCH periods and so on. |
| ***drx-ULRetransmissionTimer***  Timer for DRX in TS 36.321 [6].  Value in number of PDCCH periods. Value pp0 corresponds to 0 PDCCH period and behaviour as specified in 7.3.2 applies, value pp1 corresponds to 1 PDCCH period, pp2 corresponds to 2 PDCCH periods and so on. |
| ***logicalChannelSR-ProhibitTimer***  Timerused to delay the transmission of an SR*.* See TS 36.321 [6]. Value in number of PDCCH periods. Value pp2 corresponds to 2 PDCCH periods, pp8 corresponds to 8 PDCCH periods and so on. |
| ***offsetThresholdTA***  Offset for TA reporting as specified in TS 36.321 [6]. Value *ms0dot5* corresponds to 0.5 millisecond, value *ms1* corresponds to 1 millisecond and so on. |
| ***periodicBSR-Timer***  Timer for BSR reporting in TS 36.321 [6].  Value in number of PDCCH periods. Value pp2 corresponds to 2 PDCCH periods, pp4 corresponds to 4 PDCCH periods and so on. |
| ***ra-CFRA-Config***  Activation of contention free random access (CFRA), see TS 36.321 [6]. |
| ***rai-Activation***  Activation of release assistance indication (RAI) in TS 36.321 [6]. |
| ***retxBSR-Timer***  Timer for BSR reporting in TS 36.321 [6]. Value in number of PDCCH periods. Value pp4 corresponds to 4 PDCCH periods, pp16 corresponds to 16 PDCCH periods and so on. |
| ***onDurationTimer***  Timer for DRX in TS 36.321 [6]. Value in number of PDCCH periods. Value pp1 corresponds to 1 PDCCH period, pp2 corresponds to 2 PDCCH periods and so on. |
| ***timeAlignmentTimer***  Indicates the value of the time alignment timer, see TS 36.321 [6]. |

#### – *NPDCCH-ConfigDedicated-NB*

The IE *NPDCCH-ConfigDedicated-NB* specifies the subframes and resource blocks for NPDCCH monitoring.

*NPDCCH-ConfigDedicated-NB* information element

-- ASN1START

NPDCCH-ConfigDedicated-NB-r13 ::= SEQUENCE {

npdcch-NumRepetitions-r13 ENUMERATED {r1, r2, r4, r8, r16, r32, r64, r128,

r256, r512, r1024, r2048,

spare4, spare3, spare2, spare1},

npdcch-StartSF-USS-r13 ENUMERATED {v1dot5, v2, v4, v8, v16, v32, v48, v64},

npdcch-Offset-USS-r13 ENUMERATED {zero, oneEighth, oneFourth, threeEighth}

}

NPDCCH-ConfigDedicated-NB-v1530 ::= SEQUENCE {

npdcch-StartSF-USS-v1530 ENUMERATED {v96, v128}

}

-- ASN1STOP

| *NPDCCH-ConfigDedicated-NB* field descriptions |
| --- |
| ***npdcch-NumRepetitions***  Maximum number of repetitions for NPDCCH UE specific search space (USS), see TS 36.213 [23], clause 16.6. UE monitors one set of values (consisting of aggregation level, number of repetitions and number of blind decodes) according to the configured maximum number of repetitions. |
| ***npdcch-Offset-USS***  Fractional period offset of starting subframe for NPDCCH UE specific search space (USS), see TS 36.213 [23], clause 16.6. |
| ***npdcch-StartSF-USS***  Starting subframe configuration for an NPDCCH UE-specific search space, see TS 36.213 [23], clause 16.6. Value v1dot5 corresponds to 1.5, value 2 corresponds to 2 and so on. E-UTRAN may configure values *v1dot5* and *v2* only in FDD mode and values *v96* and *v128* only in TDD mode.  For IoT NTN TDD mode, value of 4 and value of 8 are not supported: if value *v4* is signalled, it is interpreted as 4\*11.25 and if value *v8* is signalled, it is interpreted as 8\*11.25.  The UE shall use the value signalled in *npdcch-StartSF-USS-v1530,* if present, and ignore the value signalled in *npdcch-StartSF-USS-r13*. |

#### – *NPDSCH-Config-NB*

The IE *NPDSCH-ConfigCommon-NB* is used to specify the common NPDSCH configuration. The IE *NPDSCH-ConfigDedicated-NB* is used to specify the UE specific NPDSCH configuration.

*NPDSCH-Config-NB* information element

-- ASN1START

NPDSCH-ConfigCommon-NB-r13 ::= SEQUENCE {

nrs-Power-r13 INTEGER (-60..50)

}

NPDSCH-ConfigDedicated-NB-r16 ::= SEQUENCE {

npdsch-MultiTB-Config-r16 NPDSCH-MultiTB-Config-NB-r16 OPTIONAL -- Cond twoHARQ

}

NPDSCH-MultiTB-Config-NB-r16 ::= SEQUENCE {

multiTB-Config-r16 ENUMERATED {interleaved, nonInterleaved},

harq-AckBundling-r16 ENUMERATED {true} OPTIONAL -- Cond interleaved

}

NPDSCH-ConfigDedicated-NB-v1710 ::= SEQUENCE {

npdsch-16QAM-Config-r17 SetupRelease {NPDSCH-16QAM-Config-NB-r17}

}

NPDSCH-ConfigDedicated-NB-v1800 ::= SEQUENCE {

downlinkHARQ-FeedbackDisabledBitmap-NB-r18

SetupRelease {DownlinkHARQ-FeedbackDisabledBitmap-NB-r18} OPTIONAL, -- Need ON

downlinkHARQ-FeedbackDisabledDCI-NB-r18 ENUMERATED {true} OPTIONAL -- Need OR

}

NPDSCH-16QAM-Config-NB-r17 ::=SEQUENCE{

nrs-PowerRatio-r17 ENUMERATED {dB-6, dB-4dot77, dB-3, dB-1dot77, dB0, dB1, dB2, dB3} OPTIONAL, -- Need OR

nrs-PowerRatioWithCRS-r17 ENUMERATED {dB-6, dB-4dot77, dB-3, dB-1dot77, dB0, dB1, dB2, dB3} OPTIONAL -- Cond InBand

}

DownlinkHARQ-FeedbackDisabledBitmap-NB-r18 ::= BIT STRING (SIZE(2))

-- ASN1STOP

| *NPDSCH-Config-NB* field descriptions |
| --- |
| ***downlinkHARQ-FeedbackDisabledBitmap-NB***  Used to disable the DL HARQ feedback, sent in the uplink, per HARQ process ID, see TS 36.321 [6]. The first/leftmost bit corresponds to HARQ process ID 0, the next bit to HARQ process ID 1. The bit corresponding to HARQ process ID that is not configured shall be ignored. A bit set to one identifies a HARQ process with disabled DL HARQ feedback and a bit set to zero identifies a HARQ process with enabled DL HARQ feedback. |
| ***downlinkHARQ-FeedbackDisabledDCI-NB***  Presence of this field indicates that DCI indication is used to directly indicate or override RRC configuration for disabling HARQ feedback |
| ***harq-AckBundling***  For FDD: Activation of HARQ ACK bundling for DL multiple TBs scheduling with interleaved transmission, see TS 36.213 [23]. |
| ***npdsch-16QAM-Config***  Activation of 16QAM for DL, see TS 36.213 [23]. |
| ***nrs-Power***  Provides the downlink narrowband reference-signal EPRE, see TS 36.213 [23], clause 16.2. The actual value in dBm. |
| ***nrs-PowerRatio***  The power ratio of NPDSCH EPRE to NRS EPRE in symbols without NRS for standalone and guardband deployments, or in symbols without NRS nor CRS for in-band deployments. See TS 36.213 [23]. |
| ***nrs-PowerRatioWithCRS***  The power ratio of NPDSCH EPRE to NRS EPRE in symbols with CRS for inband deployments, see TS 36.213 [23]. |
| ***multiTB-Config***  For FDD: Activation of multiple TBs scheduling in DL, see TS 36.213 [23]. Value *interleaved* indicates that multiple TBs scheduling with interleaved transmission is enabled, value *nonInterleaved* indicates that multiple TBs scheduling without interleaved transmission is enabled. |

| Conditional presence | Explanation |
| --- | --- |
| *InBand* | The field is mandatory present if carrier is inband; otherwise, the field is not present and the UE shall delete any existing value for this field. |
| *interleaved* | The field is optionally present, Need OR, if *multiTB-Config* is set to *interleaved*; otherwise the field is not present and the UE shall delete any existing value for this field. |
| *twoHARQ* | The field is optionally present, Need OR, if *twoHARQ-ProcessesConfig* is configured; otherwise the field is not present and the UE shall delete any existing value for this field. |

#### – *NPRACH-ConfigSIB-NB*

The IE *NPRACH-ConfigSIB-NB* is used to specify the NPRACH configuration for the anchor and non-anchor carriers.

*NPRACH-ConfigSIB-NB* information elements

-- ASN1START

NPRACH-ConfigSIB-NB-r13 ::= SEQUENCE {

nprach-CP-Length-r13 ENUMERATED {us66dot7, us266dot7},

rsrp-ThresholdsPrachInfoList-r13 RSRP-ThresholdsNPRACH-InfoList-NB-r13 OPTIONAL, -- Need OR

nprach-ParametersList-r13 NPRACH-ParametersList-NB-r13

}

NPRACH-ConfigSIB-NB-v1330 ::= SEQUENCE {

nprach-ParametersList-v1330 NPRACH-ParametersList-NB-v1330

}

NPRACH-ConfigSIB-NB-v1450 ::= SEQUENCE {

maxNumPreambleAttemptCE-r14 ENUMERATED {n3, n4, n5, n6, n7, n8, n10, spare1}

}

NPRACH-ConfigSIB-NB-v1530 ::= SEQUENCE {

tdd-Parameters-r15 SEQUENCE {

nprach-PreambleFormat-r15 ENUMERATED {

fmt0, fmt1, fmt2, fmt0-a, fmt1-a},

dummy ENUMERATED {

n1, n2, n4, n8, n16, n32, n64, n128,

n256, n512, n1024},

nprach-ParametersListTDD-r15 NPRACH-ParametersListTDD-NB-r15

} OPTIONAL, -- Cond TDD

fmt2-Parameters-r15 SEQUENCE {

nprach-ParametersListFmt2-r15 NPRACH-ParametersListFmt2-NB-r15 OPTIONAL, -- Need OR

nprach-ParametersListFmt2EDT-r15 NPRACH-ParametersListFmt2-NB-r15 OPTIONAL -- Cond EDT2

} OPTIONAL, -- Need OR

edt-Parameters-r15 SEQUENCE {

edt-SmallTBS-Subset-r15 ENUMERATED {true} OPTIONAL, -- Need OR

edt-TBS-InfoList-r15 EDT-TBS-InfoList-NB-r15,

nprach-ParametersListEDT-r15 NPRACH-ParametersList-NB-r14 OPTIONAL -- Need OR

} OPTIONAL -- Cond EDT1

}

NPRACH-ConfigSIB-NB-v1550 ::= SEQUENCE {

tdd-Parameters-v1550 SEQUENCE {

nprach-ParametersListTDD-v1550 NPRACH-ParametersListTDD-NB-v1550

}

}

NPRACH-ParametersList-NB-r13 ::= SEQUENCE (SIZE (1.. maxNPRACH-Resources-NB-r13)) OF NPRACH-Parameters-NB-r13

NPRACH-ParametersList-NB-v1330 ::= SEQUENCE (SIZE (1.. maxNPRACH-Resources-NB-r13)) OF NPRACH-Parameters-NB-v1330

NPRACH-Parameters-NB-r13::= SEQUENCE {

nprach-Periodicity-r13 ENUMERATED {ms40, ms80, ms160, ms240,

ms320, ms640, ms1280, ms2560},

nprach-StartTime-r13 ENUMERATED {ms8, ms16, ms32, ms64,

ms128, ms256, ms512, ms1024},

nprach-SubcarrierOffset-r13 ENUMERATED {n0, n12, n24, n36, n2, n18, n34, spare1},

nprach-NumSubcarriers-r13 ENUMERATED {n12, n24, n36, n48},

nprach-SubcarrierMSG3-RangeStart-r13 ENUMERATED {zero, oneThird, twoThird, one},

maxNumPreambleAttemptCE-r13 ENUMERATED {n3, n4, n5, n6, n7, n8, n10, spare1},

numRepetitionsPerPreambleAttempt-r13 ENUMERATED {n1, n2, n4, n8, n16, n32, n64, n128},

npdcch-NumRepetitions-RA-r13 ENUMERATED {r1, r2, r4, r8, r16, r32, r64, r128,

r256, r512, r1024, r2048,

spare4, spare3, spare2, spare1},

npdcch-StartSF-CSS-RA-r13 ENUMERATED {v1dot5, v2, v4, v8, v16, v32, v48, v64},

npdcch-Offset-RA-r13 ENUMERATED {zero, oneEighth, oneFourth, threeEighth}

}

NPRACH-Parameters-NB-v1330 ::= SEQUENCE {

nprach-NumCBRA-StartSubcarriers-r13 ENUMERATED {n8, n10, n11, n12, n20, n22, n23, n24,

n32, n34, n35, n36, n40, n44, n46, n48}

}

NPRACH-ParametersList-NB-r14 ::= SEQUENCE (SIZE (1.. maxNPRACH-Resources-NB-r13)) OF

NPRACH-Parameters-NB-r14

NPRACH-Parameters-NB-r14 ::= SEQUENCE {

nprach-Parameters-r14 SEQUENCE {

nprach-Periodicity-r14 ENUMERATED {ms40, ms80, ms160, ms240,

ms320, ms640, ms1280, ms2560}

OPTIONAL, -- NEED OP

nprach-StartTime-r14 ENUMERATED {ms8, ms16, ms32, ms64,

ms128, ms256, ms512, ms1024}

OPTIONAL, -- NEED OP

nprach-SubcarrierOffset-r14 ENUMERATED {n0, n12, n24, n36, n2, n18, n34, spare1}

OPTIONAL, -- NEED OP

nprach-NumSubcarriers-r14 ENUMERATED {n12, n24, n36, n48}

OPTIONAL, -- NEED OP

nprach-SubcarrierMSG3-RangeStart-r14 ENUMERATED {zero, oneThird, twoThird, one}

OPTIONAL, -- NEED OP

npdcch-NumRepetitions-RA-r14 ENUMERATED {r1, r2, r4, r8, r16, r32, r64, r128,

r256, r512, r1024, r2048,

spare4, spare3, spare2, spare1}

OPTIONAL, -- NEED OP

npdcch-StartSF-CSS-RA-r14 ENUMERATED {v1dot5, v2, v4, v8, v16, v32, v48, v64}

OPTIONAL, -- NEED OP

npdcch-Offset-RA-r14 ENUMERATED {zero, oneEighth, oneFourth, threeEighth}

OPTIONAL, -- NEED OP

nprach-NumCBRA-StartSubcarriers-r14 ENUMERATED {n8, n10, n11, n12, n20, n22, n23, n24,

n32, n34, n35, n36, n40, n44, n46, n48}

OPTIONAL, -- NEED OP

npdcch-CarrierIndex-r14 INTEGER (1..maxNonAnchorCarriers-NB-r14)

OPTIONAL, -- Need OP

...

} OPTIONAL -- Need OR

}

NPRACH-ParametersListTDD-NB-r15 ::= SEQUENCE (SIZE (1.. maxNPRACH-Resources-NB-r13)) OF

NPRACH-ParametersTDD-NB-r15

NPRACH-ParametersTDD-NB-r15 ::= SEQUENCE {

nprach-Parameters-r15 SEQUENCE {

nprach-Periodicity-r15 ENUMERATED {ms80, ms160, ms320, ms640,

ms1280, ms2560, ms5120, ms10240}

OPTIONAL, -- NEED OP

nprach-StartTime-r15 ENUMERATED {ms10, ms20, ms40, ms80,

ms160, ms320, ms640, ms1280,

ms2560, ms5120, spare6, spare5,

spare4, spare3, spare2, spare1}

OPTIONAL, -- NEED OP

nprach-SubcarrierOffset-r15 ENUMERATED {n0, n12, n24, n36, n2, n18, n34, spare1}

OPTIONAL, -- NEED OP

nprach-NumSubcarriers-r15 ENUMERATED {n12, n24, n36, n48}

OPTIONAL, -- NEED OP

nprach-SubcarrierMSG3-RangeStart-r15 ENUMERATED {zero, oneThird, twoThird, one}

OPTIONAL, -- NEED OP

npdcch-NumRepetitions-RA-r15 ENUMERATED {r1, r2, r4, r8, r16, r32, r64, r128,

r256, r512, r1024, r2048,

spare4, spare3, spare2, spare1}

OPTIONAL, -- NEED OP

npdcch-StartSF-CSS-RA-r15 ENUMERATED {v4, v8, v16, v32, v48, v64, v96, v128}

OPTIONAL, -- NEED OP

npdcch-Offset-RA-r15 ENUMERATED {zero, oneEighth, oneFourth, threeEighth}

OPTIONAL, -- NEED OP

nprach-NumCBRA-StartSubcarriers-r15 ENUMERATED {n8, n10, n11, n12, n20, n22, n23, n24,

n32, n34, n35, n36, n40, n44, n46, n48}

OPTIONAL, -- NEED OP

...

} OPTIONAL -- Need OR

}

NPRACH-ParametersListTDD-NB-v1550 ::= SEQUENCE (SIZE (1.. maxNPRACH-Resources-NB-r13)) OF

NPRACH-ParametersTDD-NB-v1550

NPRACH-ParametersTDD-NB-v1550 ::= SEQUENCE {

maxNumPreambleAttemptCE-v1550 ENUMERATED {n3, n4, n5, n6, n7, n8, n10, spare1},

numRepetitionsPerPreambleAttempt-v1550 ENUMERATED {n1, n2, n4, n8, n16, n32, n64, n128,

n256, n512, n1024}

}

NPRACH-ParametersListFmt2-NB-r15 ::= SEQUENCE (SIZE (1.. maxNPRACH-Resources-NB-r13)) OF NPRACH-ParametersFmt2-NB-r15

NPRACH-ParametersFmt2-NB-r15 ::= SEQUENCE {

nprach-Parameters-r15 SEQUENCE {

nprach-Periodicity-r15 ENUMERATED {ms40, ms80, ms160, ms320,

ms640, ms1280, ms2560, ms5120}

OPTIONAL, -- NEED OP

nprach-StartTime-r15 ENUMERATED {ms8, ms16, ms32, ms64,

ms128, ms256, ms512, ms1024}

OPTIONAL, -- NEED OP

nprach-SubcarrierOffset-r15 ENUMERATED {n0, n36, n72, n108, n6, n54, n102, n42,

n78, n90, n12, n24, n48, n84, n60, n18}

OPTIONAL, -- NEED OP

nprach-NumSubcarriers-r15 ENUMERATED {n36, n72, n108, n144}

OPTIONAL, -- NEED OP

nprach-SubcarrierMSG3-RangeStart-r15 ENUMERATED {zero, oneThird, twoThird, one}

OPTIONAL, -- NEED OP

npdcch-NumRepetitions-RA-r15 ENUMERATED {r1, r2, r4, r8, r16, r32, r64, r128,

r256, r512, r1024, r2048,

spare4, spare3, spare2, spare1}

OPTIONAL, -- NEED OP

npdcch-StartSF-CSS-RA-r15 ENUMERATED {v1dot5, v2, v4, v8, v16, v32, v48, v64}

OPTIONAL, -- NEED OP

npdcch-Offset-RA-r15 ENUMERATED {zero, oneEighth, oneFourth, threeEighth}

OPTIONAL, -- NEED OP

nprach-NumCBRA-StartSubcarriers-r15 ENUMERATED {

n24, n30, n33, n36, n60, n66, n69, n72,

n96, n102, n105, n108, n120, n132, n138, n144}

OPTIONAL, -- NEED OP

npdcch-CarrierIndex-r15 INTEGER (1..maxNonAnchorCarriers-NB-r14)

OPTIONAL, -- Need OP

...

} OPTIONAL -- Need OR

}

NPRACH-TxDurationFmt01-NB-r17 ::= SEQUENCE {

nprach-TxDurationFmt01-r17 ENUMERATED {n2, n4, n8, n16, n32, n64}

}

NPRACH-TxDurationFmt2-NB-r17 ::= SEQUENCE {

nprach-TxDurationFmt2-r17 ENUMERATED {n1, n2, n4, n8, n16}

}

RSRP-ThresholdsNPRACH-InfoList-NB-r13 ::= SEQUENCE (SIZE(1..2)) OF RSRP-Range

EDT-TBS-InfoList-NB-r15 ::= SEQUENCE (SIZE (1.. maxNPRACH-Resources-NB-r13)) OF EDT-TBS-NB-r15

EDT-TBS-NB-r15 ::= SEQUENCE {

edt-SmallTBS-Enabled-r15 BOOLEAN,

edt-TBS-r15 ENUMERATED {b328, b408, b504, b584, b680, b808, b936, b1000}

}

-- ASN1STOP

| *NPRACH-ConfigSIB-NB* field descriptions |
| --- |
| ***dummy***  This field is not used in the specification. If received it shall be ignored by the UE. |
| ***edt-SmallTBS-Enabled***  Value TRUE indicates UE performing EDT is allowed to select TBS smaller than *edt-TBS* for Msg3 according to the corresponding NPRACH resource, as specified in TS 36.213 [23]. |
| ***edt-SmallTBS-Subset***  Presence indicates only two of the TBS values can be used according to *edt-TBS* corresponding to the NPRACH resource, as specified in TS 36.213 [23]. When the field is not present, any of the TBS values according to *edt-TBS* corresponding to the NPRACH resource can be used. This field is applicable for a NPRACH resource only when *edt-SmallTBS-Enabled* is included for the corresponding NPRACH resource. |
| ***edt-TBS***  Largest TBS for Msg3 for a NPRACH resource applicable to a UE performing EDT. Value in bits. Value b328 corresponds to 328 bits, value b408 corresponds to 408 bits and so on. See TS 36.213 [23]. |
| ***maxNumPreambleAttemptCE***  Maximum number of preamble transmission attempts per NPRACH resource. See TS 36.321 [6].  If the UE supports enhanced random access power control and *maxNumPreambleAttemptCE-r14* is included, the UE shall use *maxNumPreambleAttemptCE-r14* instead of *maxNumPreambleAttemptCE-r13* for the first entry in *nprach-ParametersList*.  *maxNumPreambleAttemptCE-r13* applies to FDD and *maxNumPreambleAttemptCE-v1550* applies to TDD. |
| ***npdcch-CarrierIndex***  For FDD: Index of the carrier in the list of DL non anchor carriers. The first entry in the list has index '1', the second entry has index '2' and so on.  If the UE supports mixed operation mode and *dl-ConfigListMixed* is present in *systemInformationBlockType22-NB*, the UE creates a combined list of DL carriers for random access by appending *dl-ConfigListMixed* to the *dl-ConfigList* while maintaining the order among both *dl-ConfigList* and *dl-ConfigListMixed*; only the first *maxNonAnchorCarriers-NB-r14* DL non-anchor carriers in the concatenated list can be used for random access.  If the field is absent in the entry in *nprach-ParametersListEDT* in *SystemInformationBlockType22-NB*, the value of *npdcch-CarrierIndex* in the corresponding entry of *nprach-ParametersList* applies, if present. If the field is absent in an entry in *nprach-ParametersListFmt2EDT* in *SystemInformationBlockType23-NB*, the value of *npdcch-CarrierIndex* in the corresponding entry of *nprach-ParametersListFmt2* applies, if present. Otherwise, the DL anchor carrier is used.  For TDD: This parameter is absent and the same carrier is used in uplink and downlink. |
| ***npdcch-NumRepetitions-RA***  Maximum number of repetitions for NPDCCH common search space (CSS) for RAR, Msg3 retransmission and Msg4, see TS 36.213 [23], clause 16.6.  See NOTE. |
| ***npdcch-Offset-RA***  Fractional period offset of starting subframe for NPDCCH common search space (CSS Type 2), see TS 36.213 [23], clause 16.6.  See NOTE. |
| ***npdcch-StartSF-CSS-RA***  Starting subframe configuration for NPDCCH common search space (CSS), including RAR, Msg3 retransmission, and Msg4, see TS 36.213 [23], clause 16.6.  For IoT NTN TDD mode, value of 4 and value of 8 are not supported: if value *v4* is signalled, it is interpreted as 4\*11.25 and if value *v8* is signalled, it is interpreted as 8\*11.25.  See NOTE. |
| ***nprach-CP-Length***  Cyclic prefix length for NPRACH transmission (TCP), see TS 36.211 [21], clause 10.1.6. Value us66dot7 corresponds to 66.7 microseconds and value us266dot7 corresponds to 266.7 microseconds. If the UE uses a NPRACH resource for preamble format 2*,* the UE ignores the value signalled in *nprach-CP-Length* and considers the value to be800 microseconds. |
| ***nprach-NumCBRA-StartSubcarriers***  The number of start subcarriers from which a UE can randomly select a start subcarrier as specified in TS 36.321 [6].  If *nprach-Config-v1330* is not included in *SystemInformationBlockType2-NB*, the UE sets the value of *nprach-NumCBRA-StartSubcarriers-r13* to the value signalled by *nprach-NumSubcarriers-r13* for the corresponding NPRACH resource.  The start subcarrier indices that the UE is allowed to randomly select from, are given by:  *nprach-SubcarrierOffset* + [0, *nprach-NumCBRA-StartSubcarriers* - 1].  See NOTE. |
| ***nprach-NumSubcarriers***  Number of sub-carriers in a NPRACH resource, see TS 36.211 [21], clause 10.1.6. In number of subcarriers.  See NOTE. |
| ***nprach-ParametersList, nprach-ParametersListEDT***  Configures NPRACH parameters for each NPRACH resource. Up to three PRACH resources can be configured in *nprach-ParametersList* in a cell. Each NPRACH resource is associated with a different number of NPRACH repetitions.  E-UTRAN includes the same number of entries, and listed in the same order for *nprach-ParametersListEDT*, as in *nprach-ParametersList* in *SystemInformationBlockType2-NB*.  The NPRACH resources in *nprach-ParametersListEDT* are used to initiateEDT. Each NPRACH resource is associated with a TBS signalled in the corresponding entry of *edt-TBS-InfoList.*  For TDD: The UE shall use *nprach-ParametersListTDD* and ignore *nprach-ParametersList.* |
| ***nprach-ParametersListTDD***  For TDD: Configure NPRACH parameters for each NPRACH. Up to three NPRACH resources can be configured in a cell. Each NPRACH resource is associated with a different number of NPRACH repetitions. |
| ***nprach-ParametersListFmt2, nprach-ParametersListFmt2EDT***  Configures NPRACH parameters for each NPRACH resource format 2. Up to three NPRACH resources can be configured on one carrier. Each NPRACH resource is associated with a different number of NPRACH repetitions. E-UTRAN includes the same number of entries, and listed in the same order, as in *nprach-ParametersList* in *SystemInformationBlockType2-NB*.  The NPRACH resources in *nprach-ParametersListFmt2EDT* are used to initiate EDT. Each NPRACH resource is associated with a TBS signalled in the corresponding entry of *edt-TBS-InfoList.*  E-UTRAN configures the NPRACH resources format 2 so that they do not overlap in time domain with the NPRACH resources configured in *nprach-ParametersList* and *nprach-ParametersListEDT*.  If there is no NPRACH resource in *nprach-ParametersListFmt2* (respectively *nprach-ParametersListFmt2EDT*) on any UL carrier for one NPRACH repetition level, the UE uses the NPRACH resources in *nprach-ParametersList* (respectively *nprach-ParametersListEDT*) for this NPRACH repetition level. Otherwise, the UE uses only NPRACH resources in *nprach-ParametersListFmt2* (respectively *nprach-ParametersListFmt2EDT*). |
| ***nprach-Periodicity***  Periodicity of a NPRACH resource, see TS 36.211 [21], clause10.1.6. Unit in millisecond.  For IoT NTN TDD mode, periodicity of 40 milliseconds and periodicity of 80 milliseconds are not supported: if value *ms40* is signalled, it is interpreted as 90 milliseconds and if value *ms80* is signalled, it is interpreted as 180 milliseconds.  See NOTE. |
| ***nprach-PreambleFormat***  TDD: TDD preamble format, see TS 36.211 [21]. clause 10.1.6,  Value *fmt0* corresponds to preamble format 0, value *fmt1* corresponds to preamble format 1 and so on. |
| ***nprach-StartTime***  Start time of the NPRACH resource in one period, see TS 36.211 [21], clause 10.1.6. Unit in millisecond.  See NOTE. |
| ***nprach-SubcarrierOffset***  Frequency location of the NPRACH resource, see TS 36.211 [21], clause 10.1.6. In number of subcarriers, offset from sub-carrier 0.  See NOTE. |
| ***nprach-SubcarrierMSG3-RangeStart***  Fraction for calculating the starting subcarrier index of the range reserved for indication of UE support for multi-tone Msg3 transmission, within the NPRACH resource, see TS 36.211 [21], clause 10.1.6. Multi-tone Msg3 transmission is not supported for {32, 64, 128} repetitions of NPRACH. For at least one of the NPRACH resources with the number of NPRACH repetitions other than {32, 64, 128}, the value of *nprach-SubcarrierMSG3-RangeStart* should not be 0.  If *nprach-SubcarrierMSG3-RangeStart* is equal to zero, no start subcarrier index for the single-tone Msg3 NPRACH is allocated and the start subcarrier indexes for the multi-tone Msg3 NPRACH partition are given by *nprach-SubcarrierOffset* + [0, *nprach-NumCBRA-StartSubcarriers* - 1].  If *nprach-SubcarrierMSG3-RangeStart* is equal to oneThirdor twoThird, the start subcarrier indexes for the two partitions are given by:  *nprach-SubcarrierOffset* + [0, FLOOR (*nprach-NumCBRA-StartSubcarriers \** *nprach-SubcarrierMSG3-RangeStart*) -1]  for the single-tone Msg3 NPRACH partition;  *nprach-SubcarrierOffset* + [FLOOR (*nprach-NumCBRA-StartSubcarriers \* nprach-SubcarrierMSG3-RangeStart*)*, nprach-NumCBRA-StartSubcarriers* - 1]  for the multi-tone Msg3 NPRACH partition;  If *nprach-SubcarrierMSG3-RangeStart* is equal to one, the start subcarrier indexes for the single-tone Msg3 NPRACH are given by *nprach-SubcarrierOffset* + [0, *nprach-NumCBRA-StartSubcarriers* - 1] and no start subcarrier index for the multi-tone Msg3 NPRACH partition is allocated.  See NOTE. |
| ***nprach-TxDurationFmt01***  Duration of PRACH segment transmission for PRACH resource format 0 and format 1 in NTN transmission, see TS 36.213 [23]. Unit in duration of preamble repetition unit, i.e., 4 \* (TCP+TSEQ).  Value *n2* corresponds to the duration of 2 preamble repetition units, value *n4* corresponds to the duration of 4 preamble repetition units and so on. |
| ***nprach-TxDurationFmt2***  Duration of PRACH segment transmission for PRACH resource format 2 in NTN transmission, see TS 36.213 [23]. Unit in duration of preamble repetition unit, i.e., 6 \* (TCP+TSEQ).  Value *n1* corresponds to the duration of 1 preamble repetition unit, value *n2* corresponds to the duration of 2 preamble repetition units and so on. |
| ***numRepetitionsPerPreambleAttempt***  Number of NPRACH repetitions per attempt for each NPRACH resource, See TS 36.211 [21], clause 10.1.6. *numRepetitionsPerPreambleAttempt-r13* applies to FDD and *numRepetitionsPerPreambleAttempt-v1550* applies to TDD. |
| ***rsrp-ThresholdsPrachInfoList***  The criterion for UEs to select a NPRACH resource. Up to 2 RSRP threshold values can be signalled. The first element corresponds to RSRP threshold of CE level 1, the second element corresponds to RSRP threshold of CE level 2. See TS 36.321 [6]. If absent, there is only one NPRACH resource.  A UE that supports *powerClassNB-14dBm-r14* shall correct the RSRP threshold values before applying them as follows:  RSRP threshold = Signalled RSRP threshold - min{0, (14-min(23, P-Max))} where P-Max*:*is the value of *p-Max* field in *SystemInformationBlockType1-NB.* |

NOTE:

- If the field is absent in an entry of *nprach-ParametersList* in *SystemInformationBlockType22-NB*, the value of the same field in the corresponding entry of *nprach-ParametersList* in *SystemInformationBlockType2-NB* applies.

- If the field is absent in the entry in *nprach-ParametersListEDT*, the value of the same field in the corresponding entry of *nprach-ParametersList* on the same UL carrierapplies, if present. Otherwise, the value of the same field in the corresponding entry of *nprach-ParametersList* in *SystemInformationBlockType2-NB* applies.

- If the field is absent in an entry of *nprach-ParametersListTDD* in *SystemInformationBlockType22-NB*, the value of the same field in the corresponding entry of *nprach-ParametersListTDD* in *SystemInformationBlockType2-NB* applies. The field is mandatory present in *nprach-ParametersListTDD* in *SystemInformationBlockType2-NB.*

- If the field is absent in an entry of *nprach-ParametersListFmt2* in *SystemInformationBlockType23-NB*, the value of the same field, if present, in the corresponding entry of *nprach-ParametersListFmt2* in *SystemInformationBlockType2-NB* applies. Otherwise the value of the same field, if present,in thecorresponding entry of the first occurence of *nprach-ParametersListFmt2* in the non anchor carrier list applies. Otherwise, the value of the same field in the corresponding entry of *nprach-ParametersList* in *SystemInformationBlockType2-NB* applies.

- If the field is absent in an entry of *nprach-ParametersListFmt2* in *SystemInformationBlockType2-NB*, the value of the same field in the corresponding entry of *nprach-ParametersList* in *SystemInformationBlockType2-NB* applies.

- If the field is absent in an entry of *nprach-ParametersListFmt2EDT* in *SystemInformationBlockType23-NB*, the value of the same field, if present, in the corresponding entry of *nprach-ParametersListFmt2* on the same UL carrierapplies. Otherwise, the value of the same field, if present, in the corresponding entry of *nprach-ParametersListFmt2* in *SystemInformationBlockType2-NB* applies. Otherwise the value of the same field, if present,in thecorresponding entry of the first occurence of *nprach-ParametersListFmt2* in the non anchor carrier list applies. Otherwise, the value of the same field in the corresponding entry of *nprach-ParametersList* in *SystemInformationBlockType2-NB* applies.

- If the field is absent in an entry of *nprach-ParametersListFmt2EDT* in *SystemInformationBlockType2-NB*, the value of the same field, if present, in the corresponding entry of *nprach-ParametersListFmt2* in *SystemInformationBlockType2-NB* applies. Otherwise the value of the same field in the corresponding entry of *nprach-ParametersList* in *SystemInformationBlockType2-NB* applies.

| Conditional presence | Explanation |
| --- | --- |
| *EDT1* | The field is mandatory present if *cp-EDT*, *cp-EDT-5GC*, *up-EDT* or *up-EDT-5GC* in *SystemInformationBlockType2-NB* is present; otherwise the field is not present and the UE shall delete any existing value for this field. |
| *EDT2* | The field is optionally present, Need OR, if *edt-Parameters* is present; otherwise the field is not present and the UE shall delete any existing value for this field. |
| *TDD* | This field is mandatory present for TDD; otherwise the field is not present and the UE shall delete any existing value for this field. |

#### – *NPUSCH-Config-NB*

The IE *NPUSCH-ConfigCommon-NB* is used to specify the common NPUSCH configuration. The IE *NPUSCH-ConfigDedicated-NB* is used to specify the UE specific NPUSCH configuration.

*NPUSCH-Config-NB* information element

-- ASN1START

NPUSCH-ConfigCommon-NB-r13 ::= SEQUENCE {

ack-NACK-NumRepetitions-Msg4-r13 SEQUENCE (SIZE(1.. maxNPRACH-Resources-NB-r13)) OF

ACK-NACK-NumRepetitions-NB-r13,

srs-SubframeConfig-r13 ENUMERATED {

sc0, sc1, sc2, sc3, sc4, sc5, sc6, sc7,

sc8, sc9, sc10, sc11, sc12, sc13, sc14, sc15

} OPTIONAL, -- Need OR

dmrs-Config-r13 SEQUENCE {

threeTone-BaseSequence-r13 INTEGER (0..12) OPTIONAL, -- Need OP

threeTone-CyclicShift-r13 INTEGER (0..2),

sixTone-BaseSequence-r13 INTEGER (0..14) OPTIONAL, -- Need OP

sixTone-CyclicShift-r13 INTEGER (0..3),

twelveTone-BaseSequence-r13 INTEGER (0..30) OPTIONAL -- Need OP

} OPTIONAL, -- Need OR

ul-ReferenceSignalsNPUSCH-r13 UL-ReferenceSignalsNPUSCH-NB-r13

}

UL-ReferenceSignalsNPUSCH-NB-r13 ::= SEQUENCE {

groupHoppingEnabled-r13 BOOLEAN,

groupAssignmentNPUSCH-r13 INTEGER (0..29)

}

NPUSCH-ConfigDedicated-NB-r13 ::= SEQUENCE {

ack-NACK-NumRepetitions-r13 ACK-NACK-NumRepetitions-NB-r13 OPTIONAL, -- Need ON

npusch-AllSymbols-r13 BOOLEAN OPTIONAL, -- Cond SRS

groupHoppingDisabled-r13 ENUMERATED {true} OPTIONAL -- Need OR

}

NPUSCH-ConfigDedicated-NB-v1610 ::= SEQUENCE {

npusch-MultiTB-Config-r16 ENUMERATED {interleaved, nonInterleaved}

}

NPUSCH-ConfigDedicated-NB-v1700 ::= SEQUENCE {

npusch-16QAM-Config-r17 ENUMERATED {true} OPTIONAL -- Need OR

}

NPUSCH-ConfigDedicated-NB-v1800 ::= SEQUENCE {

uplinkHARQ-Mode-r18 SetupRelease {UplinkHARQ-Mode-NB-r18}

}

NPUSCH-TxDuration-NB-r17 ::= SEQUENCE {

npusch-TxDuration-r17 ENUMERATED {ms2, ms4, ms8, ms16, ms32, ms64, ms128, ms256}

}

ACK-NACK-NumRepetitions-NB-r13 ::= ENUMERATED {r1, r2, r4, r8, r16, r32, r64, r128}

UplinkHARQ-Mode-NB-r18 ::= BIT STRING (SIZE(2))

-- ASN1STOP

| *NPUSCH-Config-NB* field descriptions |
| --- |
| ***ack-NACK-NumRepetitions***  Number of repetitions for the ACK NACK resource unit carrying HARQ response to NPDSCH, see TS 36.213 [23], clause 16.4.2. If this field is absentand no value was configured via dedicated signalling, the value used for reception of Msg4 is used. |
| ***ack-NACK-NumRepetitions-Msg4***  Number of repetitions for ACK/NACK HARQ response to NPDSCH containing Msg4 per NPRACH resource, see TS 36.213 [23], clause 16.4.2. |
| ***groupAssignmentNPUSCH***  See TS 36.211 [21], clause 10.1.4.1.3. |
| ***groupHoppingDisabled***  See TS 36.211 [21], clause 10.1.4.1.3. |
| ***groupHoppingEnabled***  See TS 36.211 [21], clause 10.1.4.1.3. |
| ***npusch-16QAM-Config***  Activation of 16QAM for UL, see TS 36.213 [23]. |
| ***npusch-AllSymbols***  If set to TRUE, the UE shall use all NB-IoT symbols for NPUSCH transmission. If set to FALSE, the UE punctures the NPUSCH transmissions in the symbols that collides with SRS. If the field is not present, the UE uses all NB-IoT symbols for NPUSCH transmission. See TS 36.211 [21], clause 10.1.3.6. |
| ***npusch-MultiTB-Config***  For FDD: Activation of multiple TBs scheduling in UL, see TS 36.213 [23]. Value *interleaved* indicates that multiple TBs scheduling with interleaved transmission is enabled, value *nonInterleaved* indicates that multiple TBs scheduling without interleaved transmission is enabled. |
| ***npusch-TxDuration***  Duration of NPUSCH segment transmission in NTN transmission, see TS 36.213 [23]. Unit in ms.  Value *ms2* corresponds to 2 ms, value *ms4* corresponds to 4 ms and so on. [RIL]: N022, IoTTDD |
| ***sixTone-BaseSequence***  The base sequence of DMRS sequence in a cell for 6 tones transmission; see TS 36.211 [21], clause 10.1.4.1.2. If absent, it is given by NB-IoT CellID mod 14. Value 14 is not used. |
| ***sixTone-CyclicShift***  Define 4 cyclic shifts for the 6-tone case, see TS 36.211 [21], clause 10.1.4.1.2. |
| ***srs-SubframeConfig***  SRS SubframeConfiguration. See TS 36.211 [21], table 5.5.3.3-1. Value sc0 corresponds to value 0, sc1 to value 1 and so on. |
| ***threeTone-BaseSequence***  The base sequence of DMRS sequence in a cell for 3 tones transmission; see TS 36.211 [21], clause 10.1.4.1.2. If absent, it is given by NB-IoT CellID mod 12. Value 12 is not used. |
| ***threeTone-CyclicShift***  Define 3 cyclic shifts for the 3-tone case, see TS 36.211 [21], clause 10.1.4.1.2. |
| ***twelveTone-BaseSequence***  The base sequence of DMRS sequence in a cell for 12 tones transmission; see TS 36.211 [21], clause 10.1.4.1.2. If absent, it is given by NB-IoT CellID mod 30. Value 30 is not used. |
| ***ul-ReferenceSignalsNPUSCH***  Used to specify parameters needed for the transmission on NPUSCH. |
| ***uplinkHARQ-Mode***  Used to set the HARQ mode per HARQ process ID, see TS 36.321 [6]. The first/leftmost bit corresponds to HARQ process ID 0, the next bit to HARQ process ID 1. The bit corresponding to HARQ process ID that is not configured shall be ignored. A bit set to one identifies a HARQ process with HARQ mode A and a bit set to zero identifies a HARQ process with HARQ mode B. This field applies for SRBs and DRBs. |

| Conditional presence | Explanation |
| --- | --- |
| *SRS* | This field is optionally present, need OP, if *srs-SubframeConfig* is broadcasted.  Otherwise, the IE is not present. |

#### – *PDCP-Config-NB*

The IE *PDCP-Config-NB* is used to set the configurable PDCP parameters for data radio bearers.

*PDCP-Config-NB* information element

-- ASN1START

PDCP-Config-NB-r13 ::= SEQUENCE {

discardTimer-r13 ENUMERATED {

ms5120, ms10240, ms20480, ms40960,

ms81920, infinity, spare2, spare1

} OPTIONAL, -- Cond Setup

headerCompression-r13 CHOICE {

notUsed NULL,

rohc SEQUENCE {

maxCID-r13 INTEGER (1..16383) DEFAULT 15,

profiles-r13 SEQUENCE {

profile0x0002 BOOLEAN,

profile0x0003 BOOLEAN,

profile0x0004 BOOLEAN,

profile0x0006 BOOLEAN,

profile0x0102 BOOLEAN,

profile0x0103 BOOLEAN,

profile0x0104 BOOLEAN

},

...

}

},

...,

[[ cipheringDisabled-r16 ENUMERATED {true} OPTIONAL -- Cond ConnectedTo5GC

]]

}

-- ASN1STOP

| *PDCP-Config-NB* field descriptions |
| --- |
| ***cipheringDisabled***  If included, ciphering is disabled for this DRB regardless of which ciphering algorithm is configured for the SRB/DRBs. E-UTRAN may include this field only when the UE is connected to 5GC. The value for this field cannot be changed after the DRB is set up. |
| ***discardTimer***  Indicates the discard timer value specified in TS 36.323 [8]. Value in milliseconds. Value ms5120 means 5120 ms, ms10240 means 10240 ms and so on. |
| ***headerCompression***  E-UTRAN does not reconfigure header compression except optionally upon RRC Connection Resumption. |
| ***maxCID***  Indicates the value of the MAX\_CID parameter as specified in TS 36.323 [8]. The total value of MAX\_CIDs across all bearers for the UE should be less than or equal to the value of *maxNumberROHC-ContextSessions* parameter as indicated by the UE. |
| ***profiles***  The profiles used by both compressor and decompressor in both UE and E-UTRAN. The field indicates which of the ROHC profiles specified in TS 36.323 [8] are supported, i.e. value *true* indicates that the profile is supported. Profile 0x0000 shall always be supported when the use of ROHC is configured. If support of two ROHC profile identifiers with the same 8 LSB's is signalled, only the profile corresponding to the highest value shall be applied. |

| Conditional presence | Explanation |
| --- | --- |
| *ConnectedTo5GC* | The field is optionally present, need OR, if the UE is connected to 5GC. Otherwise the field is not present and the UE shall delete any existing value for this field. |
| *Setup* | The field is mandatory present in case of radio bearer setup. Otherwise the field is optionally present, need ON. |

#### – *PhysicalConfigDedicated-NB*

The IE *PhysicalConfigDedicated-NB* is used to specify the UE specific physical channel configuration.

*PhysicalConfigDedicated-NB* information element

-- ASN1START

PhysicalConfigDedicated-NB-r13 ::= SEQUENCE {

carrierConfigDedicated-r13 CarrierConfigDedicated-NB-r13 OPTIONAL, -- Need ON

npdcch-ConfigDedicated-r13 NPDCCH-ConfigDedicated-NB-r13 OPTIONAL, -- Need ON

npusch-ConfigDedicated-r13 NPUSCH-ConfigDedicated-NB-r13 OPTIONAL, -- Need ON

uplinkPowerControlDedicated-r13 UplinkPowerControlDedicated-NB-r13 OPTIONAL, -- Need ON

...,

[[ twoHARQ-ProcessesConfig-r14 ENUMERATED {true} OPTIONAL -- Need OR

]],

[[ interferenceRandomisationConfig-r14 ENUMERATED {true} OPTIONAL -- Need OR

]],

[[ npdcch-ConfigDedicated-v1530 NPDCCH-ConfigDedicated-NB-v1530 OPTIONAL -- Cond TDD

]],

[[ additionalTxSIB1-Config-v1540 ENUMERATED {true} OPTIONAL -- Cond additionalSIB1

]],

[[ npusch-ConfigDedicated-v1610 NPUSCH-ConfigDedicated-NB-v1610

OPTIONAL, -- Cond twoHARQ

npdsch-ConfigDedicated-r16 NPDSCH-ConfigDedicated-NB-r16

OPTIONAL, -- Need ON

resourceReservationConfigDL-r16 SetupRelease {ResourceReservationConfig-NB-r16}

OPTIONAL, -- Cond dl-NonAnchor

resourceReservationConfigUL-r16 SetupRelease {ResourceReservationConfig-NB-r16}

OPTIONAL -- Cond ul-NonAnchor

]],

[[ ntn-ConfigDedicated-r17 SEQUENCE {

npusch-TxDuration-r17 SetupRelease {NPUSCH-TxDuration-NB-r17}

} OPTIONAL, -- Cond NTN

npdsch-ConfigDedicated-v1700 NPDSCH-ConfigDedicated-NB-v1710 OPTIONAL, -- Need ON

uplinkPowerControlDedicated-v1700 UplinkPowerControlDedicated-NB-v1700 OPTIONAL -- Cond npusch-16QAM

]],

[[

uplinkSegmentedPrecompensationGap-r17 ENUMERATED {sym1,sl1,sl2} OPTIONAL -- Need OR

]],

[[ npusch-ConfigDedicated-v1740 NPUSCH-ConfigDedicated-NB-v1700 OPTIONAL -- Need ON

]],

[[ npdsch-ConfigDedicated-v1800 NPDSCH-ConfigDedicated-NB-v1800 OPTIONAL, -- Need ON

npusch-ConfigDedicated-v1800 NPUSCH-ConfigDedicated-NB-v1800 OPTIONAL -- Need ON

]]

}

-- ASN1STOP

| *PhysicalConfigDedicated-NB* field descriptions |
| --- |
| ***additionalTxSIB1-Config***  Indicates if subframe #3 not containing additional SIB1 transmission is a NB-IoT DL subframe, as specified in TS 36.213 [23], clause 16.4. |
| ***carrierConfigDedicated***  Anchor/ non-anchor carrier used for all unicast transmissions. |
| ***interferenceRandomisationConfig***  For FDD: Interference randomisation enabled in connected mode, except for random access procedure in connected mode, see TS 36.211 [21]. For random access in connected mode interference randomisation on non-anchor is used and is not used on anchor carrier, see TS 36.211 [21].  For TDD: the parameter is not present. |
| *npdcch-ConfigDedicated*  NPDCCH configuration. |
| *npdsch-ConfigDedicated*  NPDSCH configuration. |
| ***npusch-ConfigDedicated***  UL unicast configuration. |
| ***resourceReservationConfigDL***  Configuration of downlink reserved resources, e.g. for NB-IoT co-existence with NR, see TS 36.211 [21], TS 36.212 [22], and TS 36.213 [23]. |
| ***resourceReservationConfigUL***  Configuration of uplink reserved resources, e.g. for NB-IoT co-existence with NR, see TS 36.211 [21], TS 36.212 [22], and TS 36.213 [23]. |
| ***twoHARQ-ProcessesConfig***  Activation of two HARQ processes, see TS 36.212 [22] and TS 36.213 [23]. |
| ***uplink-PowerControlDedicated***  UL power control parameter. |
| ***uplinkSegmentedPrecompensationGap***  Indicates the gap value between segments for NPUSCH for TA pre-compensation. Value *sym1* corresponds to 1 symbol, value *sl1* corresponds to 1 slot, value *sl2* corresponds to 2 slots. |

| Conditional presence | Explanation |
| --- | --- |
| *additionalSIB1* | This field is optionally present, Need OR, if *additionalTransmissionSIB1* is set to TRUE in *MasterInformationBlock-NB*; otherwise it is not present. |
| *dl-NonAnchor* | The field is optionally present, Need ON, for a DL non-anchor carrier; otherwise the field is not present and the UE shall delete any existing value for this field. |
| *npusch-16QAM* | This field is mandatory present, if *npusch-16QAM-Config-r17* is true; otherwise the field is not present and the UE shall delete any existing value for this field. |
| *NTN* | The field is optionally present, Need ON, for NTN. Otherwise, the field is not present and the UE shall delete any existing value for this field. |
| *TDD* | The field is optionally present, Need OR, for TDD; otherwise the field is not present and the UE shall delete any existing value for this field. |
| *twoHARQ* | The field is optionally present, Need OR, if *twoHARQ-ProcessesConfig* is configured; otherwise the field is not present and the UE shall delete any existing value for this field. |
| *ul-NonAnchor* | The field is optionally present, Need ON, for an UL non-anchor carrier; otherwise the field is not present and the UE shall delete any existing value for this field. |

#### – *PUR-Config-NB*

The IE *PUR-Config-NB* is used to specify PUR configuration.

*PUR-Config-NB* information element

-- ASN1START

PUR-Config-NB-r16 ::= SEQUENCE {

pur-ConfigID-r16 PUR-ConfigID-NB-r16 OPTIONAL, --Need OR

pur-TimeAlignmentTimer-r16 INTEGER (1..8) OPTIONAL, --Need OR

pur-NRSRP-ChangeThreshold-r16 SetupRelease {PUR-NRSRP-ChangeThreshold-NB-r16}

OPTIONAL, --Need ON

pur-ImplicitReleaseAfter-r16 ENUMERATED {n2, n4, n8, spare} OPTIONAL, --Need OR

pur-RNTI-r16 C-RNTI OPTIONAL, --Need ON

pur-ResponseWindowTimer-r16 ENUMERATED {pp1, pp2, pp3, pp4, pp8, pp16, pp32, pp64}

OPTIONAL, --Need ON

pur-StartTimeParameters-r16 SEQUENCE {

periodicityAndOffset-r16 PUR-PeriodicityAndOffset-NB-r16,

startSFN-r16 INTEGER (0..1023),

startSubframe-r16 INTEGER (0..9),

hsfn-LSB-Info-r16 BIT STRING (SIZE(1))

} OPTIONAL, --Need ON

pur-NumOccasions-r16 ENUMERATED {one, infinite},

pur-PhysicalConfig-r16 SEQUENCE {

carrierConfig-r16 CarrierConfigDedicated-NB-r13,

npusch-NumRUsIndex-r16 INTEGER (0..7),

npusch-NumRepetitionsIndex-r16 INTEGER (0..7),

npusch-SubCarrierSetIndex-r16 CHOICE {

khz15 INTEGER (0..18),

khz3dot75 INTEGER (0..47)

},

npusch-MCS-r16 CHOICE {

singleTone INTEGER (0..10),

multiTone INTEGER (0..13)

},

p0-UE-NPUSCH-r16 INTEGER (-8..7),

alpha-r16 ENUMERATED {al0, al04, al05, al06,

al07, al08, al09, al1},

npusch-CyclicShift-r16 ENUMERATED {n0, n6},

npdcch-Config-r16 NPDCCH-ConfigDedicated-NB-r13

} OPTIONAL, -- Need ON

...,

[[

pur-PhysicalConfig-v1650 SEQUENCE {

ack-NACK-NumRepetitions-r16 ACK-NACK-NumRepetitions-NB-r13

} OPTIONAL --Need ON

]],

[[

pur-PhysicalConfig-v1700 SEQUENCE {

pur-UL-16QAM-Config-r17 SetupRelease {PUR-UL-16QAM-Config-NB-r17} OPTIONAL, -- Need ON

pur-DL-16QAM-Config-r17 SetupRelease {NPDSCH-16QAM-Config-NB-r17} OPTIONAL -- Need ON

} OPTIONAL -- Need ON

]]

}

PUR-NRSRP-ChangeThreshold-NB-r16 ::= SEQUENCE {

increaseThresh-r16 NRSRP-ChangeThresh-NB-r16,

decreaseThresh-r16 NRSRP-ChangeThresh-NB-r16 OPTIONAL --Need OP

}

PUR-UL-16QAM-Config-NB-r17 ::= SEQUENCE {

uplinkPowerControlDedicated-r17 UplinkPowerControlDedicated-NB-v1700

}

NRSRP-ChangeThresh-NB-r16 ::= ENUMERATED {dB4, dB6, dB8, dB10, dB14, dB18, dB22, dB26, dB30, dB34, spare6, spare5, spare4, spare3, spare2, spare1}

-- ASN1STOP

| *PUR-Config-NB* field descriptions |
| --- |
| ***ack-NACK-NumRepetitions***  Number of repetitions for the ACK NACK resource unit carrying HARQ response to NPDSCH, see TS 36.213 [23], clause 16.4.2. If this field is absent and no value was configured via *pur-Config*, the value of *ack-NACK-NumRepetitions* used for HARQ response to NPDSCH containing this *RRCConnectionRelease-NB* message applies. |
| ***alpha***  Parameter: *αc*(3). See TS 36.213 [23], clause 16.2.1.1.1. |
| ***carrierConfig***  Carrier used for PUR. |
| ***hsfn-LSB-Info***  LSB of the H-SFN corresponding to the last subframe of the first transmission of *RRCConnectionRelease* message containing *pur-Config*. |
| ***npdcch-Config***  NPDCCH configuration for PUR. |
| ***npusch-CyclicShift***  Parameter: . See TS 36.211 [21], clause 10.1.4.1.2. Value *n0* corresponds to value 0 and value *n6* corresponds to value 6. |
| ***npusch-MCS***  Index to tables specified in TS 36.213 [23], Table 16.5.1.2-1 and Table 16.5.1.2-2 for single tone and multi tone respectively, that defines modulation and TBS index for NPUSCH for PUR. If 16QAM UL for PUR is configured, value *singleTone* is not applicable, signalled value of *multiTone* shall be less than or equal to 7, and actual value = signalled value + 14. |
| ***npusch-NumRepetitionsIndex***  Index to a table specified in TS 36.213 [23], Table 16.5.1.1-3, that defines number of repetitions for NPUSCH for PUR. |
| ***npusch-NumRUsIndex***  Index to a table specified in TS 36.213 [23], Table 16.5.1.1-2, that defines number of resource units for NPUSCH for PUR. |
| ***npusch-SubCarrierSetIndex***  For NPUSCH transmission with subcarrier spacing 3.75 kHz, indicates the subcarrier used for PUR specified in TS 36.213 [23].  For NPUSCH transmission with subcarrier spacing 15 kHz, index to a table specified in TS 36.213 [23], Table 16.5.1.1-1, that defines the set of subcarriers for NPUSCH for PUR. |
| ***p0-UE-NPUSCH***  Parameter: . See TS 36.213 [23], clause 16.2.1.1.1, unit dB. |
| ***pur-DL-16QAM-Config***  Activation of 16QAM for downlink, see TS 36.213 [23]. |
| ***pur-ImplicitReleaseAfter***  Number of consecutive PUR occasions that can be skipped before implicit release of PUR configuration. Value *n2* corresponds to 2 PUR occasions, value *n4* corresponds to 4 PUR occasions, and so on. |
| ***pur-NRSRP-ChangeThreshold***  Threshold(s) of change in serving cell NRSRP in dB for TA validation. Value *dB4* corresponds to 4 dB, value *dB6* corresponds to 6 dB, and so on. When *pur-NRSRP-ChangeThreshold* is set to *setup*, if *decreaseThrsh* is absent the value of *increaseThresh* is also used for *decreaseThresh*. |
| ***pur-NumOccasions***  Number of PUR occasions. Value *one* corresponds to 1 PUR occasion, and value *infinite* corresponds to an infinite number of PUR occasions. |
| ***pur-PeriodicityAndOffset***  Indicates the periodicity for the PUR occasions and time offset until the first PUR occasion. |
| ***pur-ResponseWindowTimer***  Duration of the PUR response window in TS 36.321 [6]. Value in PDCCH periods. Value *pp2* corresponds to 2 PDCCH periods, *pp3* corresponds to 3 PDCCH periods, and so on.  The value considered by the UE is: *pur-ResponseWindowTimer* = Min (signaled value x PDCCH period, 10.24s). |
| ***pur-TimeAlignmentTimer***  Value of the time alignment timer for PUR. Value in number of periodicity of PUR. |
| ***pur-UL-16QAM-Config***  Activation of 16QAM for uplink, see TS 36.213 [23]. |

#### – *PUR-ConfigID-NB*

The IE *PUR-ConfigID-NB* is used to indicate the PUR configuration identity.

*PUR-ConfigID-NB* information element

-- ASN1START

PUR-ConfigID-NB-r16 ::= BIT STRING (SIZE(20))

-- ASN1STOP

#### – *PUR-PeriodicityAndOffset-NB*

The IE *PUR-PeriodicityAndOffset* is used to indicate H-SFN of the first PUR occasion and periodicity of the subsequent PUR occasions. The value of periodicity is in the unit of H-SFN duration (i.e., 10.24s). Value *periodicity8* corresponds to periodicity of 8 H-SFN, value *periodicity16* corresponds to periodicity of 16 H-SFN and so on. The value of offset is in the unit of H-SFN duration (i.e., 10.24s).

*PUR-PeriodicityAndOffset-NB* information element

-- ASN1START

PUR-PeriodicityAndOffset-NB-r16 ::= CHOICE {

periodicity8 INTEGER (1..7),

periodicity16 INTEGER (1..15),

periodicity32 INTEGER (1..31),

periodicity64 INTEGER (1..63),

periodicity128 INTEGER (1..127),

periodicity256 INTEGER (1..257),

periodicity512 INTEGER (1..511),

periodicity1024 INTEGER (1..1023),

periodicity2048 INTEGER (1..2047),

periodicity4096 INTEGER (1..4095),

periodicity8192 INTEGER (1..8191)

}

-- ASN1STOP

#### – *RACH-ConfigCommon-NB*

The IE *RACH-ConfigCommon-NB* is used to specify the generic random access parameters.

*RACH-ConfigCommon-NB* information element

-- ASN1START

RACH-ConfigCommon-NB-r13 ::= SEQUENCE {

preambleTransMax-CE-r13 PreambleTransMax,

powerRampingParameters-r13 PowerRampingParameters,

rach-InfoList-r13 RACH-InfoList-NB-r13,

connEstFailOffset-r13 INTEGER (0..15) OPTIONAL, -- Need OP

...,

[[ powerRampingParameters-v1450 PowerRampingParameters-NB-v1450 OPTIONAL -- Need OR

]],

[[ rach-InfoList-v1530 RACH-InfoList-NB-v1530 OPTIONAL -- Cond EDT

]]

}

RACH-InfoList-NB-r13 ::= SEQUENCE (SIZE (1.. maxNPRACH-Resources-NB-r13)) OF RACH-Info-NB-r13

RACH-InfoList-NB-v1530 ::= SEQUENCE (SIZE (1.. maxNPRACH-Resources-NB-r13)) OF RACH-Info-NB-v1530

RACH-Info-NB-r13 ::= SEQUENCE {

ra-ResponseWindowSize-r13 ENUMERATED {

pp2, pp3, pp4, pp5, pp6, pp7, pp8, pp10},

mac-ContentionResolutionTimer-r13 ENUMERATED {

pp1, pp2, pp3, pp4, pp8, pp16, pp32, pp64}

}

RACH-Info-NB-v1530 ::= SEQUENCE {

mac-ContentionResolutionTimer-r15 ENUMERATED {

pp1, pp2, pp3, pp4, pp8, pp16, pp32, pp64}

}

PowerRampingParameters-NB-v1450 ::= SEQUENCE {

preambleInitialReceivedTargetPower-v1450 ENUMERATED {

dBm-130, dBm-128, dBm-126, dBm-124, dBm-122,

dBm-88, dBm-86, dBm-84,dBm-82, dBm-80}

OPTIONAL, -- Need OR

powerRampingParametersCE1-r14 SEQUENCE {

powerRampingStepCE1-r14 ENUMERATED {dB0, dB2, dB4, dB6},

preambleInitialReceivedTargetPowerCE1-r14 ENUMERATED {

dBm-130, dBm-128, dBm-126, dBm-124, dBm-122,

dBm-120, dBm-118, dBm-116, dBm-114, dBm-112,

dBm-110, dBm-108, dBm-106, dBm-104, dBm-102,

dBm-100, dBm-98, dBm-96, dBm-94, dBm-92,

dBm-90, dBm-88, dBm-86, dBm-84, dBm-82, dBm-80}

} OPTIONAL -- Need OR

}

-- ASN1STOP

| *RACH-ConfigCommon-NB* field descriptions |
| --- |
| ***connEstFailOffset***  Parameter "Qoffsettemp" in TS 36.304 [4]. If the field is not present the value of infinity shall be used for "Qoffsettemp". |
| ***mac-ContentionResolutionTimer***  Timer for contention resolution in TS 36.321 [6]. Value in PDCCH periods. Value pp1 corresponds to 1 PDCCH period, pp2 corresponds to 2 PDCCH periods and so on. *mac-ContentionResolutionTimer-r15* is only applicable for EDT. UE performing EDT shall use *mac-ContentionResolutionTimer-r15*, if present.  For FDD or IoT NTN TDD: The value considered by the UE is: *mac-ContentionResolutionTimer* = Min (signaled value x PDCCH period, 10.24s).  For TDD: The value considered by the UE is: *mac-ContentionResolutionTimer* = Min (signaled value x PDCCH period, 20.48s). |
| ***powerRampingParameters, powerRampingParametersCE1***  Power ramping step and preamble initial received target power – same as TS 36.213 [23] and TS 36.321 [6].  For FDD, if the UE does not support enhanced random access power control and more than one repetition level is configured in the cell, then the UE transmits NPRACH with max power except for the lowest repetition level. Otherwise, the UE uses NPRACH power ramping.  For FDD, if the UE supports enhanced random access power control and *powerRampingParameters-v1450* is signalled, or for TDD, the UE uses NPRACH power ramping across repetition levels as specified in TS 36.321 [6]. If *preambleInitialReceivedTargetPower-v1450* is present, the UE shall use *preambleInitialReceivedTargetPower-v1450* instead of *preambleInitialReceivedTargetPower* (i.e. without suffix). If *powerRampingParametersCE1* is present, the UE shall use *powerRampingParametersCE1* instead of *powerRampingParameters* for NPRACH power ramping in the second repetition level. |
| ***preambleTransMax-CE***  Maximum number of preamble transmission in TS 36.321 [6]. Value is an integer. |
| ***ra-ResponseWindowSize***  Duration of the RA response window in TS 36.321 [6]. Value in PDCCH periods. Value pp2 corresponds to 2 PDDCH periods, pp3 corresponds to 3 PDCCH periods and so on.  For FDD or IoT NTN TDD: The value considered by the UE is: *ra-ResponseWindowSize* = Min (signaled value x PDCCH period, 10.24s).  For TDD: The value considered by the UE is: *ra-ResponseWindowSize* = Min (signaled value x PDCCH period, 20.48s). |

| Conditional presence | Explanation |
| --- | --- |
| *EDT* | The field is optionally present, Need OR, if *edt-Parameters* is present; otherwise the field is not present and the UE shall delete any existing value for this field. |

#### – *RadioResourceConfigCommonSIB-NB*

The IE *RadioResourceConfigCommonSIB-NB* is used to specify common radio resource configurations in the system information, e.g., the random access parameters and the static physical layer parameters.

*RadioResourceConfigCommonSIB-NB* information element

-- ASN1START

RadioResourceConfigCommonSIB-NB-r13 ::= SEQUENCE {

rach-ConfigCommon-r13 RACH-ConfigCommon-NB-r13,

bcch-Config-r13 BCCH-Config-NB-r13,

pcch-Config-r13 PCCH-Config-NB-r13,

nprach-Config-r13 NPRACH-ConfigSIB-NB-r13,

npdsch-ConfigCommon-r13 NPDSCH-ConfigCommon-NB-r13,

npusch-ConfigCommon-r13 NPUSCH-ConfigCommon-NB-r13,

dl-Gap-r13 DL-GapConfig-NB-r13 OPTIONAL, -- Need OP

uplinkPowerControlCommon-r13 UplinkPowerControlCommon-NB-r13,

...,

[[ nprach-Config-v1330 NPRACH-ConfigSIB-NB-v1330 OPTIONAL -- Need OR

]],

[[ nprach-Config-v1450 NPRACH-ConfigSIB-NB-v1450 OPTIONAL -- Cond EnhPowerControl

]],

[[ nprach-Config-v1530 NPRACH-ConfigSIB-NB-v1530 OPTIONAL, -- Need OR

dl-Gap-v1530 DL-GapConfig-NB-v1530 OPTIONAL, -- Cond TDD

wus-Config-r15 WUS-Config-NB-r15 OPTIONAL -- Need OR

]],

[[ nprach-Config-v1550 NPRACH-ConfigSIB-NB-v1550 OPTIONAL -- Cond TDD1

]],

[[

gwus-Config-r16 GWUS-Config-NB-r16 OPTIONAL, -- Need OR

nrs-NonAnchorConfig-r16 ENUMERATED {true} OPTIONAL, -- Need OR

ue-SpecificDRX-CycleMin-r16 ENUMERATED {rf32, rf64, rf128, rf256, rf512,

rf1024} OPTIONAL -- Need OR

]],

[[ ntn-ConfigCommon-r17 SEQUENCE {

ta-Report-r17 ENUMERATED {enabled} OPTIONAL, -- Need OR

t318-r17 ENUMERATED {

ms0, ms200, ms500, ms1000, ms2000, ms4000, ms8000},

nprach-TxDurationFmt01-r17 NPRACH-TxDurationFmt01-NB-r17 OPTIONAL, -- Need OR

nprach-TxDurationFmt2-r17 NPRACH-TxDurationFmt2-NB-r17 OPTIONAL, -- Need OR

npusch-TxDuration-r17 NPUSCH-TxDuration-NB-r17 OPTIONAL -- Need OR

} OPTIONAL -- Cond NTN

]]

}

BCCH-Config-NB-r13 ::= SEQUENCE {

modificationPeriodCoeff-r13 ENUMERATED {n16, n32, n64, n128}

}

PCCH-Config-NB-r13 ::= SEQUENCE {

defaultPagingCycle-r13 ENUMERATED {rf128, rf256, rf512, rf1024},

nB-r13 ENUMERATED {

fourT, twoT, oneT, halfT, quarterT, one8thT,

one16thT, one32ndT, one64thT,

one128thT, one256thT, one512thT, one1024thT,

spare3, spare2, spare1},

npdcch-NumRepetitionPaging-r13 ENUMERATED {

r1, r2, r4, r8, r16, r32, r64, r128,

r256, r512, r1024, r2048,

spare4, spare3, spare2, spare1}

}

-- ASN1STOP

| *RadioResourceConfigCommonSIB-NB* field descriptions |
| --- |
| ***defaultPagingCycle***  Default paging cycle, used to derive 'T' in TS 36.304 [4]. Value *rf128* corresponds to 128 radio frames, *rf256* corresponds to 256 radio frames and so on. |
| ***dl-Gap***  Downlink transmission gap configuration for the anchor carrier. See TS 36.211 [21], clause 10.2.3.4. If the field is absent, there is no gap. |
| ***gwus-Config***  For FDD: GWUS Configuration. |
| ***modificationPeriodCoeff***  Actual modification period, expressed in number of radio frames= *modificationPeriodCoeff* \* *defaultPagingCycle*. n16 corresponds to value 16, n32 corresponds to value 32, and so on. The BCCH modification period should be larger or equal to 40.96s. |
| ***nB***  Parameter: nB is used as one of parameters to derive the Paging Frame and Paging Occasion according to TS 36.304 [4]. Value in multiples of 'T' as defined in TS 36.304 [4]. A value of fourT corresponds to 4 \* T, a value of twoT corresponds to 2 \* T and so on. |
| ***npdcch-NumRepetitionPaging***  Maximum number of repetitions for NPDCCH common search space (CSS) for paging, see TS 36.213 [23], clause 16.6. |
| ***nrs-NonAnchorConfig***  For FDD: Indicates if NRS are present on non-anchor paging carriers even when no paging NPDCCH is transmitted, see TS 36.211 [21], clause 10.2.6. |
| ***t318***  The value of timer T318. Value *ms0* corresponds with 0 ms, *ms50* corresponds with 50 ms and so on. |
| ***ta-Report***  When this field is included in *SystemInformationBlockType2-NB*, it indicates reporting of timing advance is enabled during Random Access due to RRC connection establishment, RRC connection resume or RRC connection reestablishment, see TS 36.321 [6], clause 5.4.9. | |
| ***ue-SpecificDRX-CycleMin***  Minimum UE specific DRX cycle in the cell, see TS 36.304 [4], clause 7.1. Value *rf32* corresponds to 32 radio frames, *rf64* corresponds to 64 radio frames and so on.  If present, E-UTRAN ensures PCCH configuration does not lead to CSS overlap for *ue-SpecificDRX-CycleMin*.  If the field is not present, use of UE specific DRX cycle is not allowed in the cell. |
| ***wus-Config***  For FDD: WUS Configuration. |

| Conditional presence | Explanation |
| --- | --- |
| *EnhPowerControl* | This field is optional present, Need OR, if *PowerRampingParameters-NB-v1450* is included in SIB2-NB. Otherwise the field is not present. |
| *NTN* | The field is mandatory present for NTN. Otherwise, the field is not present. |
| *TDD* | The field is optionally present, Need OR, for TDD; otherwise the field is not present and the UE shall delete any existing value for this field. |
| *TDD1* | The field is mandatory present for TDD; otherwise the field is not present and the UE shall delete any existing value for this field. |

#### – *RadioResourceConfigDedicated-NB*

The IE *RadioResourceConfigDedicated-NB* is used to setup/modify/release RBs, to modify the MAC main configuration, and to modify dedicated physical configuration.

*RadioResourceConfigDedicated-NB* information element

-- ASN1START

RadioResourceConfigDedicated-NB-r13 ::= SEQUENCE {

srb-ToAddModList-r13 SRB-ToAddModList-NB-r13 OPTIONAL, -- Need ON

drb-ToAddModList-r13 DRB-ToAddModList-NB-r13 OPTIONAL, -- Need ON

drb-ToReleaseList-r13 DRB-ToReleaseList-NB-r13 OPTIONAL, -- Need ON

mac-MainConfig-r13 CHOICE {

explicitValue-r13 MAC-MainConfig-NB-r13,

defaultValue-r13 NULL

} OPTIONAL, -- Need ON

physicalConfigDedicated-r13 PhysicalConfigDedicated-NB-r13 OPTIONAL, -- Need ON

rlf-TimersAndConstants-r13 RLF-TimersAndConstants-NB-r13 OPTIONAL, -- Need ON

...,

[[ schedulingRequestConfig-r15 SchedulingRequestConfig-NB-r15 OPTIONAL -- Need ON

]],

[[ newUE-Identity-r16 C-RNTI OPTIONAL -- Need OP

]],

[[ gnss-AutonomousEnabled-r18 ENUMERATED {true} OPTIONAL, -- Need OR

ul-TransmissionExtensionEnabled-r18 ENUMERATED {true} OPTIONAL, -- Need OR

ul-TransmissionExtensionValue-r18 ENUMERATED {sf500, sf750, sf1280, sf1920,

sf2560, sf5120, sf10240, spare1}

OPTIONAL -- Need OR

]]

}

SRB-ToAddModList-NB-r13 ::= SEQUENCE (SIZE (1)) OF SRB-ToAddMod-NB-r13

SRB-ToAddMod-NB-r13 ::= SEQUENCE {

rlc-Config-r13 CHOICE {

explicitValue RLC-Config-NB-r13,

defaultValue NULL

} OPTIONAL, -- Cond Setup

logicalChannelConfig-r13 CHOICE {

explicitValue LogicalChannelConfig-NB-r13,

defaultValue NULL

} OPTIONAL, -- Cond Setup

...,

[[ rlc-Config-v1430 RLC-Config-NB-v1430 OPTIONAL -- Need ON

]],

[[ rlc-Config-v1700 RLC-Config-NB-v1700 OPTIONAL -- Need ON

]]

}

DRB-ToAddModList-NB-r13 ::= SEQUENCE (SIZE (1..maxDRB-NB-r13)) OF DRB-ToAddMod-NB-r13

DRB-ToAddMod-NB-r13 ::= SEQUENCE {

eps-BearerIdentity-r13 INTEGER (0..15) OPTIONAL, -- Cond DRB-Setup-EPC

drb-Identity-r13 DRB-Identity,

pdcp-Config-r13 PDCP-Config-NB-r13 OPTIONAL, -- Cond Setup

rlc-Config-r13 RLC-Config-NB-r13 OPTIONAL, -- Cond Setup

logicalChannelIdentity-r13 INTEGER (3..10) OPTIONAL, -- Cond DRB-Setup

logicalChannelConfig-r13 LogicalChannelConfig-NB-r13 OPTIONAL, -- Cond Setup

...,

[[ rlc-Config-v1430 RLC-Config-NB-v1430 OPTIONAL -- Need ON

]],

[[ pdu-Session-r16 PDU-SessionID-NB-r16 OPTIONAL -- Cond DRB-Setup-5GC

]],

[[ rlc-Config-v1700 RLC-Config-NB-v1700 OPTIONAL -- Need ON

]]

}

PDU-SessionID-NB-r16 ::= INTEGER (0..255)

DRB-ToReleaseList-NB-r13 ::= SEQUENCE (SIZE (1..maxDRB-NB-r13)) OF DRB-Identity

-- ASN1STOP

| *RadioResourceConfigDedicated-NB* field descriptions |
| --- |
| ***gnss-AutonomousEnabled***  Presence of this field indicates that autonomous GNSS re-acquisition using an autonomous gap is enabled by network. |
| ***logicalChannelConfig***  For SRB a choice is used to indicate whether the logical channel configuration is signalled explicitly or set to the default logical channel configuration for SRB1 as specified in 9.2.1.1. |
| ***logicalChannelIdentity***  The logical channel identity for both UL and DL for a DRB. Value 3 is not used. |
| ***mac-MainConfig***  The default MAC MAIN configuration is specified in 9.2.2. |
| ***newUE-Identity***  C-RNTI used after moving to RRC\_CONNECTED in response to transmission using PUR. |
| ***pdu-Session***  Identity of the PDU session whose QoS flow is mapped to the DRB. |
| ***physicalConfigDedicated***  The default dedicated physical configuration is specified in 9.2.4. |
| ***rlc-Config***  For SRBs a choice is used to indicate whether the RLC configuration is signalled explicitly or set to the values defined in the default RLC configuration for SRB1 in 9.2.1.1. RLC AM is the only applicable RLC mode for SRB1 and SRB1bis. |
| ***schedulingRequestConfig***  For FDD: Scheduling request configuration. |
| ***ul-TransmissionExtensionEnabled***  Presence of this field indicates that UL transmission extension after original GNSS validity duration expires is enabled by the network. |
| ***ul-TransmissionExtensionValue***  Indicates the duration after original GNSS validity duration expires within which UL transmission is allowed. Value in number of sub-frames, value *sf500* corresponds to 500 sub-frames, *sf750* corresponds to 750 sub-frames and so on. |

| **Conditional presence** | **Explanation** |
| --- | --- |
| *DRB-Setup* | The field is mandatory present if the corresponding DRB is being set up; otherwise it is not present. |
| *DRB-Setup-5GC* | The field is mandatory present if the corresponding DRB is being set up when connected to 5GC; otherwise it is not present. |
| *DRB-Setup-EPC* | The field is mandatory present if the corresponding DRB is being set up when connected to EPC; otherwise it is not present. |
| *Setup* | The field is mandatory present if the corresponding SRB/DRB is being setup; otherwise the field is optionally present, need ON. |

#### – *ResourceReservationConfig-NB*

The IE *ResourceReservationConfig-NB* is used to specify the reserved downlink or uplink resources on a NB-IoT carrier, e.g. for deployment within a NR carrier.

*ResourceReservationConfig-NB* information element

-- ASN1START

ResourceReservationConfig-NB-r16::= SEQUENCE {

periodicity-r16 ENUMERATED {ms10, ms20, ms40, ms80, ms160, spare3, spare2, spare1},

startPosition-r16 INTEGER (0..15),

resourceReservation-r16 CHOICE {

subframeBitmap-r16 CHOICE {

subframePattern10ms BIT STRING (SIZE (10)),

subframePattern40ms BIT STRING (SIZE (40))

},

slotConfig-r16 SEQUENCE {

slotBitmap-r16 CHOICE {

slotPattern10ms BIT STRING (SIZE (20)),

slotPattern40ms BIT STRING (SIZE (80))

},

symbolBitmap-r16 CHOICE {

symbolBitmapFddDl SEQUENCE {

symbolBitmap1-r16 BIT STRING (SIZE (5)) OPTIONAL, -- Cond Bitmap1

symbolBitmap2-r16 BIT STRING (SIZE (5)) OPTIONAL -- Cond Bitmap2

},

symbolBitmapFddUlOrTdd SEQUENCE {

symbolBitmap1-r16 BIT STRING (SIZE (7)) OPTIONAL, -- Cond Bitmap1

symbolBitmap2-r16 BIT STRING (SIZE (7)) OPTIONAL -- Cond Bitmap2

}

}

}

},

...

}

-- ASN1STOP

| *ResourceReservationConfig* field descriptions |
| --- |
| ***periodicity***  Periodicity of the reserved resource. Value *ms10* corresponds to 10 milliseconds, value *ms20* corresponds to 20 milliseconds, and so on. |
| ***slotPattern10ms, slotPattern40ms***  For FDD: Downlink slot-level resource reservation configuration over 10ms or 40ms.  Parameter slot-reserved-resource-config-DL in TS 36.211 [21] and TS 36.213 [23]  The first/leftmost 2-bits corresponds to the subframe #0 of the radio frame satisfying SFN mod x = *startPosition*, where x is the periodicity of the reserved resource divided by 10. Two bits for each subframe coded as:  00: both slots are not reserved  01: the first slot is not reserved, the second slot is reserved  10: the first slot is reserved, the second slot is not reserved  11: both slots are reserved |
| ***startPosition***  Start time of the resource reservation pattern in one period. Unit in multiple of 10 milliseconds.  E-UTRAN configures the value of *startPosition* such as *startPosition \* 10 < periodicity.* |
| ***subframePattern10ms, subframePattern40ms***  For FDD: Downlink subframe-level resource reservation configuration over 10ms or 40ms.  Parameters valid-subframe-config-DL in TS 36.211 [21] and TS 36.213 [23].  The first/leftmost bit corresponds to the subframe #0 of the radio frame satisfying SFN mod x = *startPosition*, where x is the periodicity of the reserved resource divided by 10. Value 0 indicates that the corresponding subframe is not reserved, value 1 indicates that the corresponding subframe is reserved. |
| ***symbolBitmap***  Symbol-level resource reservation for one subframe*.*  E-UTRAN configures *symbolConfigFddDl* for a DL FDD NB-IoT carrier. E-UTRAN configures *symbolConfigFddULOrTdd* for an UL FDD NB-IoT carrier or a TDD NB-IoT carrier. |
| ***symbolBitmap1, symbolBitmap2***  Symbol-level resource reservation over the first or the second slot of one subframe, see TS 36.211 [21].  The first/leftmost bit corresponds to the symbol #0 in the slot. Value 0 indicates that the corresponding symbol is not reserved, value 1 indicates that the corresponding symbol is reserved.  If *symbolBitmap1* is absent, value '01' in the *slotBitmap* corresponds to the second slot being reserved.  If *symbolBitmap2* is absent, value '10' in the *slotBitmap* corresponds to the first slot being reserved. | |
| ***symbolBitmapFddDl***  For FDD: Downlink symbol-level resource reservation over the first and the second slot of one subframe, see TS 36.211 [21].  Symbols that carry NRS are not reserved. |
| ***symbolBitmapFddUlOrTdd***  For FDD: Uplink symbol-level resource reservation over the first and the second slot of one subframe, see TS 36.211 [21].  For TDD: Uplink or downlink symbol-level resource reservation over the first and the second slot of one subframe, see TS 36.211 [21].  Symbols that carry NRS are not reserved. |

| Conditional presence | Explanation | |
| --- | --- | --- |
| *Bitmap1* | The field is optional present, need OR, if value of *slotBitmap* corresponditing to at least one subrame is '01'; otherwise the field is not present. |
| *Bitmap2* | The field is optional present, need OR, if value of *slotBitmap* corresponditing to at least one subrame is '10'; otherwise the field is not present. |

#### – *RLC-Config-NB*

The IE *RLC-Config-NB* is used to specify the RLC configuration of SRBs and DRBs.

*RLC-Config-NB information element*

-- ASN1START

RLC-Config-NB-r13 ::= CHOICE {

am SEQUENCE {

ul-AM-RLC-r13 UL-AM-RLC-NB-r13,

dl-AM-RLC-r13 DL-AM-RLC-NB-r13

},

...,

um-Bi-Directional-r15 NULL,

um-Uni-Directional-UL-r15 NULL,

um-Uni-Directional-DL-r15 NULL

}

RLC-Config-NB-v1430 ::= SEQUENCE {

t-Reordering-r14 T-Reordering OPTIONAL -- Cond twoHARQ

}

RLC-Config-NB-v1700 ::= SEQUENCE {

t-ReorderingExt-r17 SetupRelease {T-ReorderingExt-r17}

}

UL-AM-RLC-NB-r13 ::= SEQUENCE {

t-PollRetransmit-r13 T-PollRetransmit-NB-r13,

maxRetxThreshold-r13 ENUMERATED {t1, t2, t3, t4, t6, t8, t16, t32}

}

DL-AM-RLC-NB-r13 ::= SEQUENCE {

enableStatusReportSN-Gap-r13 ENUMERATED {true} OPTIONAL

}

T-PollRetransmit-NB-r13 ::= ENUMERATED {

ms250, ms500, ms1000, ms2000, ms3000, ms4000,

ms6000, ms10000, ms15000, ms25000, ms40000, ms60000,

ms90000, ms120000, ms180000, ms300000-v1530}

-- ASN1STOP

| *RLC-Config-NB* field descriptions |
| --- |
| ***enableStatusReportSN-Gap***  Indicates that status reporting due to detection of reception failure is enabled, as specified in TS 36.322 [7]. |
| ***maxRetxThreshold***  Parameter for RLC AM in TS 36.322 [7]. Value t1 corresponds to 1 retransmission, t2 to 2 retransmissions and so on. |
| ***t-PollRetransmit***  Timer for RLC AM inTS 36.322 [7], in milliseconds. Value msX means X ms, msY means Y ms and so on.  E-UTRAN may configure the value *msX-v1530* (with suffix) only in TDD mode. |
| ***t-Reordering***  Timer for reordering in TS 36.322 [7], in milliseconds. |
| ***t-ReorderingExt***  Timer for reordering in TS 36.322 [7], in milliseconds.  The UE shall use the extended value *t-ReorderingExt-r17*, if present, and ignore the value signaled by *t-Reordering-r14*.  E-UTRAN may configure *t-ReorderingExt* only if *twoHARQ-ProcessesConfig* is set to TRUE. |

| **Conditional presence** | **Explanation** |
| --- | --- |
| *twoHARQ* | The field is mandatory present if *twoHARQ-ProcessesConfig* is set to TRUE. Otherwise, the field is not present and, if previously configured, the timer is released. |

#### – *RLF-TimersAndConstants-NB*

The IE *RLF-TimersAndConstants-NB* contains UE specific timers and constants applicable for UEs in RRC\_CONNECTED.

*RLF-TimersAndConstants-NB* information element

-- ASN1START

RLF-TimersAndConstants-NB-r13 ::= CHOICE {

release NULL,

setup SEQUENCE {

t301-r13 ENUMERATED {

ms2500, ms4000, ms6000, ms10000,

ms15000, ms25000, ms40000, ms60000},

t310-r13 ENUMERATED {

ms0, ms200, ms500, ms1000, ms2000, ms4000, ms8000},

n310-r13 ENUMERATED {

n1, n2, n3, n4, n6, n8, n10, n20},

t311-r13 ENUMERATED {

ms1000, ms3000, ms5000, ms10000, ms15000,

ms20000, ms30000},

n311-r13 ENUMERATED {

n1, n2, n3, n4, n5, n6, n8, n10},

...,

[[ t311-v1350 ENUMERATED {

ms40000, ms60000, ms90000, ms120000}

OPTIONAL -- Need OR

]],

[[ t301-v1530 ENUMERATED {

ms80000, ms100000, ms120000}

OPTIONAL, -- Cond TDD

t311-v1530 ENUMERATED {

ms160000, ms200000}

OPTIONAL -- Cond TDD

]]

}

}

-- ASN1STOP

| *RLF-TimersAndConstants-NB* field descriptions |
| --- |
| ***n3xy***  Constants are described in clause 7.4. n1 corresponds with 1, n2 corresponds with 2 and so on. |
| ***t3xy***  Timers are described in clause 7.3. Value ms0 corresponds with 0 ms, ms200 corresponds with 200 ms and so on. The UE shall use the extended values *t311-v1350*, *t301-v1530* and *t311-v1530*, if present, and ignore the value signaled by *t311-r13*, *t301-r13* and *t311-r13* respectively. |

|  |  |
| --- | --- |
| Conditional presence | Explanation |
| *TDD* | The field is optionally present, Need OR, in TDD mode. Otherwise, the field is not present. |

#### – *SchedulingRequestConfig-NB*

The IE *SchedulingRequestConfig-NB* is used to specify the Scheduling Request related parameters.

*SchedulingRequestConfig-NB* information element

-- ASN1START

SchedulingRequestConfig-NB-r15 ::= SEQUENCE {

sr-WithHARQ-ACK-Config-r15 ENUMERATED {true} OPTIONAL,

sr-WithoutHARQ-ACK-Config-r15 SR-WithoutHARQ-ACK-Config-NB-r15 OPTIONAL, -- Need ON

sr-SPS-BSR-Config-r15 SR-SPS-BSR-Config-NB-r15 OPTIONAL, -- Need ON

...,

[[ sr-WithoutHARQ-ACK-Config-v1700 SR-WithoutHARQ-ACK-Config-NB-v1700 OPTIONAL -- Need ON

]]

}

SR-WithoutHARQ-ACK-Config-NB-r15 ::= CHOICE {

release NULL,

setup SEQUENCE {

sr-ProhibitTimer-r15 INTEGER (0..7) OPTIONAL, -- Need ON

sr-NPRACH-Resource-r15 SR-NPRACH-Resource-NB-r15 OPTIONAL -- Need ON

}

}

SR-WithoutHARQ-ACK-Config-NB-v1700 ::= SEQUENCE {

sr-ProhibitTimerOffset-r17 SetupRelease {SR-ProhibitTimerOffset-NB-r17} OPTIONAL -- Need ON

}

SR-NPRACH-Resource-NB-r15 ::= SEQUENCE {

nprach-CarrierIndex-r15 INTEGER (0..maxNonAnchorCarriers-NB-r14),

nprach-ResourceIndex-r15 INTEGER (1..maxNPRACH-Resources-NB-r13),

nprach-SubCarrierIndex-r15 CHOICE {

nprach-Fmt0Fmt1-r15 INTEGER (0..47),

nprach-Fmt2-r15 INTEGER (0..143)

},

p0-SR-r15 INTEGER (-126..24),

alpha-r15 ENUMERATED {al0, al04, al05, al06, al07, al08, al09, al1}}

SR-SPS-BSR-Config-NB-r15 ::= CHOICE {

release NULL,

setup SEQUENCE {

semiPersistSchedC-RNTI-r15 C-RNTI,

semiPersistSchedIntervalUL-r15 ENUMERATED {sf128, sf256, sf512, sf1024,

sf1280, sf2048, sf2560, sf5120}

}

}

SR-ProhibitTimerOffset-NB-r17 ::= ENUMERATED {

ms90, ms180, ms270, ms360, ms450, ms540, ms1080, spare}

-- ASN1STOP

| ***SchedulingRequestConfig-NB* field descriptions** |
| --- |
| ***alpha***  Parameter: *αc*. Fractional power control parameter for SR without HARQ-ACK. See TS 36.213 [23], clause 16.2.1.2.1, where value *al0* corresponds to 0, value *al04* corresponds to 0.4, value *al05* to 0.5, value *al06* to 0.6, value *al07* to 0.7, value *al08* to 0.8, value *al09* to 0.9 and value *al1* corresponds to 1. |
| ***nprach-CarrierIndex***  Index of the carrier in the list of UL non anchor carriers in *SystemInformationBlockType22-NB*. The first entry in the list has index '1', the second entry has index '2' and so on. Value '0' indicates the anchor carrier. |
| ***nprach-ResourceIndex***  Index of the NPRACH resource in the list of NPRACH resources in *NPRACH-ParametersList* or *NPRACH-ParametersList-Fmt2* for the UL carrier indicated by *nprach-CarrierIndex*. The first entry in the list has index '1', the second entry has index '2' and so on.  E-UTRAN configures a NPRACH resource in *NPRACH-ParametersList-Fmt2* only to UEs that have reported support of NPRACH resource Format2. |
| ***nprach-SubCarrierIndex***  Index of the subcarrier in the NPRACH resource in *NPRACH-ParametersList* or or *NPRACH-ParametersList-Fmt2* for the indicated UL carrier.  E-UTRAN does not configure *nprach-SubcarrierIndex* to a smaller value than *nprach-SubcarrierOffset* + *nprach-NumCBRA-StartSubcarriers* for the indicated NPRACH resource. |
| ***p0-SR***  Parameter:. Target power for SR without HARQ-ACK. See TS 36.213 [23], clause 16.2.1.2.1, unit dBm. |
| ***semiPersistSchedC-RNTI***  Semi-persistent Scheduling C-RNTI, see TS 36.321 [6]. |
| ***semiPersistSchedIntervalUL***  Semi-persistent scheduling interval in uplink, see TS 36.321 [6]. Value in number of sub-frames. Value *sf128* corresponds to 128 sub-frames, value *sf256* corresponds to 256 sub-frames and so on. |
| ***sr-NPRACH-Resource***  NPRACH resource for physical layer SR without HARQ-ACK, see TS 36.211 [21] and TS 36.213 [23]. |
| ***sr-ProhibitTimer***  Timer for SR transmission on the NPRACH resource for SR in TS 36.321 [6]. Value in number of SR period, where the SR period is equal to the field *nprach-Periodicity* of the NPRACH resource. Value 0 means that behaviour as specified in 7.3.2 applies. Value 1 corresponds to one SR period, Value 2 corresponds to 2\*SR period and so on.  If *sr-ProhibitTimerOffset* is present, actual value of *sr-ProhibitTimer* = CEIL (*sr-ProhibitTimerOffset*/ SR period) + signalled value of *sr-ProhibitTimer*. |
| ***sr-ProhibitTimerOffset***  Time offset for SR transmission on the NPRACH resource for SR in TS 36.321 [6]. Value in milliseconds. Value *ms90* corresponds to 90 ms, value *ms180* corresponds to 180 ms and so on. |
| ***sr-WithHARQ-ACK-Config***  Activation of physical layer SR with HARQ ACK, see TS 36.213 [23]. |
| ***sr-WithoutHARQ-ACK-Config***  Activation of physical layer SR without HARQ ACK, see TS 36.211 [21] and TS 36.213 [23].  E-UTRAN cannot configure *sr-WithoutHARQ-ACK-Config* together with *sr-SPS-BSR-Config*. |

#### *– TDD-Config-NB*

The IE *TDD-Config-NB* is used to specify the TDD specific physical channel configuration.

***TDD-Config* information element**

-- ASN1START

TDD-Config-NB-r15 ::= SEQUENCE {

subframeAssignment-r15 ENUMERATED {

sa1, sa2, sa3, sa4, sa5},

specialSubframePatterns-r15 ENUMERATED {

ssp0, ssp1, ssp2, ssp3, ssp4, ssp5, ssp6, ssp7,

ssp8, ssp9, ssp10, ssp10-CRS-LessDwPTS}

}

-- ASN1STOP

| *TDD-Config* field descriptions |
| --- |
| ***specialSubframePatterns***  Indicates Configuration as in TS 36.211 [21], table 4.2-1 where ssp0 points to Configuration 0, ssp1 to Configuration 1 etc. Value *ssp10-CRS-LessDwPTS* corresponds to ssp10 without CRS transmission on the 5th symbol of DwPTS. |
| ***subframeAssignment***  Indicates DL/UL subframe configuration where *sa1* points to Configuration1, *sa2* to Configuration 2 and so on, as specified in TS 36.211 [21], table 4.2-2.  E-UTRAN configures the same value for serving cells residing on same frequency band. |

#### *– TDD-UL-DL-AlignmentOffset-NB*

The IE *TDD-UL-DL-AlignmentOffset-NB* is used to specify the offset between the UL carrier frequency center with respect to DL carrier frequency center. This information should be used to calculate the Mul value, see TS 36.101 [42].

***TDD-UL-DL-AlignmentOffset-NB* information element**

-- ASN1START

TDD-UL-DL-AlignmentOffset-NB-r15 ::= ENUMERATED { khz-7dot5, khz0, khz7dot5}

-- ASN1STOP

#### – *UplinkPowerControl-NB*

The IE *UplinkPowerControlCommon-NB* and IE *UplinkPowerControlDedicated-NB* are used to specify parameters for uplink power control in the system information and in the dedicated signalling, respectively.

*UplinkPowerControl-NB* information elements

-- ASN1START

UplinkPowerControlCommon-NB-r13 ::= SEQUENCE {

p0-NominalNPUSCH-r13 INTEGER (-126..24),

alpha-r13 ENUMERATED {al0, al04, al05, al06, al07, al08, al09, al1},

deltaPreambleMsg3-r13 INTEGER (-1..6)

}

UplinkPowerControlDedicated-NB-r13 ::= SEQUENCE {

p0-UE-NPUSCH-r13 INTEGER (-8..7)

}

UplinkPowerControlDedicated-NB-v1700 ::= SEQUENCE {

deltaMCS-Enabled-r17 ENUMERATED {en0, en1}

}

-- ASN1STOP

| *UplinkPowerControl-NB* field descriptions |
| --- |
| ***alpha***  Parameter: *αc*(1). See TS 36.213 [23], clause 16.2.1.1, where al0 corresponds to 0, al04 corresponds to value 0.4, al05 to 0.5, al06 to 0.6, al07 to 0.7, al08 to 0.8, al09 to 0.9 and al1 corresponds to 1. |
| ***deltaMCS-Enabled***  Parameter: *KS*. See TS 36.213 [23], clause 16.2.1.1.1. Value *en0* corresponds to value 0 corresponding to state "disabled" and value *en1* corresponds to value 1.25 corresponding to state "enabled". |
| ***deltaPreambleMsg3***  Parameter: . See TS 36.213 [23], clause 16.2.1.1. Actual value = IE value \* 2 [dB]. |
| ***p0-NominalNPUSCH***  Parameter: . See TS 36.213 [23], clause 16.2.1.1, unit dBm. |
| ***p0-UE-NPUSCH***  Parameter: . See TS 36.213 [23], clause 16.2.1.1, unit dB. |

#### *– WUS-Config-NB*

The IE *WUS-Config-NB* is used to specify the WUS configuration. For UEs supporting WUS, E-UTRAN uses WUS to indicate that the UE shall attempt to receive paging in that cell, see TS 36.304 [4].

*WUS-Config-NB information element*

-- ASN1START

WUS-Config-NB-r15 ::= SEQUENCE {

maxDurationFactor-r15 WUS-MaxDurationFactor-NB-r15,

numPOs-r15 ENUMERATED {n1, n2, n4} DEFAULT n1,

numDRX-CyclesRelaxed-r15 ENUMERATED {n1, n2, n4, n8},

timeOffsetDRX-r15 ENUMERATED {ms40, ms80, ms160, ms240},

timeOffset-eDRX-Short-r15 ENUMERATED {ms40, ms80, ms160, ms240},

timeOffset-eDRX-Long-r15 ENUMERATED {ms1000, ms2000} OPTIONAL, -- Need OP

...

}

WUS-ConfigPerCarrier-NB-r15 ::= SEQUENCE {

maxDurationFactor-r15 WUS-MaxDurationFactor-NB-r15

}

WUS-MaxDurationFactor-NB-r15 ::= ENUMERATED {one128th, one64th, one32th, one16th,

oneEighth, oneQuarter, oneHalf}

-- ASN1STOP

| *WUS-Config-NB* field descriptions |
| --- |
| ***maxDurationFactor***  Maximum WUS duration, expressed as a ratio of Rmax for Type 1-CSS. Value *one128th* means Rmax \* 1/128, value *one64th* means Rmax \* 1/64 and so on.  The value in TS 36.213 [23] considered by the UE is : maxDuration = Max (signalled value \* Rmax, 1) where Rmax is the value of *npdcch-NumRepetitionPaging* for the carrier. |
| ***numDRX-CyclesRelaxed***  Maximum number of consecutive DRX cycles during which the UE may use WUS for synchronisation and skip serving cell measurements, see TS 36.133 [16]. Value n1 corresponds to 1 DRX cycle, value n2 corresponds to 2 DRX cycles and so on. |
| ***numPOs***  Number of consecutive Paging Occasions (PO) mapped to one Wake Up Signal (WUS), applicable to UEs configured to use extended DRX, see TS 36.304 [4]. Value n1 corresponds to 1 PO and value n2 corresponds to 2 POs and so on. |
| ***timeOffsetDRX***  When DRX is used, non-zero gap from the end of the configured maximum WUS duration to the associated PO, see TS 36.304 [4], clause 7.4 and TS 36.211 [21]. In milliseconds. Value *ms40* corresponds to 40ms, value *ms80* corresponds to 80 ms and so on. |
| ***timeOffset-eDRX-Short***  When eDRX is used, the short non-zero gap from the end of the configured maximum WUS duration to the associated PO, see TS 36.304 [4], clause 7.4 and TS 36.211 [21]. In milliseconds. Value *ms40* corresponds to 40ms, value *ms80* corresponds to 80 ms and so on.  E-UTRAN configures *timeOffset-eDRX-Short* to a value longer than or equal to *timeOffsetDRX*. |
| ***timeOffset-eDRX-Long***  When eDRX is used, the long non-zero gap from the end of the configured maximum WUS duration to the associated PO, see TS 36.304 [4], clause 7.4 and TS 36.211 [21]. In milliseconds. Value *ms1000* corresponds to 1000 ms, value *ms2000* corresponds to 2000 ms. |

#### 6.7.3.3 NB-IoT Security control information elements

Void

#### 6.7.3.4 NB-IoT Mobility control information elements

#### – *AdditionalBandInfoList-NB*

*AdditionalBandInfoList-NB information element*

-- ASN1START

AdditionalBandInfoList-NB-r14 ::= SEQUENCE (SIZE (1..maxMultiBands)) OF FreqBandIndicator-NB-r13

-- ASN1STOP

#### – *FreqBandIndicator-NB*

The IE *FreqBandIndicator-NB* indicates the E-UTRA operating band as defined in TS 36.101 [42], table 5.5-1 and TS 36.102 [113], table 5.2-1 for NTN capable UE.

*FreqBandIndicator-NB information element*

-- ASN1START

FreqBandIndicator-NB-r13 ::= INTEGER (1.. maxFBI2)

-- ASN1STOP

#### – *MultiBandInfoList-NB*

*MultiBandInfoList-NB information element*

-- ASN1START

MultiBandInfoList-NB-r13 ::= SEQUENCE (SIZE (1..maxMultiBands)) OF MultiBandInfo-NB-r13

MultiBandInfo-NB-r13 ::= SEQUENCE {

freqBandIndicator-r13 FreqBandIndicator-NB-r13 OPTIONAL, -- Need OR

freqBandInfo-r13 NS-PmaxList-NB-r13 OPTIONAL -- Need OR

}

-- ASN1STOP

#### *– NS-PmaxList-NB*

The IE *NS-PmaxList-NB* concerns a list of *additionalPmax* and *additionalSpectrumEmission* as defined in TS 36.101 [42], clause 6.2.4F and TS 36.102 [113], clause 6.2B.3 for NTN capable UE, for a given frequency band. E-UTRAN does not include the same value of *additionalSpectrumEmission* in *SystemInformationBlockType2-NB* within this list.

*NS-PmaxList-NB* information element

-- ASN1START

NS-PmaxList-NB-r13 ::= SEQUENCE (SIZE (1..maxNS-Pmax-NB-r13)) OF NS-PmaxValue-NB-r13

NS-PmaxValue-NB-r13 ::= SEQUENCE {

additionalPmax-r13 P-Max OPTIONAL, -- Need OR

additionalSpectrumEmission-r13 AdditionalSpectrumEmission

}

-- ASN1STOP

#### *– ReselectionThreshold-NB*

The IE *ReselectionThreshold-NB* is used to indicate an Rx level threshold for cell reselection. Actual value of threshold = field value \* 2 [dB].

***ReselectionThreshold-NB* information element**

-- ASN1START

ReselectionThreshold-NB-v1360 ::= INTEGER (32..63)

-- ASN1STOP

#### – *T-Reselection-NB*

The IE *T-Reselection-NB* concerns the cell reselection timer TreselectionRAT for NB-IoT.

Value in seconds. s0 means 0 second and behaviour as specified in 7.3.2 applies, s3 means 3 seconds and so on.

*T-Reselection-NB information element*

-- ASN1START

T-Reselection-NB-r13 ::= ENUMERATED {s0, s3, s6, s9, s12, s15, s18, s21}

-- ASN1STOP

#### 6.7.3.5 NB-IoT Measurement information elements

#### – *ANR-MeasConfig-NB*

The IE *ANR-MeasConfig-NB* is used to convey the configuration of the measurements to be performed by the UE in RRC\_IDLE for ANR.

*ANR-MeasConfig-NB* information element

-- ASN1START

ANR-MeasConfig-NB-r16 ::= SEQUENCE {

anr-QualityThreshold-r16 NRSRP-Range-NB-r14,

anr-CarrierList-r16 ANR-CarrierList-NB-r16,

...

}

ANR-CarrierList-NB-r16 ::= SEQUENCE (SIZE (1..maxFreqANR-NB-r16)) OF ANR-Carrier-NB-r16

ANR-Carrier-NB-r16::= SEQUENCE {

carrierFreqIndex-r16 INTEGER (1..maxFreq),

excludedCellList-r16 ANR-ExcludedCellList-NB-r16 OPTIONAL, -- Need OP

...

}

ANR-ExcludedCellList-NB-r16 ::= SEQUENCE (SIZE (1..maxExcludedCell)) OF PhysCellId

-- ASN1STOP

| *ANR-MeasConfig-NB* field descriptions |
| --- |
| ***anr-CarrierList***  List of NB-IoT carriers to be measured for ANR. |
| ***anr-QualityThreshold***  Indicates the quality threshold for reporting the CGI of the strongest cell. |
| ***carrierFreqIndex***  Index of the carrier frequency in *interFreqCarrierFreqList* in *SystemInformationBlockType5-NB*. |
| ***excludedCellList***  List of exclude-listed neighbouring cells for ANR reporting. |

#### – *ANR-MeasReport-NB*

The IE *ANR-MeasReport-NB* includes the ANR measurements information.

*ANR-MeasReport-NB* information element

-- ASN1START

ANR-MeasReport-NB-r16 ::= SEQUENCE {

servCellIdentity-r16 CellGlobalIdEUTRA OPTIONAL,

measResultServCell-r16 MeasResultServCell-NB-r14,

relativeTimeStamp-r16 INTEGER (0..95),

measResultList-r16 SEQUENCE (SIZE (1..maxFreqANR-NB-r16)) OF ANR-MeasResult-NB-r16,

...

}

ANR-MeasResult-NB-r16 ::= SEQUENCE {

carrierFreq-r16 CarrierFreq-NB-r13,

physCellId-r16 PhysCellId OPTIONAL,

measResultLastServCell-r16 MeasResultServCell-NB-r14,

measResult-r16 NRSRP-Range-NB-r14 OPTIONAL,

cgi-Info-r16 SEQUENCE {

cellGlobalId-r16 CellGlobalIdEUTRA,

trackingAreaCode-r16 TrackingAreaCode,

plmn-IdentityList-r16 PLMN-IdentityList2 OPTIONAL

} OPTIONAL

}

-- ASN1STOP

| *ANR-MeasReport-NB* field descriptions |
| --- |
| ***carrierFreq***  Indicates the carrier frequency of the reported cell. |
| ***cgi-info***  Broadcast information of the reported cell. |
| ***measResult***  Measured result of the reported cell. |
| ***measResultList***  List of measured results for the maximum number of reported carrier frequencies. |
| ***measResultLastServCell***  The last measurement results taken in the serving cell when the measured results of the reported cell is stored. |
| ***measResultServingCell***  Measurement results taken in the serving cell when the configuration of the measurements is received. |
| ***plmn-IdentityList***  The list of PLMN Identity read from the broadcast information of the reported cell. |
| ***relativeTimeStamp***  Indicates the time when the ANR measurements are complete, measured relative to the time when the configuration of the measurements was received. Value in hours. |
| ***servingCellIdentity***  Indicates the cell where the measurement configuration was received.  If the field is absent, it is the same as the current serving cell. |

#### – *CQI-NPDCCH-NB*

The IE *CQI-NPDCCH-NB* represents the downlink channel quality measurement of the NB-IoT carrier where the random access response is received. The codepoints for the CQI-NPDCCH measurements are according to the mapping table in TS 36.133 [16]. The value *noMeasurements* indicates no measurement reporting.

*CQI-NPDCCH-NB* information element

-- ASN1START

CQI-NPDCCH-NB-r14 ::= ENUMERATED {

noMeasurements, candidateRep-A, candidateRep-B, candidateRep-C,

candidateRep-D, candidateRep-E, candidateRep-F, candidateRep-G,

candidateRep-H, candidateRep-I, candidateRep-J, candidateRep-K,

candidateRep-L}

-- ASN1STOP

#### – *CQI-NPDCCH-Short-NB*

The IE *CQI-NPDCCH-Short-NB* represents the short version of the downlink channel quality measurement of the NB-IoT carrier where the random access response is received. The codepoints for the CQI-NPDCCH-Short measurements are according to the mapping table in TS 36.133 [16]. The value *noMeasurements* indicates no measurement reporting.

*CQI-NPDCCH-Short-NB* information element

-- ASN1START

CQI-NPDCCH-Short-NB-r14 ::= ENUMERATED {

noMeasurements, candidateRep-1, candidateRep-2, candidateRep-3}

-- ASN1STOP

#### – *MeasResultServCell-NB*

The IE *MeasResultServCell-NB* covers the measured results for the serving cell.

*MeasResultServCell-NB* information element

-- ASN1START

MeasResultServCell-NB-r14 ::= SEQUENCE {

nrsrpResult-r14 NRSRP-Range-NB-r14,

nrsrqResult-r14 NRSRQ-Range-NB-r14

}

-- ASN1STOP

#### *– NRSRP-Range-NB*

The IE *NRSRP-Range-NB* specifies the value range used in NRSRP measurements and thresholds. Integer value for NRSRP measurements according to mapping table in TS 36.133 [16], Table 9.1.22.9-1.

***NRSRP-Range-NB* information element**

-- ASN1START

NRSRP-Range-NB-r14 ::= INTEGER(0..113)

-- ASN1STOP

#### *– NRSRQ-Range-NB*

The IE *NRSRQ-Range-NB* specifies the value range used in NRSRQ measurements and thresholds. Integer value for RSRQ measurements is according to mapping table in TS 36.133 [16], Table 9.1.22.14-1. The UE shall not report values 0 and 34.

***NRSRQ-Range-NB* information element**

-- ASN1START

NRSRQ-Range-NB-r14 ::= INTEGER(-30..46)

-- ASN1STOP

#### *– NSSS-RRM-Config-NB*

The IE *NSSS-RRM-Config-NB* provides the configuration for NSSS-based RRM measurements. See TS 36.133 [16], TS 36.211 [21] and TS 36.214 [48]. The UE only perfoms NSSS-based RRM measurement on cells for which the configuration has been provided.

*NSSS-RRM-Config-NB* information element

-- ASN1START

NSSS-RRM-Config-NB-r15 ::= SEQUENCE {

nsss-RRM-PowerOffset-r15 ENUMERATED {dB-3, db0, dB3},

nsss-NumOccDiffPrecoders-r15 ENUMERATED {n1, n2, n4, n8} OPTIONAL -- Need OP

}

-- ASN1STOP

| *NSSS-RRM-Config-NB* field descriptions |
| --- |
| ***nsss-RRM-PowerOffset***  NSSS to NRS ratio for the serving cell as specified in TS 36.214 [48]. Value in dB. Value dB-3 corresponds to -3 dB, dB0 corresponds to 0 dB and so on. |
| ***nsss-NumOccDiffPrecoders***  Number of consecutive NSSS occasions that use different precoders for NSSS transmission.See TS 36.211 [21]. Value *n1* corresponds to 1 occasion, *n2* corresponds to 2 occasions and so on.  For value *n2*, *n4*, and *n8*, UE may assume for *nsss-NumOccDiffPrecoders* consecutive NSSS occasions, E-UTRAN uses different precoders for NSSS transmission. For value *n1*, UE may assume that E-UTRAN always uses the same precoder.  If the field is absent, the UE makes no assumption on the antenna port(s) used for NSSS. |

#### 6.7.3.6 NB-IoT Other information elements

#### – *EstablishmentCause-NB*

The IE *EstablishmentCause-NB* provides the establishment cause for the RRC connection request or the RRC connection resume request as provided by the upper layers.

*EstablishmentCause-NB* informationelement

-- ASN1START

EstablishmentCause-NB-r13 ::= ENUMERATED {

mt-Access, mo-Signalling, mo-Data, mo-ExceptionData,

delayTolerantAccess-v1330, mt-EDT-v1610, spare2, spare1}

-- ASN1STOP

#### – *UE-Capability-NB*

The IE *UE-Capability-NB* is used to convey the NB-IoT UE Radio Access Capability Parameters, see TS 36.306 [5]. The IE *UE-Capability-NB* is transferred in NB-IoT only.

*UE-Capability-NB* information element

-- ASN1START

UE-Capability-NB-r13 ::= SEQUENCE {

accessStratumRelease-r13 AccessStratumRelease-NB-r13,

ue-Category-NB-r13 ENUMERATED {nb1} OPTIONAL,

multipleDRB-r13 ENUMERATED {supported} OPTIONAL,

pdcp-Parameters-r13 PDCP-Parameters-NB-r13 OPTIONAL,

phyLayerParameters-r13 PhyLayerParameters-NB-r13,

rf-Parameters-r13 RF-Parameters-NB-r13,

dummy SEQUENCE {} OPTIONAL

}

UE-Capability-NB-Ext-r14-IEs ::= SEQUENCE {

ue-Category-NB-r14 ENUMERATED {nb2} OPTIONAL,

mac-Parameters-r14 MAC-Parameters-NB-r14 OPTIONAL,

phyLayerParameters-v1430 PhyLayerParameters-NB-v1430 OPTIONAL,

rf-Parameters-v1430 RF-Parameters-NB-v1430,

nonCriticalExtension UE-Capability-NB-v1440-IEs OPTIONAL

}

UE-Capability-NB-v1440-IEs ::= SEQUENCE {

phyLayerParameters-v1440 PhyLayerParameters-NB-v1440 OPTIONAL,

nonCriticalExtension UE-Capability-NB-v14x0-IEs OPTIONAL

}

UE-Capability-NB-v14x0-IEs ::= SEQUENCE {

-- Following field is only to be used for late REL-14 extensions

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension UE-Capability-NB-v1530-IEs OPTIONAL

}

UE-Capability-NB-v1530-IEs ::= SEQUENCE {

earlyData-UP-r15 ENUMERATED {supported} OPTIONAL,

rlc-Parameters-r15 RLC-Parameters-NB-r15,

mac-Parameters-v1530 MAC-Parameters-NB-v1530,

phyLayerParameters-v1530 PhyLayerParameters-NB-v1530 OPTIONAL,

tdd-UE-Capability-r15 TDD-UE-Capability-NB-r15 OPTIONAL,

nonCriticalExtension UE-Capability-NB-v15x0-IEs OPTIONAL

}

UE-Capability-NB-v15x0-IEs ::= SEQUENCE {

-- Following field is only to be used for late REL-15 extensions

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension UE-Capability-NB-v1610-IEs OPTIONAL

}

UE-Capability-NB-v1610-IEs ::= SEQUENCE {

earlySecurityReactivation-r16 ENUMERATED {supported} OPTIONAL,

earlyData-UP-5GC-r16 ENUMERATED {supported} OPTIONAL,

pur-Parameters-r16 PUR-Parameters-NB-r16 OPTIONAL,

mac-Parameters-v1610 MAC-Parameters-NB-v1610,

phyLayerParameters-v1610 PhyLayerParameters-NB-v1610 OPTIONAL,

son-Parameters-r16 SON-Parameters-NB-r16 OPTIONAL,

measParameters-r16 MeasParameters-NB-r16,

tdd-UE-Capability-v1610 TDD-UE-Capability-NB-v1610 OPTIONAL,

nonCriticalExtension UE-Capability-NB-v16x0-IEs OPTIONAL

}

UE-Capability-NB-v16x0-IEs ::= SEQUENCE {

-- Following field is only to be used for late REL-16 extensions

lateNonCriticalExtension OCTET STRING (CONTAINING UE-EUTRA-Capability-v16f0-IEs) OPTIONAL,

nonCriticalExtension UE-Capability-NB-v1700-IEs OPTIONAL

}

-- Late non-critical extensions

UE-EUTRA-Capability-v16f0-IEs ::= SEQUENCE {

son-Parameters-v16f0 SON-Parameters-NB-v16f0,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- Regular non-critical extensions

UE-Capability-NB-v1700-IEs ::= SEQUENCE {

coverageBasedPaging-r17 ENUMERATED {supported} OPTIONAL,

phyLayerParameters-v1700 PhyLayerParameters-NB-v1700,

ntn-Parameters-r17 NTN-Parameters-NB-r17 OPTIONAL,

nonCriticalExtension UE-Capability-NB-v1710-IEs OPTIONAL

}

UE-Capability-NB-v1710-IEs ::= SEQUENCE {

measParameters-v1710 MeasParameters-NB-v1710 OPTIONAL,

rf-Parameters-v1710 RF-Parameters-NB-v1710,

tdd-UE-Capability-v1710 TDD-UE-Capability-NB-v1710,

nonCriticalExtension UE-Capability-NB-v1720-IEs OPTIONAL

}

UE-Capability-NB-v1720-IEs ::= SEQUENCE {

ntn-Parameters-v1720 NTN-Parameters-NB-v1720,

nonCriticalExtension UE-Capability-NB-v1800-IEs OPTIONAL

}

UE-Capability-NB-v1800-IEs ::= SEQUENCE {

ntn-Parameters-v1800 NTN-Parameters-NB-v1800 OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

TDD-UE-Capability-NB-r15 ::= SEQUENCE {

ue-Category-NB-r15 ENUMERATED {nb2} OPTIONAL,

phyLayerParametersRel13-r15 PhyLayerParameters-NB-r13 OPTIONAL,

phyLayerParametersRel14-r15 PhyLayerParameters-NB-v1430 OPTIONAL,

phyLayerParameters-v1530 PhyLayerParameters-NB-v1530 OPTIONAL,

...

}

TDD-UE-Capability-NB-v1610 ::= SEQUENCE {

slotSymbolResourceResvDL-r16 ENUMERATED {supported} OPTIONAL,

slotSymbolResourceResvUL-r16 ENUMERATED {supported} OPTIONAL,

subframeResourceResvDL-r16 ENUMERATED {supported} OPTIONAL,

subframeResourceResvUL-r16 ENUMERATED {supported} OPTIONAL

}

TDD-UE-Capability-NB-v1710 ::= SEQUENCE {

phyLayerParameters-v1710 PhyLayerParameters-NB-v1700 OPTIONAL

}

AccessStratumRelease-NB-r13 ::= ENUMERATED {rel13, rel14, rel15, rel16, rel17, rel18, spare2, spare1, ...}

PDCP-Parameters-NB-r13 ::= SEQUENCE {

supportedROHC-Profiles-r13 SEQUENCE {

profile0x0002 BOOLEAN,

profile0x0003 BOOLEAN,

profile0x0004 BOOLEAN,

profile0x0006 BOOLEAN,

profile0x0102 BOOLEAN,

profile0x0103 BOOLEAN,

profile0x0104 BOOLEAN

},

maxNumberROHC-ContextSessions-r13 ENUMERATED {cs2, cs4, cs8, cs12} DEFAULT cs2,

...

}

RLC-Parameters-NB-r15 ::= SEQUENCE {

rlc-UM-r15 ENUMERATED {supported} OPTIONAL

}

MAC-Parameters-NB-r14 ::= SEQUENCE {

dataInactMon-r14 ENUMERATED {supported} OPTIONAL,

rai-Support-r14 ENUMERATED {supported} OPTIONAL

}

MAC-Parameters-NB-v1530 ::= SEQUENCE {

sr-SPS-BSR-r15 ENUMERATED {supported} OPTIONAL

}

MAC-Parameters-NB-v1610 ::= SEQUENCE {

rai-SupportEnh-r16 ENUMERATED {supported} OPTIONAL

}

NTN-Parameters-NB-r17 ::= SEQUENCE {

ntn-Connectivity-EPC-r17 ENUMERATED {supported} OPTIONAL,

ntn-TA-Report-r17 ENUMERATED {supported} OPTIONAL,

ntn-PUR-TimerDelay-r17 ENUMERATED {supported} OPTIONAL,

ntn-OffsetTimingEnh-r17 ENUMERATED {supported} OPTIONAL,

ntn-ScenarioSupport-r17 ENUMERATED {ngso,gso} OPTIONAL

}

NTN-Parameters-NB-v1720 ::= SEQUENCE {

ntn-SegmentedPrecompensationGaps-r17 ENUMERATED {sym1,sl1,sl2} OPTIONAL

}

NTN-Parameters-NB-v1800 ::= SEQUENCE {

ntn-LocationBasedMeasTrigger-EFC-r18 ENUMERATED {supported} OPTIONAL,

ntn-LocationBasedMeasTrigger-EMC-r18 ENUMERATED {supported} OPTIONAL,

ntn-TimeBasedMeasTrigger-r18 ENUMERATED {supported} OPTIONAL,

ntn-RRC-HarqDisableSingleTB-r18 ENUMERATED {supported} OPTIONAL,

ntn-OverriddenHarqDisableSingleTB-r18 ENUMERATED {supported} OPTIONAL,

ntn-DCI-HarqDisableSingleTB-r18 ENUMERATED {supported} OPTIONAL,

ntn-RRC-HarqDisableMultiTB-r18 ENUMERATED {supported} OPTIONAL,

ntn-OverriddenHarqDisableMultiTB-r18 ENUMERATED {supported} OPTIONAL,

ntn-DCI-HarqDisableMultiTB-r18 ENUMERATED {supported} OPTIONAL,

ntn-UplinkHarq-ModeB-SingleTB-r18 ENUMERATED {supported} OPTIONAL,

ntn-UplinkHarq-ModeB-MultiTB-r18 ENUMERATED {supported} OPTIONAL,

ntn-HarqEnhScenarioSupport-r18 ENUMERATED {ngso,gso} OPTIONAL,

ntn-Triggered-GNSS-Fix-r18 ENUMERATED {supported} OPTIONAL,

ntn-Autonomous-GNSS-Fix-r18 ENUMERATED {supported} OPTIONAL,

ntn-UplinkTxExtension-r18 ENUMERATED {supported} OPTIONAL,

ntn-GNSS-EnhScenarioSupport-r18 ENUMERATED {ngso,gso} OPTIONAL

}

MeasParameters-NB-r16 ::= SEQUENCE {

dl-ChannelQualityReporting-r16 ENUMERATED {supported} OPTIONAL

}

MeasParameters-NB-v1710 ::= SEQUENCE {

connModeMeasIntraFreq-r17 ENUMERATED {supported} OPTIONAL,

connModeMeasInterFreq-r17 ENUMERATED {supported} OPTIONAL

}

PhyLayerParameters-NB-r13 ::= SEQUENCE {

multiTone-r13 ENUMERATED {supported} OPTIONAL,

multiCarrier-r13 ENUMERATED {supported} OPTIONAL

}

PhyLayerParameters-NB-v1430 ::= SEQUENCE {

multiCarrier-NPRACH-r14 ENUMERATED {supported} OPTIONAL,

twoHARQ-Processes-r14 ENUMERATED {supported} OPTIONAL

}

PhyLayerParameters-NB-v1440 ::= SEQUENCE {

interferenceRandomisation-r14 ENUMERATED {supported} OPTIONAL

}

PhyLayerParameters-NB-v1530 ::= SEQUENCE {

mixedOperationMode-r15 ENUMERATED {supported} OPTIONAL,

sr-WithHARQ-ACK-r15 ENUMERATED {supported} OPTIONAL,

sr-WithoutHARQ-ACK-r15 ENUMERATED {supported} OPTIONAL,

nprach-Format2-r15 ENUMERATED {supported} OPTIONAL,

additionalTransmissionSIB1-r15 ENUMERATED {supported} OPTIONAL,

npusch-3dot75kHz-SCS-TDD-r15 ENUMERATED {supported} OPTIONAL

}

PhyLayerParameters-NB-v1610 ::= SEQUENCE {

npdsch-MultiTB-r16 ENUMERATED {supported} OPTIONAL,

npdsch-MultiTB-Interleaving-r16 ENUMERATED {supported} OPTIONAL,

npusch-MultiTB-r16 ENUMERATED {supported} OPTIONAL,

npusch-MultiTB-Interleaving-r16 ENUMERATED {supported} OPTIONAL,

multiTB-HARQ-AckBundling-r16 ENUMERATED {supported} OPTIONAL,

slotSymbolResourceResvDL-r16 ENUMERATED {supported} OPTIONAL,

slotSymbolResourceResvUL-r16 ENUMERATED {supported} OPTIONAL,

subframeResourceResvDL-r16 ENUMERATED {supported} OPTIONAL,

subframeResourceResvUL-r16 ENUMERATED {supported} OPTIONAL

}

PUR-Parameters-NB-r16 ::= SEQUENCE {

pur-CP-EPC-r16 ENUMERATED {supported} OPTIONAL,

pur-CP-5GC-r16 ENUMERATED {supported} OPTIONAL,

pur-UP-EPC-r16 ENUMERATED {supported} OPTIONAL,

pur-UP-5GC-r16 ENUMERATED {supported} OPTIONAL,

pur-NRSRP-Validation-r16 ENUMERATED {supported} OPTIONAL,

pur-CP-L1Ack-r16 ENUMERATED {supported} OPTIONAL

}

PhyLayerParameters-NB-v1700 ::= SEQUENCE {

npdsch-16QAM-r17 ENUMERATED {supported} OPTIONAL

}

RF-Parameters-NB-r13 ::= SEQUENCE {

supportedBandList-r13 SupportedBandList-NB-r13,

multiNS-Pmax-r13 ENUMERATED {supported} OPTIONAL

}

RF-Parameters-NB-v1430 ::= SEQUENCE {

powerClassNB-14dBm-r14 ENUMERATED {supported} OPTIONAL

}

RF-Parameters-NB-v1710 ::= SEQUENCE {

supportedBandList-v1710 SupportedBandList-NB-v1710 OPTIONAL

}

SupportedBandList-NB-r13 ::= SEQUENCE (SIZE (1..maxBands)) OF SupportedBand-NB-r13

SupportedBandList-NB-v1710 ::= SEQUENCE (SIZE (1..maxBands)) OF SupportedBand-NB-v1710

SupportedBand-NB-r13 ::= SEQUENCE {

band-r13 FreqBandIndicator-NB-r13,

powerClassNB-20dBm-r13 ENUMERATED {supported} OPTIONAL

}

SupportedBand-NB-v1710 ::= SEQUENCE {

npusch-16QAM-r17 ENUMERATED {supported} OPTIONAL

}

SON-Parameters-NB-r16 ::= SEQUENCE {

anr-Report-r16 ENUMERATED {supported} OPTIONAL,

rach-Report-r16 ENUMERATED {supported} OPTIONAL

}

SON-Parameters-NB-v16f0 ::= SEQUENCE {

locationInfo-r16 ENUMERATED {supported} OPTIONAL

}

-- ASN1STOP

| *UE-Capability-NB* field descriptions | *FDD/TDD appl* | *FDD/TDD diff* |
| --- | --- | --- |
| ***accessStratumRelease***  This field indicates the release supported by the UE. | FDD/TDD | No |
| ***additionalTransmissionSIB1***  Indicates whether the UE supports additional SIB1 transmission as specified in TS 36.213 [23]. | FDD | - |
| ***anr-Report***  Indicates whether the UE supports ANR measurements in RRC\_IDLE. | FDD/TDD | No |
| ***connModeMeasIntraFreq, connModeMeasInterFreq***  Indicates whether the UE in RRC\_CONNECTED supports neighbour cell measurements. | FDD/TDD | No |
| ***coverageBasedPaging***  Indicates whether the UE in RRC\_IDLE supports coverage based paging carrier selection as defined in TS 36.304 [4]. | FDD/TDD | No |
| ***dataInactMon***  Indicates whether the UE supports the data inactivity monitoring as specified in TS 36.321 [6]. | FDD/TDD | No |
| ***dl-ChannelQualityReporting-r16***  Indicates whether the UE supports DL channel quality reporting in connected mode as specified in TS 36.321 [6]. | FDD | - |
| ***dummy***  This field is not used in the specification. It shall not be sent by the UE. | NA | NA |
| ***earlyData-UP, earlyData-UP-5GC***  Indicates whether the UE supports EDT for User plane CIoT EPS/5GS optimisations, as defined in TS 24.301 [35] and TS 24.501 [95] respectively. | FDD | - |
| ***earlySecurityReactivation***  Indicates whether the UE supports early security reactivation when resuming a suspended RRC connection. | FDD/TDD | No |
| ***interferenceRandomisation***  For FDD: Indicates whether the UE supports interference randomisation in connected mode as defined in TS.36.211 [21]. | FDD | - |
| ***locationInfo***  Indicates whether the UE supports reporting of *locationInfo* in RLF report. | FDD/TDD | No |
| ***maxNumberROHC-ContextSessions***  Set to the maximum number of concurrently active ROHC contexts supported by the UE, excluding context sessions that leave all headers uncompressed. cs2 corresponds with 2 (context sessions), cs4 corresponds with 4 and so on. The network ignores this field if the UE supports none of the ROHC profiles in *supportedROHC-Profiles*. | FDD/TDD | No |
| ***mixedOperationMode***  Defines whether the UE supports multi-carrier operation with mixed operation mode, standalone or inband/guardband, between the anchor carrier and the non-anchor carrier for unicast, paging, and random access as specified in TS 36.300 [9]. | FDD | - |
| ***multiCarrier***  Defines whether the UE supports multi -carrier operation. | FDD/TDD | Yes |
| ***multicarrier-NPRACH***  Defines whether the UE supports NPRACH on non-anchor carrier as specified in TS 36.321 [6]. | FDD/TDD | Yes |
| ***multipleDRB***  Defines whether the UE supports multiple DRBs. | FDD/TDD | No |
| ***multiNS-Pmax***  Defines whether the UE supports the mechanisms defined for NB-IoT cells broadcasting *NS-PmaxList-NB*. | FDD/TDD | No |
| ***multiTB-HARQ-AckBundling***  Indicates whether the UE supports HARQ ACK bundling for interleaved transmission for DL.  If *multiTB-HARQ-AckBundling* is included, the UE shall also indicate support for *npdsch-MultiTB-Interleaving*. | FDD | - |
| ***multiTone***  Defines whether the UE supports UL multi-tone transmissions on NPUSCH. | FDD/TDD | Yes |
| ***npdsch-16QAM***  Indicates whether the UE supports 16QAM for DL unicast as defined in TS 36.213 [23]. | FDD/TDD | Yes |
| ***npdsch-MultiTB***  Indicates whether the UE supports multiple TBs scheduling in RRC\_CONNECTED for DL.  If *npdsch-MultiTB* is included, the UE shall also indicate support for *twoHARQ-Processes*. | FDD | - |
| ***npdsch-MultiTB-Interleaving***  Indicates whether the UE supports interleaved transmission when multiple TBs is scheduled in RRC\_CONNECTED for DL. | FDD | - |
| ***nprach-Format2***  Defines whether the UE supports NPRACH resources using preamble format 2. | FDD | - |
| ***npusch-16QAM***  Indicates whether the UE supports 16QAM for UL unicast on the band as defined in TS 36.213 [23]. | FDD/TDD | No |
| ***npusch-3dot75kHz-SCS-TDD***  Indicates whether the UE supports NPUSCH with 3.75kHz SCS for TDD. | TDD | - |
| ***npusch-MultiTB***  Indicates whether the UE supports multiple TBs scheduling in RRC\_CONNECTED for UL.  If *npusch-MultiTB* is included, the UE shall also indicate support for *twoHARQ-Processes*. | FDD | - |
| ***npusch-MultiTB-Interleaving***  Indicates whether the UE supports interleaved transmission when multiple TBs is scheduled in RRC\_CONNECTED for UL. | FDD | - |
| ***ntn-Autonomous-GNSS-Fix***  This field indicates whether the UE supports autonomous GNSS position fix in RRC\_CONNECTED. | FDD | - |
| ***ntn-Connectivity-EPC***  Indicates whether the UE supports NTN access when connected to EPC. If the UE indicates this capability, the UE shall support all NTN essential features as specified in TS 36.306 [5]. | FDD | - |
| ***ntn-DCI-HarqDisableMultiTB***  This field indicates whether the UE supports DCI-based HARQ feedback disabling for downlink transmission when HARQ feedback disabling per HARQ process for downlink transmission is not configured by RRC and when configured with *npdsch-MultiTB-Config*. | FDD | - |
| ***ntn-DCI-HarqDisableSingleTB***  This field indicates whether the UE supports DCI-based HARQ feedback disabling for downlink transmission when HARQ feedback disabling per HARQ process for downlink transmission is not configured by RRC. | FDD | - |
| ***ntn-GNSS-EnhScenarioSupport***  This field indicates whether the UE supports GNSS measurement and UL transmission extension enhancements in RRC\_CONNECTED for only GSO or NGSO scenario. If this field is not included, the GNSS measurement and UL transmission extension enhancements in RRC\_CONNECTED that are indicated as supported are applicable for both GSO and NGSO scenario. | FDD | - |
| ***ntn-HarqEnhScenarioSupport***  This field indicates whether the UE supports UL and DL HARQ process enhancements for only GSO or NGSO scenario. If this field is not included, the UL and DL HARQ process enhancements that are indicated as supported are applicable for both GSO and NGSO scenario. | FDD | - |
| ***ntn-LocationBasedMeasTrigger-EFC***  This field indicates whether the UE supports location-based measurement trigger in RRC\_CONNECTED in earth fixed cell. | FDD | - |
| ***ntn-LocationBasedMeasTrigger-EMC***  This field indicates whether the UE supports location-based measurement trigger in RRC\_CONNECTED in earth moving cell. | FDD | - |
| ***ntn-OffsetTimingEnh***  Indicates whether the UE supports timing relationship enhancement using *Differential Koffset* as specified in TS 36.321 [6] and TS 36.213 [23]. | FDD | - |
| ***ntn-OverriddenHarqDisableMultiTB***  This field indicates whether the UE supports DCI-based HARQ feedback disabling for downlink transmission by overriding the RRC configuration when configured with *npdsch-MultiTB-Config*. | FDD | - |
| ***ntn-OverriddenHarqDisableSingleTB***  This field indicates whether the UE supports DCI-based HARQ feedback disabling for downlink transmission by overriding the RRC configuration. | FDD | - |
| ***ntn-PUR-TimerDelay***  Indicates whether the UE supports delaying the start of the *pur-ResponseWindowTimer* for NTN, see TS 36.321 [6]. | FDD |  |
| ***ntn-RRC-HarqDisableMultiTB***  This field indicates whether the UE supports HARQ feedback disabling per HARQ process for downlink transmission by RRC configuration when configured with *npdsch-MultiTB-Config*. | FDD | - |
| ***ntn-RRC-HarqDisableSingleTB***  This field indicates whether the UE supports HARQ feedback disabling per HARQ process for downlink transmission by RRC configuration. | FDD | - |
| ***ntn-SegmentedPrecompensationGaps***  Indicates the minimum supported gap length between segments for segmented uplink transmission. Value *sym1* corresponds to 1 symbol, value *sl1* corresponds to 1 slot, value *sl2* corresponds to 2 slots. | FDD | - |
| ***ntn-ScenarioSupport***  Indicates whether the UE supports NTN features for only GSO or NGSO scenario. If a UE does not include this field but includes *ntn-Connectivity-EPC-r17*, the UE supports the NTN features for both GSO and NGSO scenarios. | FDD | - |
| ***ntn-TA-report***  Indicates whether the UE supports timing advance reporting in RRC\_CONNECTED, see TS 36.321 [6]. | FDD | - |
| ***ntn-TimeBasedMeasTrigger***  This field indicates whether the UE supports time-based measurement trigger in RRC\_CONNECTED. | FDD | - |
| ***ntn-Triggered-GNSS-Fix***  This field indicates whether the UE supports network triggered GNSS position fix in RRC\_CONNECTED. | FDD | - |
| ***ntn-UplinkHarq-ModeB-MultiTB***  This field indicates whether the UE supports HARQ Mode B when scheduled with uplink transmission of multiple TBs. | FDD | - |
| ***ntn-UplinkHarq-ModeB-SingleTB***  This field indicates whether the UE supports HARQ Mode B. | FDD | - |
| ***ntn-UplinkTxExtension***  This field indicates whether the UE supports to perform UL transmission in a duration after original GNSS validity duration expires without GNSS re-acquisition. | FDD | - |
| ***powerClassNB-14dBm***  Defines whether the UE supports power class 14dBm in all the bands supported by the UE as specified in TS 36.101 [42].  If *powerClassNB-20dBm* is included, the UE shall not include the field *powerClassNB-14dBm*. | FDD/TDD | No |
| ***powerClassNB-20dBm***  Defines whether the UE supports power class 20dBm in NB-IoT for the band, as specified in TS 36.101 [42] and TS 36.102 [113] for NTN capable UE. If neither *powerClassNB-14dBm* nor *powerClassNB-20dBm* is included, UE supports power class 23 dBm in the NB-IoT band. | FDD/TDD | No |
| ***pur-CP-EPC*, *pur-CP-5GC***  Indicates whether the UE supports transmission using PUR for Control plane CIoT EPS/5GS optimisations, as defined in TS 24.301 [35] and TS 24.501 [95] respectively. | FDD | - |
| ***pur-CP-L1Ack***  Indicates whether UE supports L1 acknowledgement in response to CP transmission using PUR.  If *pur-CP-L1Ack* is included, the UE shall also indicate support for *pur-CP-EPC* or *pur-CP-5GC*. | FDD | - |
| ***pur-NRSRP-Validation***  Indicates whether UE supports serving cell NRSRP for TA validation for transmission using PUR.  If *pur-NRSRP-Validation* is included, the UE shall also indicate support for *pur-CP-EPC*, *pur-CP-5GC*, *pur-UP-EPC* or *pur-CP-5GC*. | FDD | - |
| ***pur-UP-EPC*, *pur-UP-5GC***  Indicates whether the UE supports transmission using PUR for User plane CIoT EPS/5GS optimisations, as defined in TS 24.301 [35] and TS 24.501 [95] repectively. | FDD | - |
| ***rach-Report***  Indicates whether the UE supports delivery of *rach-Report*. | FDD/TDD | No |
| ***rai-Support***  Defines whether the UE supports release assistance indication (RAI) as specified in TS 36.321 [6]. | FDD/TDD | No |
| ***rai-SupportEnh***  Indicates whether the UE supports AS Release Assistance Indication via the DCQR and AS RAI MAC CE when connected to EPC as specified in TS 36.321 [6]. | FDD/TDD | No |
| ***rlc-UM***  Defines whether the UE supports RLC UM as specified in TS 36.322 [7]. | FDD/TDD | No |
| ***slotSymbolResourceResvDL***  Indicates whether the UE supports slot/symbol-level time-domain DL resource reservation, e.g. for NB-IoT coexistence with NR.  If *slotSymbolResourceResvDL* is included, the UE shall also indicate support for *subframeResourceResvDL*. | FDD/TDD | Yes |
| ***slotSymbolResourceResvUL***  Indicates whether the UE supports slot/symbol-level time-domain UL resource reservation, e.g. for NB-IoT coexistence with NR.  If *slotSymbolResourceResvUL* is included, the UE shall also indicate support for *subframeResourceResvUL*. | FDD/TDD | Yes |
| ***supportedBandList, supportedBandList*-v1710**  Includes the supported NB-IoT bands as defined in TS 36.101 [42] and TS 36.102 [113] for NTN capable UE. If *supportedBandList-v1710* is included, the UE shall include the same number of entries, and listed in the same order, as in *supportedBandList-r13*. | FDD/TDD | No |
| ***sr-SPS-BSR***  Defines whether the UE supports SR using SPS BSR as specified in TS 36.321 [6]. | FDD | - |
| ***sr-withHARQ-ACK***  Defines whether the UE supports physical layer SR with HARQ ACK as specified in TS 36.213 [23]. | FDD | - |
| ***sr-withoutHARQ-ACK***  Defines whether the UE supports physical layer SR without HARQ ACK as specified in TS 36.211 [21] and TS 36.213 [23]. | FDD | - |
| ***subframeResourceResvDL***  Indicates whether the UE supports subframe-level time-domain DL resource reservation, e.g. for NB-IoT coexistence with NR. | FDD/TDD | Yes |
| ***subframeResourceResvUL***  Indicates whether the UE supports subframe-level time-domain UL resource reservation, e.g. for NB-IoT coexistence with NR. | FDD/TDD | Yes |
| ***supportedROHC-Profiles***  List of supported ROHC profiles as defined in TS 36.323 [8]. | FDD/TDD | No |
| ***twoHARQ-Processes***  Defines whether the UE supports two HARQ processes operation in DL and UL as specified in TS 36.212 [22] and TS 36.213 [23]. | FDD/TDD | Yes |
| ***ue-Category-NB***  UE category as defined in TS 36.306 [5]. Value nb1 corresponds to UE category NB1, value nb2 corresponds to UE category NB2.  A UE shall always include the field *ue-Category-NB-r13* in this version of the specification. | FDD/TDD | Yes |

NOTE 1: The IE *UE-Capability-NB* does not include AS security capability information, since these are the same as the security capabilities that are signalled by NAS. Consequently AS need not provide "man-in-the-middle" protection for the security capabilities.

NOTE 2: The column 'FDD/TDD appl' indicates the applicability to the xDD mode: 'FDD' means applicable to FDD only, 'TDD' means applicable to TDD only and 'FDD/TDD' means applicable to FDD and TDD.

NOTE 3: The column 'FDD/TDD diff' indicates if the UE is allowed to signal a different value for FDD and TDD when the capability applies to both FDD and TDD modes. '-' is used when the capability applies to one mode only, 'No' is used for dual mode capabilities where a common value is signalled for both modes, and 'Yes' is used for dual mode capabilities where a separate value is signalled for each mode. Common capabilities and FDD capabilities are reported in the fields of *UE-Capability-NB* except field *tdd-UE-Capability.* TDD capabilities are reported in *tdd-UE-Capability*.

#### – *UE-RadioPagingInfo-NB*

The IE *UE-RadioPagingInfo-NB* contains UE NB-IoT capability information needed for paging.

*UE-RadioPagingInfo-NB* information element

-- ASN1START

UE-RadioPagingInfo-NB-r13 ::= SEQUENCE {

ue-Category-NB-r13 ENUMERATED {nb1} OPTIONAL,

...,

[[ multiCarrierPaging-r14 ENUMERATED {true} OPTIONAL

]],

[[ mixedOperationMode-r15 ENUMERATED {supported} OPTIONAL,

wakeUpSignal-r15 ENUMERATED {true} OPTIONAL,

wakeUpSignalMinGap-eDRX-r15 ENUMERATED {ms40, ms240, ms1000, ms2000} OPTIONAL,

multiCarrierPagingTDD-r15 ENUMERATED {true} OPTIONAL

]],

[[ ue-Category-NB-r16 ENUMERATED {nb2} OPTIONAL,

groupWakeUpSignal-r16 ENUMERATED {true} OPTIONAL,

groupWakeUpSignalAlternation-r16 ENUMERATED {true} OPTIONAL

]]

}

-- ASN1STOP

| *UE-RadioPagingInfo-NB field descriptions* |
| --- |
| ***groupWakeUpSignal***  Indicates whether the UE in RRC\_IDLE supports GWUS without group resource alternation for paging in DRX in FDD as specified in TS 36.211 [21], TS 36.213 [23] and TS 36.304 [4]. If this field is included, the minimum gap between GWUS and associated PO for DRX is fixed as 40 ms. |
| ***groupWakeUpSignalAlternation***  Indicates whether the UE in RRC\_IDLE supports GWUS with group resource alternation for paging in DRX in FDD as specified in TS 36.211 [21], TS 36.213 [23] and TS 36.304 [4]. If this field is included, the minimum gap between GWUS and associated PO for DRX is fixed as 40 ms. |
| ***mixedOperationMode***  Indicates whether the UE supports multi-carrier operation with mixed operation mode, standalone or inband/guardband, between the anchor carrier and non-anchor carrier for unicast, paging, and random access, as specified in TS 36.300 [9]. |
| ***multiCarrierPaging***  Indicates whether the UE supports paging on non-anchor carriers as defined in TS 36.304 [4]. |
| ***multiCarrierPagingTDD***  Indicates whether the UE supports paging on non-anchor carriers for TDD as defined in TS 36.304 [4]. |
| ***ue-Category-NB***  UE NB-IoT category as defined in TS 36.306 [5]. Value *nb1* corresponds to UE category NB1, value *nb2* corresponds to UE category NB2.  A UE shall always include the field *ue-Category-NB-r13* in this version of the specification. |
| ***wakeUpSignal***  Indicates whether the UE supports WUS for paging in DRX in FDD as specified in TS 36.304 [4]. If this field is included, the minimum gap between WUS and associated PO for DRX is fixed as 40 ms. |
| ***wakeUpSignalMinGap-eDRX***  Indicates the minimum gap the UE supports between WUS or GWUS and associated PO in case of eDRX in FDD, as specified in TS 36.304 [4]. Value *ms40* corresponds to 40 ms, value *ms240* corresponds to 240 ms and so on.  If this field is included, the UE shall also indicate support for WUS or GWUS for paging in DRX. |

#### – *UE-TimersAndConstants-NB*

The IE *UE-TimersAndConstants-NB* contains timers and constants used by the UE in either RRC\_CONNECTED or RRC\_IDLE.

*UE-TimersAndConstants-NB* information element

-- ASN1START

UE-TimersAndConstants-NB-r13 ::= SEQUENCE {

t300-r13 ENUMERATED {

ms2500, ms4000, ms6000, ms10000,

ms15000, ms25000, ms40000, ms60000},

t301-r13 ENUMERATED {

ms2500, ms4000, ms6000, ms10000,

ms15000, ms25000, ms40000, ms60000},

t310-r13 ENUMERATED {

ms0, ms200, ms500, ms1000, ms2000, ms4000, ms8000},

n310-r13 ENUMERATED {

n1, n2, n3, n4, n6, n8, n10, n20},

t311-r13 ENUMERATED {

ms1000, ms3000, ms5000, ms10000, ms15000,

ms20000, ms30000},

n311-r13 ENUMERATED {

n1, n2, n3, n4, n5, n6, n8, n10},

...,

[[ t311-v1350 ENUMERATED {

ms40000, ms60000, ms90000, ms120000}

OPTIONAL -- Need OR

]],

[[ t300-v1530 ENUMERATED {

ms80000, ms100000, ms120000} OPTIONAL, -- Cond TDD

t301-v1530 ENUMERATED {

ms80000, ms100000, ms120000} OPTIONAL, -- Cond TDD

t311-v1530 ENUMERATED {

ms160000, ms200000} OPTIONAL, -- Cond TDD

t300-r15 ENUMERATED {ms6000, ms10000, ms15000, ms25000, ms40000,

ms60000, ms80000, ms120000} OPTIONAL -- Cond EDTorPUR

]]

}

-- ASN1STOP

| *UE-TimersAndConstants-NB* field descriptions |
| --- |
| ***n3xy***  Constants are described in clause 7.4. n1 corresponds with 1, n2 corresponds with 2 and so on. |
| ***t3xy***  Timers are described in clause 7.3. Value ms0 corresponds with 0 ms, ms200 corresponds with 200 ms and so on. The UE shall use the extended values *t311-v1350*, *t300-v1530, t301-v1530 and t311-v1530*, if present, and ignore the value signaled by *t311-r13, t300-r13, t301-r13* and *t311-r13* respectively.  *t300-r15* is only applicable for EDT or transmission using PUR with uplink data. UE performing EDT or transmission using PUR with uplink data shall use *t300-r15*, if present. |

| Conditional presence | Explanation |
| --- | --- |
| *EDTorPUR* | The field is optionally present, Need OR, if *edt-Parameters* or *cp-PUR-5GC* or *cp-PUR-EPC* or *up-PUR-5GC or up-PUR-EPC* is present in SIB2-NB; otherwise the field is not present and the UE shall delete any existing value for this field. |
| *TDD* | The field is optionally present, Need OR, in TDD mode. Otherwise, the field is not present. |

#### 6.7.3.7 NB-IoT MBMS information elements

Void

#### 6.7.3.7a NB-IoT SC-PTM information elements

#### – *SC-MTCH-InfoList-NB*

The IE *SC-MTCH-InfoList-NB* provides the list of ongoing MBMS sessions transmitted via SC-MRB and for each MBMS session, the associated G-RNTI and scheduling information.

*SC-MTCH-InfoList-NB* information element

-- ASN1START

SC-MTCH-InfoList-NB-r14 ::= SEQUENCE (SIZE (0.. maxSC-MTCH-NB-r14)) OF SC-MTCH-Info-NB-r14

SC-MTCH-Info-NB-r14 ::= SEQUENCE {

sc-mtch-CarrierConfig-r14 CHOICE {

dl-CarrierConfig-r14 DL-CarrierConfigCommon-NB-r14,

dl-CarrierIndex-r14 INTEGER (0.. maxNonAnchorCarriers-NB-r14)

},

mbmsSessionInfo-r14 MBMSSessionInfo-r13,

g-RNTI-r14 BIT STRING(SIZE(16)),

sc-mtch-SchedulingInfo-r14 SC-MTCH-SchedulingInfo-NB-r14 OPTIONAL, -- Need OP

sc-mtch-NeighbourCell-r14 BIT STRING (SIZE(maxNeighCell-SCPTM-NB-r14)) OPTIONAL, -- Need OP

npdcch-NPDSCH-MaxTBS-SC-MTCH-r14 ENUMERATED {n680, n2536},

npdcch-NumRepetitions-SC-MTCH-r14 ENUMERATED {r1, r2, r4, r8, r16,

r32, r64, r128, r256,

r512, r1024, r2048, spare4,

spare3, spare2, spare1},

npdcch-StartSF-SC-MTCH-r14 ENUMERATED {v1dot5, v2, v4, v8,

v16, v32, v48, v64},

npdcch-Offset-SC-MTCH-r14 ENUMERATED {zero, oneEighth, oneQuarter,

threeEighth, oneHalf, fiveEighth,

threeQuarter, sevenEighth},

...

}

SC-MTCH-SchedulingInfo-NB-r14 ::= SEQUENCE {

onDurationTimerSCPTM-r14 ENUMERATED {

pp1, pp2, pp3, pp4,

pp8, pp16, pp32, spare},

drx-InactivityTimerSCPTM-r14 ENUMERATED {

pp0, pp1, pp2, pp3,

pp4, pp8, pp16, pp32},

schedulingPeriodStartOffsetSCPTM-r14 CHOICE {

sf10 INTEGER(0..9),

sf20 INTEGER(0..19),

sf32 INTEGER(0..31),

sf40 INTEGER(0..39),

sf64 INTEGER(0..63),

sf80 INTEGER(0..79),

sf128 INTEGER(0..127),

sf160 INTEGER(0..159),

sf256 INTEGER(0..255),

sf320 INTEGER(0..319),

sf512 INTEGER(0..511),

sf640 INTEGER(0..639),

sf1024 INTEGER(0..1023),

sf2048 INTEGER(0..2047),

sf4096 INTEGER(0..4095),

sf8192 INTEGER(0..8191)

},

...

}

-- ASN1STOP

| ***SC-MTCH-InfoList-NB* field descriptions** |
| --- |
| ***dl-CarrierConfig***  Downlink carrier used for SC-MTCH. E-UTRAN cannot configure a downlink carrier operating in mixed operation mode. |
| ***dl-CarrierIndex***  Index to a downlink carrier signalled in system information. Value '0' corresponds to the anchor carrier, value '1' corresponds to the first entry in *dl-ConfigList* in *SystemInformationBlockType22-NB,* value'2' corresponds to the second entry in *dl-ConfigList* and so on. |
| ***drx-InactivityTimerSCPTM***  Timer for SC-MTCH reception in TS 36.321 [6]. Value in number of NPDCCH periods. Value pp1 corresponds to 1 NPDCCH period, pp2 corresponds to 2 NPDCCH periods and so on. |
| ***g-RNTI***  G-RNTI used to scramble the scheduling and transmission of a SC-MTCH. |
| ***mbmsSessionInfo***  Indicates the ongoing MBMS session in a SC-MTCH. |
| ***npdcch-NPDSCH-MaxTBS-SC-MTCH***  Maximum NPDSCH TBS for the SC-MTCH, see TS 36.213 [23]. Value *n680* corresponds to 680 bits and value *n2536* corresponds to 2536 bits. |
| ***npdcch-NumRepetition-SC-MTCH***  The maximum number of NPDCCH repetitions the UE needs to monitor for SC-MTCH multicast search space, see TS 36.213 [23]. |
| ***npdcch-Offset-SC-MTCH***  Fractional period offset of starting subframe for NPDCCH multicast search space for SC-MTCH, see TS 36.213 [23]. |
| ***npdcch-startSF-SC-MTCH***  Starting subframes configuration of the NPDCCH multicast search space for SC-MTCH, see TS 36.213 [23].  For IoT NTN TDD mode, value of 4 and value of 8 are not supported: if value *v4* is signalled, it is interpreted as 4\*11.25 and if value *v8* is signalled, it is interpreted as 8\*11.25. |
| ***onDurationTimerSCPTM***  Timer for SC-MTCH reception in TS 36.321 [6]. Value in number of NPDCCH periods. Value pp1 corresponds to 1 NPDCCH period, pp2 corresponds to 2 NPDCCH periods and so on. |
| ***schedulingPeriodStartOffsetSCPTM***  *SCPTM-SchedulingCycle* and *SCPTM-SchedulingOffset* in TS 36.321 [6]. The value of *SCPTM-SchedulingCycle* is in number of sub-frames. Value sf10 corresponds to 10 sub-frames, sf20 corresponds to 20 sub-frames and so on. The value of *SCPTM-SchedulingOffset* is in number of sub-frames. |
| ***sc-mtch-CarrierConfig***  Downlink carrier that is used for SC-MTCH. |
| ***sc-mtch-NeighbourCell***  Indicates neighbour cells which also provide this service on SC-MTCH. The first bit is set to 1 if the service is provided on SC-MTCH in the first cell in *scptmNeighbourCellList*, otherwise it is set to 0. The second bit is set to 1 if the service is provided on SC-MTCH in the second cell in *scptmNeighbourCellList*, and so on. If this field is absent, the UE shall assume that this service is not available on SC-MTCH in any neighbour cell. |
| ***sc-mtch-SchedulingInfo***  DRX information for the SC-MTCH.  If this field is absent, DRX is not used for the SC-MTCH. |

#### – *SCPTM-NeighbourCellList-NB*

The IE *SCPTM-NeighbourCellList-NB* indicates a list of neighbour cells where ongoing MBMS sessions provided via SC-MRB in the current cells are also provided.

-- ASN1START

SCPTM-NeighbourCellList-NB-r14 ::= SEQUENCE (SIZE (1..maxNeighCell-SCPTM-NB-r14)) OF PCI-ARFCN-NB-r14

PCI-ARFCN-NB-r14 ::= SEQUENCE {

physCellId-r14 PhysCellId,

carrierFreq-r14 CarrierFreq-NB-r13 OPTIONAL -- Need OP

}

-- ASN1STOP

| *SCPTM-NeighbourCellList-NB field descriptions* |
| --- |
| ***physCellId***  Physical Cell Identity of the neighbour cell. |
| ***carrierFreq***  Carrier frequency of the neighbour cell.  Absence of the IE means that the neighbour cell is on the same frequency as the current cell. |

### 6.7.4 NB-IoT RRC multiplicity and type constraint values

### – Multiplicity and type constraint definitions

-- ASN1START

maxFreqANR-NB-r16 INTEGER ::= 2 -- Maximum number of NB-IOT carrier frequencies that can

-- be configured or reported for ANR measurement

maxFreqEUTRA-NB-r16 INTEGER ::= 8 -- Maximum number of EUTRAN carrier frequencies that can

-- be provided as assistance information for inter-RAT

-- cell selection

maxFreqsGERAN-NB-r16 INTEGER ::= 8 -- Maximum number of groups of GERAN carrier frequencies

-- that can be provided as assistance information for

-- inter-RAT cell selection

maxGWUS-Groups-1-NB-r16 INTEGER ::= 15 -- Maximum number of groups for each paging probability

-- group

maxGWUS-Resources-NB-r16 INTEGER ::= 2 -- Maximum number of GWUS resources for each gap

maxGWUS-ProbThresholds-NB-r16 INTEGER ::= 3 -- Maximum number of paging probability thresholds

maxNPRACH-Resources-NB-r13 INTEGER ::= 3 -- Maximum number of NPRACH resources for NB-IoT

maxNonAnchorCarriers-NB-r14 INTEGER ::= 15 -- Maximum number of non-anchor carriers for NB-IoT

maxDRB-NB-r13 INTEGER ::= 2 -- Maximum number of Data Radio Bearers for NB-IoT

maxNeighCell-SCPTM-NB-r14 INTEGER ::= 8 -- Maximum number of SCPTM neighbour cells

maxNS-Pmax-NB-r13 INTEGER ::= 4 -- Maximum number of NS and P-Max values per band

maxSC-MTCH-NB-r14 INTEGER ::= 64 -- Maximum number of SC-MTCHs in one cell for NB-IoT

maxSI-Message-NB-r13 INTEGER ::= 8 -- Maximum number of SI messages for NB-IoT

maxTAC-NB-r17 INTEGER ::= 12 -- Maximum number of Tracking Area Codes

-- broadcast in a cell

-- ASN1STOP

### – End of NBIOT-RRC-Definitions

-- ASN1START

END

-- ASN1STOP

### 6.7.5 Direct Indication Information

Direct Indication information is transmitted on NPDCCH using P-RNTI but without associated *Paging-NB* message. Table 6.7.5-1 defines the Direct Indication information, see TS 36.212 [22], clause 6.4.3.3.

When bit n is set to 1, the UE shall behave as if the corresponding field is set in the *Paging-NB* message, see 5.3.2.3. Bit 1 is the least significant bit.

Table 6.7.5-1: Direct Indication information

|  |  |
| --- | --- |
| **Bit** | Field in *Direct Indication information* |
| 1 | *systemInfoModification* |
| 2 | *systemInfoModification-eDRX* |
| 3, 4, 5, 6, 7, 8 | Not used, and shall be ignored by UE if received |

# 7 Variables and constants

## 7.1a NB-IoT UE variables

NOTE: To facilitate the specification of the UE behavioural requirements, UE variables are represented using ASN.1. Unless explicitly specified otherwise, it is however up to UE implementation how to store the variables. The optionality of the IEs in ASN.1 is used only to indicate that the values may not always be available.

#### – *NBIOT-UE-Variables*

This ASN.1 segment is the start of the NB-IoT UE variable definitions.

-- ASN1START

NBIOT-UE-Variables DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS

CellGlobalIdEUTRA,

maxFreq,

PLMN-IdentityList3-r11

FROM EUTRA-RRC-Definitions

VarShortMAC-Input,

VarShortResumeMAC-Input-r13

FROM EUTRA-UE-Variables

ANR-CarrierList-NB-r16,

ANR-MeasResult-NB-r16,

maxFreqANR-NB-r16,

MeasResultServCell-NB-r14,

NRSRP-Range-NB-r14,

RLF-Report-NB-r16

FROM NBIOT-RRC-Definitions;

-- ASN1STOP

#### – *VarANR-MeasConfig-NB*

The UE variable *VarANR-MeasConfig-NB* includes the configuration of the measurements to be performed by the UE in RRC\_IDLE for ANR. The UE performs these measurements once while in RRC\_IDLE and only in the cell where it receives the measurement configuration.

*VarANR-MeasConfig-NB*

-- ASN1START

VarANR-MeasConfig-NB-r16::= SEQUENCE {

anr-QualityThreshold-r16 NRSRP-Range-NB-r14,

anr-CarrierList-r16 ANR-CarrierList-NB-r16

}

-- ASN1STOP

#### – *VarANR-MeasReport-NB*

The UE variable *VarANR-MeasReport-NB* includes the stored ANR measurements information.

*VarANR-MeasReport-NB*

-- ASN1START

VarANR-MeasReport-NB-r16::= SEQUENCE {

plmn-IdentityList-r16 PLMN-IdentityList3-r11,

servCellIdentity-r16 CellGlobalIdEUTRA,

measResultServCell-r16 MeasResultServCell-NB-r14,

relativeTimeStamp-r16 INTEGER (0..95),

measResultList-r16 SEQUENCE (SIZE (1..maxFreqANR-NB-r16)) OF ANR-MeasResult-NB-r16

}

-- ASN1STOP

#### – *VarRLF-Report-NB*

The UE variable *VarRLF-Report-NB* includes the radio link failure information.

*VarRLF-Report-NB* UE variable

-- ASN1START

VarRLF-Report-NB-r16 ::= SEQUENCE {

rlf-Report-r16 RLF-Report-NB-r16,

plmn-IdentityList-r16 PLMN-IdentityList3-r11

}

-- ASN1STOP

#### – *VarShortMAC-Input-NB*

The UE variable *VarShortMAC-Input-NB* specifies the input used to generate the shortMAC-I.

*VarShortMAC-Input-NB UE variable*

-- ASN1START

VarShortMAC-Input-NB-r13 ::= VarShortMAC-Input

-- ASN1STOP

#### – *VarShortResumeMAC-Input-NB*

The UE variable *VarShortResumeMAC-Input-NB* specifies the input used to generate the *shortResumeMAC-I* during RRC Connection Resume procedure.

*VarShortResumeMAC-Input-NB UE variable*

-- ASN1START

VarShortResumeMAC-Input-NB-r13 ::= VarShortResumeMAC-Input-r13

-- ASN1STOP

#### – End of *NBIOT-UE-Variables*

-- ASN1START

END

-- ASN1STOP

## 7.2 Counters

| Counter | Reset | Incremented | When reaching max value |
| --- | --- | --- | --- |
|  |  |  |  |

## 7.3 Timers

### 7.3.1 Timers (Informative)

| Timer | Start | Stop | At expiry |
| --- | --- | --- | --- |
| T300  NOTE1 | Transmission of *RRCConnectionRequest* or *RRCConnectionResumeRequest* or *RRCEarlyDataRequest* | Reception of *RRCConnectionSetup*, *RRCConnectionReject* or *RRCConnectionResume* or *RRCEarlyDataComplete* or *RRCConnectionRelease* for UP-EDT, cell re-selection and upon abortion of connection establishment by upper layers | Perform the actions as specified in 5.3.3.6 |
| T301  NOTE1 | Transmission of *RRCConnectionReestabilshmentRequest* | Reception of *RRCConnectionReestablishment* or *RRCConnectionReestablishmentReject* message as well as when the selected cell becomes unsuitable | Go to RRC\_IDLE |
| T302 | Reception of *RRCConnectionReject* while performing RRC connection establishment or reception of *RRCConnectionRelease* including *waitTime* | Upon entering RRC\_CONNECTED and upon cell re-selection, or upon reception of *RRCEarlyDataComplete* or *RRCConnectionRelease* for UP-EDT or *RRCConnectionRelease* for UP transmission using PUR, or upon reception of *RRCConnectionReject* message for E-UTRA/5GC. | Inform upper layers about barring alleviation as specified in 5.3.3.7 |
| T303 | Access barred while performing RRC connection establishment for mobile originating calls | Upon entering RRC\_CONNECTED and upon cell re-selection, or upon reception of *RRCEarlyDataComplete* or *RRCConnectionRelease* for UP-EDT or *RRCConnectionRelease* for UP transmission using PUR. | Inform upper layers about barring alleviation as specified in 5.3.3.7 |
| T304 | Reception of *RRCConnectionReconfiguration* message including the *MobilityControl Info* or  reception of *MobilityFromEUTRACommand* message including *CellChangeOrder* or upon conditional reconfiguration execution i.e. when applying a stored *RRCConnectionReconfiguration* message including the *MobilityControl Info*. | Criterion for successful completion of handover within E-UTRA, handover to E-UTRA or cell change order is met (the criterion is specified in the target RAT in case of inter-RAT) | In case of cell change order from E-UTRA or intra E-UTRA handover, initiate the RRC connection re-establishment procedure; In case of handover to E-UTRA, perform the actions defined in the specifications applicable for the source RAT; If any DAPS bearer is configured and if there is no RLF in source PCell, initiate the failure information procedure. |
| T305 | Access barred while performing RRC connection establishment for mobile originating signalling | Upon entering RRC\_CONNECTED and upon cell re-selection, or upon reception of *RRCEarlyDataComplete* or *RRCConnectionRelease* for UP-EDT or *RRCConnectionRelease* for UP transmission using PUR. | Inform upper layers about barring alleviation as specified in 5.3.3.7 |
| T306 | Access barred while performing RRC connection establishment for mobile originating CS fallback. | Upon entering RRC\_CONNECTED and upon cell re-selection, or upon reception of *RRCEarlyDataComplete* or *RRCConnectionRelease* for UP-EDT or *RRCConnectionRelease* for UP transmission using PUR. | Inform upper layers about barring alleviation as specified in 5.3.3.7 |
| T307 | Reception of *RRCConnectionReconfiguration* message including *MobilityControlInfoSCG* | Successful completion of random access on the PSCell, upon initiating re-establishment and upon SCG release | Initiate the SCG failure information procedure as specified in 5.6.13. |
| T308 | Access barred due to ACDC while performing RRC connection establishment subject to ACDC | Upon entering RRC\_CONNECTED and upon cell re-selection, or upon reception of *RRCEarlyDataComplete* or *RRCConnectionRelease* for UP-EDT or *RRCConnectionRelease* for UP transmission using PUR. | Inform upper layers about barring alleviation for ACDC as specified in 5.3.3.7 |
| T309  NOTE1 | When access attempt is barred at access barring check for an Access Category. The UE shall maintain one instance of this timer per Access Category. | Upon entering RRC\_CONNECTED, upon cell (re)selection, upon reception of *RRCConnectionRelease,* upon change of PCell while in RRC\_CONNECTED, or upon reception of *MobilityFromEUTRACommand*. | Perform the actions as specified in 5.3.16.4. |
| T310  NOTE1  NOTE2 | Upon detecting physical layer problems for the PCell i.e. upon receiving N310 consecutive out-of-sync indications from lower layers | Upon receiving N311 consecutive in-sync indications from lower layers for the PCell, upon triggering the handover procedure, upon initiating the connection re-establishment procedure, and upon initiating the MCG failure information procedure, upon expiry of *t-Service* or being out of the current serving cell coverage in discontinuous coverage scenario. | If security is not activated and the UE is not a NB-IoT UE that supports RRC connection re-establishment for the Control Plane CIoT EPS/5GS optimisation: go to RRC\_IDLE else: initiate the MCG failure information procedure as specified in 5.6.26 or the connection re-establishment procedure as specified in 5.3.7. |
| T311  NOTE1 | Upon initiating the RRC connection re-establishment procedure | Selection of a suitable E-UTRA cell or a cell using another RAT. | Go to RRC\_IDLE |
| T312  NOTE2 | Upon triggering a measurement report for a measurement identity for which T312 has been configured and *useT312* has been set to true, while T310 is running | Upon receiving N311 consecutive in-sync indications from lower layers, upon triggering the handover procedure, upon initiating the connection re-establishment procedure, upon initiating the MCG failure information procedure, and upon the expiry of T310 | Initiate the MCG failure information procedure as specified in 5.6.26 or the connection re-establishment procedure as specified in 5.3.7. |
| T313  NOTE2 | Upon detecting physical layer problems for the PSCell i.e. upon receiving N313 consecutive out-of-sync indications from lower layers | Upon receiving N314 consecutive in-sync indications from lower layers for the PSCell, upon initiating the connection re-establishment procedure, upon SCG release and upon receiving *RRCConnectionReconfiguration* including *MobilityControlInfoSCG* | Inform E-UTRAN about the SCG radio link failure by initiating the SCG failure information procedure as specified in 5.6.13. |
| T314  NOTE2 | Upon early detecting physical layer problems for the PCell i.e. upon receiving N310 consecutive "early-out-of-sync" indications from lower layers. | Upon receiving N311 consecutive in-sync indications from lower layers for the PCell, upon triggering the handover procedure and upon initiating the connection re-establishment procedure | Initiate the UE Assistance Information procedure to report early detection of physical layer problems in accordance with 5.6.10. |
| T315  NOTE2 | Upon detecting physical layer improvements of the PCell i.e. upon receiving N311 consecutive "early-in-sync" indications from lower layers. | Upon receiving N310 consecutive "early-out-of-sync" indications from lower layers for the PCell. | Initiate the UE Assistance Information procedure to report detection of physical layer improvements in accordance with 5.6.10. |
| T316 | Upon transmission of the *MCGFailureInformation* message | Upon receiving *RRCConnectionRelease*, *RRCConnectionReconfiguration* with *mobilityControlInfo, MobilityFromEUTRACommand*, or upon initiaitng the re-establishment procedure, | Perform the actions as specified in 5.6.26.5. |
| T317  NOTE1 | Start or restart from the subframe indicated by *epochTime* upon reception of *SystemInformationBlockType31* (*SystemInformationBlockType31-NB* in NB-IoT), or upon reception of *RRCConnectionReconfiguration* message for the target cell including *mobilityControlInfo*, or upon conditional reconfiguration execution i.e. when applying a stored *RRCConnectionReconfiguration* message for the target cell including *mobilityControlInfo*. | Stop T317, if it is running, for the source cell upon reception of *RRCConnectionReconfiguration* message including *mobilityControlInfo*, or upon conditional reconfiguration execution i.e. when applying a stored *RRCConnectionReconfiguration* message including *mobilityControlInfo*. | Perform the actions as specified in 5.3.18. |
| T318  NOTE1 | Upon starting acquisition of *SystemInformationBlockType31* (*SystemInformationBlockType31-NB* in NB-IoT) in RRC\_CONNECTED | Upon successful acquisition of *SystemInformationBlockType31* (*SystemInformationBlockType31-NB* in NB-IoT) if broadcast, and optionally after successful acquisition of *SystemInformationBlockType33* (*SystemInformationBlockType33-NB* in NB-IoT) if broadcast, in RRC\_CONNECTED, as specified in 5.3.18. | If security is not activated and the UE is not a NB-IoT UE that supports RRC connection re-establishment for the Control Plane CIoT EPS optimisation: go to RRC\_IDLE else: initiate the connection re-establishment procedure as specified in 5.3.7. |
| T320 | Upon receiving *t320* or upon cell (re)selection to E-UTRA from another RAT with validity time configured for dedicated priorities (in which case the remaining validity time is applied). | Upon entering RRC\_CONNECTED, when PLMN selection is performed on request by NAS, when the UE enters RRC\_IDLE from RRC\_INACTIVE, or upon cell (re)selection to another RAT (in which case the timer is carried on to the other RAT), or upon reception of *RRCEarlyDataComplete* or *RRCConnectionRelease* for UP-EDT or *RRCConnectionRelease* for UP transmission using PUR. | Discard the cell reselection priority information provided by dedicated signalling. |
| T321 | Upon receiving *measConfig* including a *reportConfig* with the *purpose* set to *reportCGI* | Upon acquiring the information needed to set all fields of *cellGlobalId* for the requested cell, upon receiving *measConfig* that includes removal of the *reportConfig* with the *purpose* set to *reportCGI* and upon detecting that a cell is not broadcasting SIB1. | Initiate the measurement reporting procedure, stop performing the related measurements and remove the corresponding *measId* |
| T322  NOTE1 | Upon receiving *redirectedCarrierOffsetDedicated* included in *RedirectedCarrierInfo* | Upon entering RRC\_CONNECTED, when PLMN selection is performed on request by NAS, or upon cell (re)selection to another frequency or RAT, or upon reception of *RRCEarlyDataComplete* or *RRCConnectionRelease* for UP-EDT or *RRCConnectionRelease* for UP transmission using PUR. | Release *redirectedCarrierOffsetDedicated*. |
| T323 | Upon receiving *t323*. | Upon entering RRC\_CONNECTED, when PLMN selection is performed on request by NAS, when the UE enters RRC\_IDLE from RRC\_INACTIVE, or upon cell (re)selection to another RAT, or upon reception of *RRCEarlyDataComplete* or *RRCConnectionRelease* for UP-EDT or *RRCConnectionRelease* for UP transmission using PUR. | Discard the *altFreqPriorities* provided by dedicated signalling. UE shall apply the cell reselection priority information broadcast in the system information via *cellReselectionPriority* and *cellReselectionSubPriority*. |
| T325 | Timer (re)started upon receiving *RRCConnectionReject* message with *deprioritisationTimer*. |  | Stop deprioritisation of all frequencies or E-UTRA signalled by *RRCConnectionReject.* |
| T326  NOTE1 | Upon entering RRC\_CONNECTED, upon update to NRSRPRef . | Upon leaving RRC\_CONNECTED. | Stop performing connected mode neighbour cell measurement. |
| T330 | Upon receiving *LoggedMeasurementConfiguration* message | Upon log volume exceeding the suitable UE memory, upon initiating the release of *LoggedMeasurementConfiguration* procedure | Perform the actions specified in 5.6.6.4 |
| T331 | Upon receiving *RRCConnectionRelease* message including *measIdleConfig.* | Upon receiving *RRCConnectionSetup, RRCConnectionResume, RRCConnectionRelease* with an idle/inactive measurement configuration or indication to release the configuration, if *validityArea* is configured, upon cell selection/reselection to a cell that does not belong to the *validityArea* (if configured)*,* or upon reselecting to an inter-RAT cell. | Perform the actions specified in 5.6.20.3. |
| T340  NOTE2 | Upon transmitting *UEAssistanceInformation* message with *powerPrefIndication* set to *normal* | Upon releasing *powerPrefIndication* during the connection re-establishment procedure | No action. |
| T341  NOTE2 | Upon transmitting *UEAssistanceInformation* message with *bw-Preference.* | Upon resuming an RRC connection or upon releasing *bw-Preference* during the connection re-establishment procedure | No action. |
| T342  NOTE2 | Upon transmitting *UEAssistanceInformation* message with *delayBudgetReport*. | Upon releasing *delayBudgetReportingConfig* during the connection re-establishment and connection resume procedures | No action. |
| T343  NOTE2 | Upon transmitting *UEAssistanceInformation* message with *RLM-Report* including *earlyOutOfSync*. | Upon initiating the connection re-establishment procedure | No action. |
| T344  NOTE2 | Upon transmitting *UEAssistanceInformation* message with *RLM-Report* including *earlyInSync*. | Upon initiating the connection re-establishment procedure | No action. |
| T345 | Upon transmitting *UEAssistanceInformation* message with *overheatingAssistance* | Upon releasing *overheatingAssistance* during the connection re-establishment procedure, or connection resume procedure. | No action. |
| T346 | Upon transmitting UEAssistanceInformation message with *scg-DeactivationPreference* | Upon releasing *scg-DeactivationPreferenceConfig* during the RRC connection establishment or re-establishment procedures, or upon reconfiguration of *scg-DeactivationPreferenceConfig* to *release*. | No action. |
| T350 | Upon entering RRC\_IDLE if *t350* has been received in wlan-OffloadInfo. | Upon entering RRC\_CONNECTED, or upon cell reselection. | Perform the actions specified in 5.6.12.4. |
| T351 | Reception of *RRCConnectionReconfiguration* message including the association*Timer* in *WLAN-MobilityConfig*. | Upon successful connection to WLAN, upon WLAN connection failure, upon leaving RRC\_CONNECTED, upon triggering the handover procedure, or upon initiating the connection re-establishment procedure. | Perform WLAN Connection Status Reporting specified in 5.6.15.2. |
| T360 | Upon performing the redistribution target selection as specified in TS 36.304 [4]. | Upon entering RRC\_CONNECTED, upon receiving a Paging message including *redistributionIndication*; upon reselecting a cell not belonging to the redistribution target. | Stop considering a frequency or cell to be redistribution target, and perform the redistribution target selection if the condition specified in TS 36.304 [4] is met. |
| T370 | Upon receiving *SL-DiscConfig* including a *discSysInfoToReportConfig* set to *setup.* | Upon initiating the transmission of *SidelinkUEInformation* including *discSysInfoReportFreqList*, upon receiving *SL-DiscConfig* including *discSysInfoToReportConfig* set to *release*, upon handover and re-establishment*.* | Release *discSysInfoToReportConfig*. |
| T380 | Upon reception of *periodic-RNAU-timer* in RRCConnectionRelease. | Upon reception of *RRCConnectionResume*, *RRCConnectionRelease* or *RRCConnectionSetup*. | Initiate the RAN notification area update procedure |
| T390  NOTE1 | Upon GNSS validity duration expiry if *ul-TransmissionExtensionEnabled* is configured. | Upon leaving RRC\_CONNECTED, or upon reception of network triggered GNSS measurement, or upon initiating the connection re-establishment procedure, or upon indication that a new GNSS position becomes valid during available idle periods in RRC\_CONNECTED. | Perform the actions as specified in 5.3.3.21. |
| NOTE1: Only the timers marked with "NOTE1" are applicable to NB-IoT.  NOTE2: The behaviour as specified in 7.3.2 applies. | | | |

### 7.3.2 Timer handling

When the UE applies zero value for a timer, the timer shall be started and immediately expire unless explicitly stated otherwise.

## 7.4 Constants

| Constant | Usage |
| --- | --- |
| N310 | Maximum number of consecutive "out-of-sync" or "early-out-of-sync" indications for the PCell received from lower layers |
| N311 | Maximum number of consecutive "in-sync" or "early-in-sync" indications for the PCell received from lower layers |
| N313 | Maximum number of consecutive "out-of-sync" indications for the PSCell received from lower layers |
| N314 | Maximum number of consecutive "in-sync" indications for the PSCell received from lower layers |

# 9 Specified and default radio configurations

Specified and default configurations are configurations of which the details are specified in the standard. Specified configurations are fixed while default configurations can be modified using dedicated signalling.

## 9.1 Specified configurations

### 9.1.1 Logical channel configurations

#### 9.1.1.1 BCCH configuration

Parameters

| Name | Value | Semantics description | Ver |
| --- | --- | --- | --- |
| PDCP configuration | N/A |  |  |
| RLC configuration | TM |  |  |
| MAC configuration | TM |  |  |

NOTE: RRC will perform padding, if required due to the granularity of the TF signalling, as defined in 8.5.

#### 9.1.1.2 CCCH configuration

Parameters

| Name | Value | Semantics description | Ver |
| --- | --- | --- | --- |
| PDCP configuration | N/A |  |  |
| RLC configuration | TM |  |  |
| MAC configuration |  | Normal MAC headers are used |  |
| Logical channel configuration |  |  |  |
| *priority* | 1 | Highest priority |  |
| *prioritisedBitRate* | infinity |  |  |
| *bucketSizeDuration* | N/A |  |  |
| *logicalChannelGroup* | 0 |  |  |
| *logicalChannelSR-Mask-r9* | release |  | v920 |

#### 9.1.1.3 PCCH configuration

Parameters

| Name | Value | Semantics description | Ver |
| --- | --- | --- | --- |
| PDCP configuration | N/A |  |  |
| RLC configuration | TM |  |  |
| MAC configuration | TM |  |  |

NOTE: RRC will perform padding, if required due to the granularity of the TF signalling, as defined in 8.5.

#### 9.1.1.4 MCCH and MTCH configuration

Parameters

| Name | Value | Semantics description | Ver |
| --- | --- | --- | --- |
| PDCP configuration | N/A |  |  |
| RLC configuration | UM |  |  |
| *sn-FieldLength* | size5 |  |  |
| *t-Reordering* | 0 |  |  |

#### 9.1.1.5 SBCCH configuration

Parameters

| Name | Value | Semantics description | Ver |
| --- | --- | --- | --- |
| PDCP configuration | N/A |  |  |
| RLC configuration | TM |  |  |
| MAC configuration | TM |  |  |

NOTE: RRC will perform padding, if required due to the granularity of the TF signalling, as defined in 8.5.

#### 9.1.1.6 STCH configuration

Parameters

| Name | Value | Semantics description | Ver |
| --- | --- | --- | --- |
| PDCP configuration |  |  |  |
| discardTimer | Undefined | Up to UE implementation |  |
| pdcp-SN-Size | 16 |  |  |
| maxCID | 15 |  |  |
| profiles |  |  |  |
| t-Reordering (PDCP) | Undefined | Only used for V2X sidelink communication. Selected by the receiving UE, up to UE implementation | V1520 |
| RLC configuration |  | Uni-directional UM RLC  UM window size is set to 0 |  |
|  | Uni-directional UM RLC  UM window size is set to 0 for sidelink communication | v1440 |
| *sn-FieldLength* | 5 |  |  |
| logicalChannelIdentity | Undefined | Selected by the transmitting UE, up to UE implementation |  |
| Logical channel configuration |  |  |  |
| priority | Undefined | Selected by the transmitting UE, up to UE implementation |  |
| prioritisedBitRate | Undefined | Selected by the transmitting UE, up to UE implementation |  |
| bucketSizeDuration | Undefined | Selected by the transmitting UE, up to UE implementation |  |
| logicalChannelGroup | 3 |  |  |
| t-Reordering | Undefined | Only used for V2X sidelink communication.  Selected by the receiving UE, up to UE implementation | v1440 |
| MAC configuration |  |  |  |

#### 9.1.1.7 SC-MCCH and SC-MTCH configuration

Parameters

| **Name** | **Value** | **Semantics description** | **Ver** |
| --- | --- | --- | --- |
| PDCP configuration | N/A |  |  |
| RLC configuration | UM |  |  |
| *sn-FieldLength* | size5 |  |  |
| *t-Reordering* | 0 |  |  |

#### 9.1.1.8 BR-BCCH configuration

Parameters

| Name | Value | Semantics description | Ver |
| --- | --- | --- | --- |
| PDCP configuration | N/A |  |  |
| RLC configuration | TM |  |  |
| MAC configuration | TM |  |  |

NOTE: RRC will perform padding, if required due to the granularity of the TF signalling, as defined in 8.5.

### 9.1.2 SRB configurations

#### 9.1.2.1 SRB1

Parameters

| Name | Value | Semantics description | Ver |
| --- | --- | --- | --- |
| RLC configuration |  |  |  |
| *logicalChannelIdentity* | 1 |  |  |

#### 9.1.2.1a SRB1bis

Parameters

| Name | Value | Semantics description | Ver |
| --- | --- | --- | --- |
| RLC configuration |  |  |  |
| *logicalChannelIdentity* | 3 |  |  |

#### 9.1.2.2 SRB2

Parameters

| Name | Value | Semantics description | Ver |
| --- | --- | --- | --- |
| RLC configuration |  |  |  |
| *logicalChannelIdentity* | 2 |  |  |

#### 9.1.2.3 SRB4

Parameters

| Name | Value | Semantics description | Ver |
| --- | --- | --- | --- |
| RLC configuration |  |  |  |
| *logicalChannelIdentity* | 4 |  |  |

## 9.2 Default radio configurations

The following clauses only list default values for REL-8 parameters included in protocol version v8.5.0. For all fields introduced in a later protocol version, the default value is "released" unless explicitly specified otherwise. If UE is to apply default configuration while it is configured with some critically extended fields, the UE shall apply the original version with only default values. For the following fields, introduced in a protocol version later than v8.5.0, the default corresponds with "value not applicable":

- *codeBookSubsetRestriction-v920*;

- *pmi-RI-Report*;

NOTE 1: Value "N/A" indicates that the UE does not apply a specific value (i.e. upon switching to a default configuration, E-UTRAN can not assume the UE keeps the previously configured value). This implies that E-UTRAN needs to configure a value before invoking the related functionality.

NOTE 2: In general, the signalling should preferably support a "release" option for fields introduced after v8.5.0. The "value not applicable" should be used restrictively, mainly limited to for fields which value is relevant only if another field is set to a value other than its default.

### 9.2.1 SRB configurations

#### 9.2.1.1 SRB1

Parameters

| Name | Value | NB-IoT | Semantics description | Ver |
| --- | --- | --- | --- | --- |
| RLC configuration CHOICE | am | am |  |  |
| *ul-RLC-Config*  *>t-PollRetransmit*  *>pollPDU*  *>pollByte*  *>maxRetxThreshold* | ms45  infinity  infinity  t4 | ms25000  N/A  N/A  t4 |  |  |
| *dl-RLC-Config*  *>t-Reordering*  *>t-StatusProhibit*  *>enableStatusReportSN-Gap* | ms35  ms0  N/A | released  N/A  disabled |  |  |
| Logical channel configuration |  |  |  |  |
| *priority* | 1 | 1 | Highest priority |  |
| *prioritisedBitRate* | infinity | N/A |  |  |
| *bucketSizeDuration* | N/A | N/A |  |  |
| *logicalChannelGroup* | 0 | N/A |  |  |
| *logicalChannelSR-Prohibit* | N/A | TRUE |  |  |

#### 9.2.1.2 SRB2

Parameters

| Name | Value | Semantics description | Ver |
| --- | --- | --- | --- |
| RLC configuration CHOICE | am |  |  |
| *ul-RLC-Config*  *>t-PollRetransmit*  *>pollPDU*  *>pollByte*  *>maxRetxThreshold* | ms45  infinity  infinity  t4 |  |  |
| *dl-RLC-Config*  *>t-Reordering*  *>t-StatusProhibit* | ms35  ms0 |  |  |
| Logical channel configuration |  |  |  |
| *priority* | 3 |  |  |
| *prioritisedBitRate* | infinity |  |  |
| *bucketSizeDuration* | N/A |  |  |
| *logicalChannelGroup* | 0 |  |  |

### 9.2.2 Default MAC main configuration

Parameters

| Name | Value | NB-IoT | Semantics description | Ver |
| --- | --- | --- | --- | --- |
| MAC main configuration |  |  |  |  |
| *maxHARQ-tx* | n5 | N/A |  |  |
| *periodicBSR-Timer* | infinity | pp8 |  |  |
| *retxBSR-Timer* | sf2560 | infinity |  |  |
| *ttiBundling* | FALSE | N/A |  |  |
| *drx-Config* | release | N/A |  |  |
| *phr-Config* | release | N/A |  |  |

### 9.2.3 Default semi-persistent scheduling configuration

|  |  |  |  |
| --- | --- | --- | --- |
| SPS-Config  >*sps-ConfigDL*  *>sps-ConfigUL* | release  release |  |  |

### 9.2.4 Default physical channel configuration

Parameters (not applicable for NB-IoT)

| Name | Value | Semantics description | Ver |
| --- | --- | --- | --- |
| *PDSCH-ConfigDedicated*  *>p-a* | dB0 |  |  |
| *PUCCH-ConfigDedicated*  *>tdd-AckNackFeedbackMode*  *>ackNackRepetition* | bundling  release | Only valid for TDD mode |  |
| *PUSCH-ConfigDedicated*  *>betaOffset-ACK-Index*  *>betaOffset-RI-Index*  *>betaOffset-CQI-Index* | 10  12  15 |  |  |
| *UplinkPowerControlDedicated*  >*p0-UE-PUSCH*  *>deltaMCS-Enabled*  *>accumulationEnabled*  *>p0-UE-PUCCH*  *>pSRS-Offset*  *>filterCoefficient* | 0  en0 (disabled)  TRUE  0  7  fc4 |  |  |
| *tpc-pdcch-ConfigPUCCH* | release |  |  |
| *tpc-pdcch-ConfigPUSCH* | release |  |  |
| *CQI-ReportConfig*  *>CQI-ReportPeriodic*  *>cqi-ReportModeAperiodic*  *>nomPDSCH-RS-EPRE-Offset* | release  N/A  N/A |  |  |
| *SoundingRS-UL-ConfigDedicated* | release |  |  |
| *AntennaInfoDedicated*  *>transmissionMode*  *>codebookSubsetRestriction*  *>ue-TransmitAntennaSelection* | tm1, tm2  N/A  release | If the number of PBCH antenna ports is one, tm1 is used as default; otherwise tm2 is used as default |  |
| *SchedulingRequestConfig* | release |  |  |

Parameters applicable for NB-IoT

| Name | Value | Semantics description | Ver |
| --- | --- | --- | --- |
| *NPUSCH-ConfigDedicated-NB*  *>ack-NACK-NumRepetitions*  *>npusch-AllSymbols* | N/A  TRUE |  |  |
| *UplinkPowerControlDedicated*  >*p0-UE-NPUSCH* | 0 |  |  |

### 9.2.5 Default values timers and constants

Parameters

| Name | Value | Semantics description | Ver |
| --- | --- | --- | --- |
| t310 | ms1000 |  |  |
| n310 | n1 |  |  |
| t311 | ms1000 |  |  |
| n311 | n1 |  |  |

# 10 Radio information related interactions between network nodes

## 10.1 General

This clause specifies RRC messages that are transferred between network nodes. These RRC messages may be transferred to or from the UE via another Radio Access Technology. Consequently, these messages have similar characteristics as the RRC messages that are transferred across the E-UTRA radio interface, i.e. the same transfer syntax and protocol extension mechanisms apply.

## 10.2 Inter-node RRC messages

### 10.2.1 General

This clause specifies RRC messages that are sent either across the X2- or the S1-interface, either to or from the eNB, unless explicitly stated otherwise, i.e. a single 'logical channel' is used for all RRC messages transferred across network nodes. The information could originate from or be destined for another RAT.

### – *EUTRA-InterNodeDefinitions*

This ASN.1 segment is the start of the E‑UTRA inter-node PDU definitions.

-- ASN1START

EUTRA-InterNodeDefinitions DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS

AntennaInfoCommon,

AntennaInfoDedicated-v10i0,

ARFCN-ValueEUTRA,

ARFCN-ValueEUTRA-v9e0,

ARFCN-ValueEUTRA-r9,

CellIdentity,

C-RNTI,

DAPS-PowerCoordinationInfo-r16,

DL-DCCH-Message,

DRB-Identity,

DRB-ToReleaseList,

DRB-ToReleaseList-r15,

FreqBandIndicator-r11,

InDeviceCoexIndication-r11,

LWA-Config-r13,

MasterInformationBlock,

maxBands,

maxFreq,

maxDRB,

maxDRBExt-r15,

maxDRB-r15,

maxSCell-r10,

maxSCell-r13,

maxServCell-r10,

maxServCell-r13,

MBMSInterestIndication-r11,

MeasConfig,

MeasGapConfig,

MeasGapConfigPerCC-List-r14,

MeasResultForRSSI-r13,

MeasResultListWLAN-r13,

OtherConfig-r9,

PhysCellId,

P-Max,

PowerCoordinationInfo-r12,

SidelinkUEInformation-r12,

SL-CommConfig-r12,

SL-DiscConfig-r12,

SubframeAssignment-r15,

RadioResourceConfigDedicated,

RadioResourceConfigDedicated-v13c0,

RadioResourceConfigDedicated-v1370,

RAN-NotificationAreaInfo-r15,

RCLWI-Configuration-r13,

RSRP-Range,

RSRQ-Range,

RSRQ-Range-v1250,

RS-SINR-Range-r13,

SCellToAddModList-r10,

SCellToAddModList-v13c0,

SCellToAddModListExt-r13,

SCellToAddModListExt-v13c0,

SCG-ConfigPartSCG-r12,

SCG-ConfigPartSCG-v12f0,

SCG-ConfigPartSCG-v13c0,

SecurityAlgorithmConfig,

SCellIndex-r10,

SCellIndex-r13,

SCellToReleaseList-r10,

SCellToReleaseListExt-r13,

ServCellIndex-r10,

ServCellIndex-r13,

ShortMAC-I,

MeasResultServFreqListNR-r15,

MeasResultSSTD-r13,

SL-V2X-ConfigDedicated-r14,

SystemInformationBlockType1,

SystemInformationBlockType1-v890-IEs,

SystemInformationBlockType2,

TDM-PatternConfig-r15,

UEAssistanceInformation-r11,

UECapabilityInformation,

UE-CapabilityRAT-ContainerList,

UE-RadioPagingInfo-r12,

WLANConnectionStatusReport-r13,

WLAN-OffloadConfig-r12

FROM EUTRA-RRC-Definitions;

-- ASN1STOP

### 10.2.2 Message definitions

#### – *HandoverCommand*

This message is used to transfer the handover command generated by the target eNB.

Direction: target eNB to source eNB/ source RAN

*HandoverCommand* message

-- ASN1START

HandoverCommand ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE{

handoverCommand-r8 HandoverCommand-r8-IEs,

spare7 NULL,

spare6 NULL, spare5 NULL, spare4 NULL,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

HandoverCommand-r8-IEs ::= SEQUENCE {

handoverCommandMessage OCTET STRING (CONTAINING DL-DCCH-Message),

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *HandoverCommand* field descriptions |
| --- |
| ***handoverCommandMessage***  Contains the entire DL-DCCH-Message including the *RRCConnectionReconfiguration* message used to perform handover within E-UTRAN or handover to E-UTRAN, generated (entirely) by the target eNB. |

NOTE: The source BSC, in case of inter-RAT handover from GERAN to E-UTRAN, expects that the HandoverCommand message includes DL-DCCH-Message only. Thus, criticalExtensionsFuture, spare1-spare7 and nonCriticalExtension should not be used regardless whether the source RAT is E-UTRAN, UTRAN or GERAN.

#### – *HandoverPreparationInformation*

This message is used to transfer the E-UTRA RRC information used by the target eNB or target ng-eNB during handover preparation or UE context retrieval, e.g. in case of resume or re-establishment, including UE capability information.

Direction: source eNB/ source RAN to target eNB or target ng-eNB

*HandoverPreparationInformation* message

-- ASN1START

HandoverPreparationInformation ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE{

handoverPreparationInformation-r8 HandoverPreparationInformation-r8-IEs,

spare7 NULL,

spare6 NULL, spare5 NULL, spare4 NULL,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

HandoverPreparationInformation-r8-IEs ::= SEQUENCE {

ue-RadioAccessCapabilityInfo UE-CapabilityRAT-ContainerList,

as-Config AS-Config OPTIONAL, -- Cond HO

rrm-Config RRM-Config OPTIONAL,

as-Context AS-Context OPTIONAL, -- Cond HO

nonCriticalExtension HandoverPreparationInformation-v920-IEs OPTIONAL

}

HandoverPreparationInformation-v920-IEs ::= SEQUENCE {

ue-ConfigRelease-r9 ENUMERATED {

rel9, rel10, rel11, rel12, v10j0, v11e0,

v1280, rel13, ..., rel14, rel15, rel16, rel17, rel18} OPTIONAL, -- Cond HO2

nonCriticalExtension HandoverPreparationInformation-v9d0-IEs OPTIONAL

}

HandoverPreparationInformation-v9d0-IEs ::= SEQUENCE {

lateNonCriticalExtension OCTET STRING (CONTAINING HandoverPreparationInformation-v9j0-IEs) OPTIONAL,

nonCriticalExtension HandoverPreparationInformation-v9e0-IEs OPTIONAL

}

-- Late non-critical extensions:

HandoverPreparationInformation-v9j0-IEs ::= SEQUENCE {

-- Following field is only for pre REL-10 late non-critical extensions

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension HandoverPreparationInformation-v10j0-IEs OPTIONAL

}

HandoverPreparationInformation-v10j0-IEs ::= SEQUENCE {

as-Config-v10j0 AS-Config-v10j0 OPTIONAL,

nonCriticalExtension HandoverPreparationInformation-v10x0-IEs OPTIONAL

}

HandoverPreparationInformation-v10x0-IEs ::= SEQUENCE {

-- Following field is only for late non-critical extensions from REL-10 to REL-12

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension HandoverPreparationInformation-v13c0-IEs OPTIONAL

}

HandoverPreparationInformation-v13c0-IEs ::= SEQUENCE {

as-Config-v13c0 AS-Config-v13c0 OPTIONAL,

-- Following field is only for late non-critical extensions from REL-13

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- Regular non-critical extensions:

HandoverPreparationInformation-v9e0-IEs ::= SEQUENCE {

as-Config-v9e0 AS-Config-v9e0 OPTIONAL, -- Cond HO2

nonCriticalExtension HandoverPreparationInformation-v1130-IEs OPTIONAL

}

HandoverPreparationInformation-v1130-IEs ::= SEQUENCE {

as-Context-v1130 AS-Context-v1130 OPTIONAL, -- Cond HO2

nonCriticalExtension HandoverPreparationInformation-v1250-IEs OPTIONAL

}

HandoverPreparationInformation-v1250-IEs ::= SEQUENCE {

ue-SupportedEARFCN-r12 ARFCN-ValueEUTRA-r9 OPTIONAL, -- Cond HO3

as-Config-v1250 AS-Config-v1250 OPTIONAL, -- Cond HO2

nonCriticalExtension HandoverPreparationInformation-v1320-IEs OPTIONAL

}

HandoverPreparationInformation-v1320-IEs ::= SEQUENCE {

as-Config-v1320 AS-Config-v1320 OPTIONAL, -- Cond HO2

as-Context-v1320 AS-Context-v1320 OPTIONAL, -- Cond HO2

nonCriticalExtension HandoverPreparationInformation-v1430-IEs OPTIONAL

}

HandoverPreparationInformation-v1430-IEs ::= SEQUENCE {

as-Config-v1430 AS-Config-v1430 OPTIONAL, -- Cond HO2

makeBeforeBreakReq-r14 ENUMERATED {true} OPTIONAL, -- Cond HO2

nonCriticalExtension HandoverPreparationInformation-v1530-IEs OPTIONAL

}

HandoverPreparationInformation-v1530-IEs ::= SEQUENCE {

ran-NotificationAreaInfo-r15 RAN-NotificationAreaInfo-r15 OPTIONAL,

nonCriticalExtension HandoverPreparationInformation-v1540-IEs OPTIONAL

}

HandoverPreparationInformation-v1540-IEs ::= SEQUENCE {

sourceRB-ConfigIntra5GC-r15 OCTET STRING OPTIONAL, --Cond HO4

nonCriticalExtension HandoverPreparationInformation-v1610-IEs OPTIONAL

}

HandoverPreparationInformation-v1610-IEs ::= SEQUENCE {

as-Context-v1610 AS-Context-v1610 OPTIONAL, --Cond HO5

nonCriticalExtension HandoverPreparationInformation-v1620-IEs OPTIONAL

}

HandoverPreparationInformation-v1620-IEs ::= SEQUENCE {

as-Context-v1620 AS-Context-v1620 OPTIONAL, --Cond HO2

nonCriticalExtension HandoverPreparationInformation-v1630-IEs OPTIONAL

}

HandoverPreparationInformation-v1630-IEs ::= SEQUENCE {

as-Context-v1630 AS-Context-v1630 OPTIONAL, --Cond HO2

nonCriticalExtension HandoverPreparationInformation-v1700-IEs OPTIONAL

}

HandoverPreparationInformation-v1700-IEs ::= SEQUENCE {

as-Config-v1700 AS-Config-v1700 OPTIONAL, --Cond HO5

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *HandoverPreparationInformation* field descriptions |
| --- |
| ***as-Config***  The radio resource configuration. Applicable in case of intra-E-UTRA handover, resume or re-establishment. If the target receives an incomplete *MeasConfig* and/or *RadioResourceConfigDedicated* in the *as-Config*, the target eNB may decide to apply the full configuration option based on the *ue-ConfigRelease*. |
| ***as-Context***  Local E-UTRAN context required by the target eNB. |
| ***makeBeforeBreakReq***  To request the target eNB to add the *makeBeforeBreak* indication in the *mobilityControlInfo* in case of intra-frequency handover. |
| ***rrm-Config***  Local E-UTRAN context used depending on the target node's implementation, which is mainly used for the RRM purpose. May also be provided at inter-RAT handover from NR. |
| ***sourceRB-ConfigIntra5GC***  NR radio bearer config used at intra5GC handover, resume or re-establishment, as defined by *RadioBearerConfig* IE in TS 38.331 [82]. |
| ***ue-ConfigRelease***  Indicates the RRC protocol release or version applicable for the current UE configuration. This could be used by target eNB to decide if the full configuration approach should be used. If this field is not present, the target assumes that the current UE configuration is based on the release 8 version of RRC protocol. NOTE 1. |
| ***ue-RadioAccessCapabilityInfo***  For E-UTRA radio access capabilities, it is up to E-UTRA how the backward compatibility among *supportedBandCombinationReduced*, *supportedBandCombination* and *supportedBandCombinationAdd* is ensured. If *supportedBandCombinationReduced* and *supportedBandCombination*/*supportedBandCombinationAdd* are included into *ueCapabilityRAT-Container*, it can be assumed that the value of fields, *requestedBands*, *reducedIntNonContCombRequested* and *requestedCCsXL* are consistend with all supported band combination fields. NOTE 2 |
| ***ue-SupportedEARFCN***  Includes UE supported EARFCN of the handover target E-UTRA cell if the target E-UTRA cell belongs to multiple frequency bands. |

NOTE 1: The source typically sets the *ue-ConfigRelease* to the release corresponding with the current dedicated radio configuration. The source may however also consider the common radio resource configuration e.g. in case interoperability problems would appear if the UE temporary continues extensions of this part of the configuration in a target PCell not supporting them.

NOTE 2: The following table indicates per source RAT whether RAT capabilities are included or not.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source RAT | E-UTRA capabilites | UTRA capabilities | GERAN capabilities | MR DC capabilities | NR capabilities |
| UTRAN | Included | May be included, ignored by eNB if received | May be included | Excluded | Excluded |
| GERAN CS | Excluded | May be included, ignored by eNB if received | Included | Excluded | Excluded |
| GERAN PS | Excluded | May be included, ignored by eNB if received | Included | Excluded | Excluded |
| E-UTRAN | May be included if UE Radio Capability ID as specified in 23.502 [102] is used for the UE. Included otherwise. | May be included | May be included | May be included | May be included |
| NR | May be included if UE Radio Capability ID as specified in 23.502 [102] is used for the UE. Included otherwise. | Excluded | Excluded | May be included | May be included |

| Conditional presence | Explanation |
| --- | --- |
| *HO* | The field is mandatory present in case of handover or UE context retrieval, e.g. in case of resume or re-establishment within E-UTRA; otherwise the field is not present. |
| *HO2* | The field is optional present in case of handover or UE context retrieval, e.g. in case of resume or re-establishment within E-UTRA; otherwise the field is not present. |
| *HO3* | The field is optional present in case of handover from GERAN to E-UTRA, otherwise the field is not present. |
| *HO4* | The field is mandatory present in case of handover or UE context retrieval, e.g. in case of resume or re-establishment within E-UTRA/5GC and optional present in case of handover from NR to E-UTRA/5GC; otherwise the field is not present. |
| *HO5* | The field is optional present in case of handover within E-UTRA, or handover from NR to E-UTRA; otherwise the field is not present. |

#### – *SCG-Config*

This message is used to transfer the SCG radio configuration generated by the SeNB.

Direction: Secondary eNB to master eNB

*SCG-Config* message

-- ASN1START

SCG-Config-r12 ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE{

scg-Config-r12 SCG-Config-r12-IEs,

spare7 NULL,

spare6 NULL, spare5 NULL, spare4 NULL,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

SCG-Config-r12-IEs ::= SEQUENCE {

scg-RadioConfig-r12 SCG-ConfigPartSCG-r12 OPTIONAL,

nonCriticalExtension SCG-Config-v12i0a-IEs OPTIONAL

}

SCG-Config-v12i0a-IEs ::= SEQUENCE {

-- Following field is only for late non-critical extensions from REL-12

lateNonCriticalExtension OCTET STRING (CONTAINING SCG-Config-v12i0b-IEs) OPTIONAL,

nonCriticalExtension SCG-Config-v13c0-IEs OPTIONAL

}

SCG-Config-v12i0b-IEs ::= SEQUENCE {

scg-RadioConfig-v12i0 SCG-ConfigPartSCG-v12f0 OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

SCG-Config-v13c0-IEs ::= SEQUENCE {

scg-RadioConfig-v13c0 SCG-ConfigPartSCG-v13c0 OPTIONAL,

-- Following field is only for late non-critical extensions from REL-13 onwards

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *SCG-Config* field descriptions |
| --- |
| ***scg-RadioConfig-r12***  Includes the change of the dedicated SCG configuration and, upon addition of an SCG cell, the common SCG configuration.  The SeNB only includes a new SCG cell in response to a request from MeNB, but may include release of an SCG cell release or release of the SCG part of an SCG/Split DRB without prior request from MeNB. The SeNB does not use this field to initiate release of the SCG. |

#### – *SCG-ConfigInfo*

This message is used by MeNB to request the SeNB to perform certain actions e.g. to establish, modify or release an SCG, and it may include additional information e.g. to assist the SeNB with assigning the SCG configuration.

Direction: Master eNB to secondary eNB

*SCG-ConfigInfo* message

-- ASN1START

SCG-ConfigInfo-r12 ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE{

scg-ConfigInfo-r12 SCG-ConfigInfo-r12-IEs,

spare7 NULL,

spare6 NULL, spare5 NULL, spare4 NULL,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

SCG-ConfigInfo-r12-IEs ::= SEQUENCE {

radioResourceConfigDedMCG-r12 RadioResourceConfigDedicated OPTIONAL,

sCellToAddModListMCG-r12 SCellToAddModList-r10 OPTIONAL,

measGapConfig-r12 MeasGapConfig OPTIONAL,

powerCoordinationInfo-r12 PowerCoordinationInfo-r12 OPTIONAL,

scg-RadioConfig-r12 SCG-ConfigPartSCG-r12 OPTIONAL,

eutra-CapabilityInfo-r12 OCTET STRING (CONTAINING UECapabilityInformation) OPTIONAL,

scg-ConfigRestrictInfo-r12 SCG-ConfigRestrictInfo-r12 OPTIONAL,

mbmsInterestIndication-r12 OCTET STRING (CONTAINING

MBMSInterestIndication-r11) OPTIONAL,

measResultServCellListSCG-r12 MeasResultServCellListSCG-r12 OPTIONAL,

drb-ToAddModListSCG-r12 DRB-InfoListSCG-r12 OPTIONAL,

drb-ToReleaseListSCG-r12 DRB-ToReleaseList OPTIONAL,

sCellToAddModListSCG-r12 SCellToAddModListSCG-r12 OPTIONAL,

sCellToReleaseListSCG-r12 SCellToReleaseList-r10 OPTIONAL,

p-Max-r12 P-Max OPTIONAL,

nonCriticalExtension SCG-ConfigInfo-v1310-IEs OPTIONAL

}

SCG-ConfigInfo-v1310-IEs ::= SEQUENCE {

measResultSSTD-r13 MeasResultSSTD-r13 OPTIONAL,

sCellToAddModListMCG-Ext-r13 SCellToAddModListExt-r13 OPTIONAL,

measResultServCellListSCG-Ext-r13 MeasResultServCellListSCG-Ext-r13 OPTIONAL,

sCellToAddModListSCG-Ext-r13 SCellToAddModListSCG-Ext-r13 OPTIONAL,

sCellToReleaseListSCG-Ext-r13 SCellToReleaseListExt-r13 OPTIONAL,

nonCriticalExtension SCG-ConfigInfo-v1330-IEs OPTIONAL

}

SCG-ConfigInfo-v1330-IEs ::= SEQUENCE {

measResultListRSSI-SCG-r13 MeasResultListRSSI-SCG-r13 OPTIONAL,

nonCriticalExtension SCG-ConfigInfo-v1430-IEs OPTIONAL

}

SCG-ConfigInfo-v1430-IEs ::= SEQUENCE {

makeBeforeBreakSCG-Req-r14 ENUMERATED {true} OPTIONAL,

measGapConfigPerCC-List MeasGapConfigPerCC-List-r14 OPTIONAL,

nonCriticalExtension SCG-ConfigInfo-v1530-IEs OPTIONAL

}

SCG-ConfigInfo-v1530-IEs ::= SEQUENCE {

drb-ToAddModListSCG-r15 DRB-InfoListSCG-r15 OPTIONAL,

drb-ToReleaseListSCG-r15 DRB-ToReleaseList-r15 OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

DRB-InfoListSCG-r12 ::= SEQUENCE (SIZE (1..maxDRB)) OF DRB-InfoSCG-r12

DRB-InfoListSCG-r15 ::= SEQUENCE (SIZE (1..maxDRB-r15)) OF DRB-InfoSCG-r12

DRB-InfoSCG-r12 ::= SEQUENCE {

eps-BearerIdentity-r12 INTEGER (0..15) OPTIONAL, -- Cond DRB-Setup

drb-Identity-r12 DRB-Identity,

drb-Type-r12 ENUMERATED {split, scg} OPTIONAL, -- Cond DRB-Setup

...

}

SCellToAddModListSCG-r12 ::= SEQUENCE (SIZE (1..maxSCell-r10)) OF Cell-ToAddMod-r12

SCellToAddModListSCG-Ext-r13 ::= SEQUENCE (SIZE (1..maxSCell-r13)) OF Cell-ToAddMod-r12

Cell-ToAddMod-r12 ::= SEQUENCE {

sCellIndex-r12 SCellIndex-r10,

cellIdentification-r12 SEQUENCE {

physCellId-r12 PhysCellId,

dl-CarrierFreq-r12 ARFCN-ValueEUTRA-r9

} OPTIONAL, -- Cond SCellAdd

measResultCellToAdd-r12 SEQUENCE {

rsrpResult-r12 RSRP-Range,

rsrqResult-r12 RSRQ-Range

} OPTIONAL, -- Cond SCellAdd2

...,

[[ sCellIndex-r13 SCellIndex-r13 OPTIONAL,

measResultCellToAdd-v1310 SEQUENCE {

rs-sinr-Result-r13 RS-SINR-Range-r13

} OPTIONAL -- Cond SCellAdd2

]]

}

MeasResultServCellListSCG-r12 ::= SEQUENCE (SIZE (1..maxServCell-r10)) OF MeasResultServCellSCG-r12

MeasResultServCellListSCG-Ext-r13 ::= SEQUENCE (SIZE (1..maxServCell-r13)) OF MeasResultServCellSCG-r12

MeasResultServCellSCG-r12 ::= SEQUENCE {

servCellId-r12 ServCellIndex-r10,

measResultSCell-r12 SEQUENCE {

rsrpResultSCell-r12 RSRP-Range,

rsrqResultSCell-r12 RSRQ-Range

},

...,

[[ servCellId-r13 ServCellIndex-r13 OPTIONAL,

measResultSCell-v1310 SEQUENCE {

rs-sinr-ResultSCell-r13 RS-SINR-Range-r13

} OPTIONAL

]]

}

MeasResultListRSSI-SCG-r13 ::= SEQUENCE (SIZE (1..maxServCell-r13)) OF MeasResultRSSI-SCG-r13

MeasResultRSSI-SCG-r13 ::= SEQUENCE {

servCellId-r13 ServCellIndex-r13,

measResultForRSSI-r13 MeasResultForRSSI-r13

}

SCG-ConfigRestrictInfo-r12 ::= SEQUENCE {

maxSCH-TB-BitsDL-r12 INTEGER (1..100),

maxSCH-TB-BitsUL-r12 INTEGER (1..100)

}

-- ASN1STOP

| *SCG-ConfigInfo* field descriptions |
| --- |
| ***drb-ToAddModListSCG***  Includes DRBs the SeNB is requested to establish or modify (DRB type change). |
| ***drb-ToReleaseListSCG***  Includes DRBs the SeNB is requested to release. |
| ***makeBeforeBreakSCG-Req***  To request the target eNB to add the *makeBeforeBreakSCG* indication in the *mobilityControlInfoSCG* in case of intra-frequency SCG change. |
| ***maxSCH-TB-BitsXL***  Indicates the maximum DL-SCH/UL-SCH TB bits that may be scheduled in a TTI. Specified as a percentage of the value defined for the applicable UE category. |
| ***measGapConfig***  Includes the current measurement gap configuration. |
| ***measResultListRSSI-SCG***  Includes RSSI measurement results of SCG (serving) cells |
| ***measResultSSTD***  Includes measurement results of UE SFN and Subframe Timing Difference between the PCell and the PSCell. |
| ***measResultServCellListSCG***  Includes measurement results of SCG (serving) cells. |
| ***radioResourceConfigDedMCG***  Includes the current dedicated MCG radio resource configuration. |
| ***sCellIndex***  If sCellIndex-r13 is present, sCellIndex-r12 shall be ignored. |
| ***sCellToAddModListMCG, sCellToAddModListMCG-Ext***  Includes the current MCG SCell configuration. Field *sCellToAddModListMCG* is used to add the first 4 SCells with *sCellIndex-r10* while *sCellToAddModListMCG-Ext* is used to add the rest. |
| ***sCellToAddModListSCG, sCellToAddModListSCG-Ext***  Includes SCG cells the SeNB is requested to establish. Measurement results may be provided for these cells. Field *sCellToAddModListSCG* is used to add the first 4 SCells with *sCellIndex-r12* while *sCellToAddModListSCG-Ext* is used to add the rest. |
| ***sCellToReleaseListSCG, sCellToReleaseListSCG-Ext***  Includes SCG cells the SeNB is requested to release. |
| ***scg-RadioConfig***  Includes the current dedicated SCG configuration. |
| ***scg-ConfigRestrictInfo***  Includes fields for which MeNB explictly indicates the restriction to be observed by SeNB. |
| ***servCellId***  If servCellId-r13 is present, servCellId-r12 shall be ignored. |
| ***p-Max***  Cell specific value i.e. as broadcast by PCell. |

| Conditional presence | Explanation |
| --- | --- |
| *DRB-Setup* | The field is mandatory present in case DRB establishment is requested; otherwise the field is not present. |
| *SCellAdd* | The field is mandatory present in case SCG cell establishment is requested; otherwise the field is not present. |
| *SCellAdd2* | The field is optional present in case SCG cell establishment is requested; otherwise the field is not present. |

#### – *UEPagingCoverageInformation*

This message is used to transfer UE paging coverage information, covering both upload to and download from the EPC/5GC.

Direction: eNB to/from EPC, ng-eNB to/from 5GC

*UEPagingCoverageInformation* message

-- ASN1START

UEPagingCoverageInformation ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE{

uePagingCoverageInformation-r13 UEPagingCoverageInformation-r13-IEs,

spare7 NULL,

spare6 NULL, spare5 NULL, spare4 NULL,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

UEPagingCoverageInformation-r13-IEs ::= SEQUENCE {

mpdcch-NumRepetition-r13 INTEGER (1..256) OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *UEPagingCoverageInformation* field descriptions |
| --- |
| ***mpdcch-NumRepetition***  Number of repetitions for MPDCCH. The value is an estimate of the required number of repetitions for MPDCCH for paging. |

#### – *UERadioAccessCapabilityInformation*

This message is used to transfer UE radio access capability information, covering both upload to and download from the EPC/5GC.

Direction: eNB to/from EPC, ng-eNB to/from 5GC

*UERadioAccessCapabilityInformation* message

-- ASN1START

UERadioAccessCapabilityInformation ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE{

ueRadioAccessCapabilityInformation-r8

UERadioAccessCapabilityInformation-r8-IEs,

spare7 NULL,

spare6 NULL, spare5 NULL, spare4 NULL,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

UERadioAccessCapabilityInformation-r8-IEs ::= SEQUENCE {

ue-RadioAccessCapabilityInfo OCTET STRING (CONTAINING UECapabilityInformation),

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *UERadioAccessCapabilityInformation* field descriptions |
| --- |
| ***ue-RadioAccessCapabilityInfo***  Including E-UTRA, GERAN, CDMA2000-1xRTT Bandclass, NR and MR-DC radio access capabilities (separated). UTRA radio access capabilities are not included. For E-UTRA radio access capabilities, it is up to E-UTRA how the backward compatibility among *supportedBandCombinationReduced*, *supportedBandCombination* and *supportedBandCombinationAdd* is ensured. If *supportedBandCombinationReduced* and *supportedBandCombination*/*supportedBandCombinationAdd* are included into *ueCapabilityRAT-Container*, it can be assumed that the value of fields, *requestedBands*, *reducedIntNonContCombRequested* and *requestedCCsXL* are consistent with all supported band combination fields. |

#### – *UERadioPagingInformation*

This message is used to transfer radio paging information, covering both upload to and download from the EPC/5GC.

Direction: eNB to/ from EPC, ng-eNB to/from 5GC

*UERadioPagingInformation* message

-- ASN1START

UERadioPagingInformation ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE{

ueRadioPagingInformation-r12 UERadioPagingInformation-r12-IEs,

spare7 NULL,

spare6 NULL, spare5 NULL, spare4 NULL,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

UERadioPagingInformation-r12-IEs ::= SEQUENCE {

ue-RadioPagingInfo-r12 OCTET STRING (CONTAINING UE-RadioPagingInfo-r12),

nonCriticalExtension UERadioPagingInformation-v1310-IEs OPTIONAL

}

UERadioPagingInformation-v1310-IEs ::= SEQUENCE {

supportedBandListEUTRAForPaging-r13 SEQUENCE (SIZE (1..maxBands)) OF FreqBandIndicator-r11 OPTIONAL,

nonCriticalExtension UERadioPagingInformation-v1610-IEs OPTIONAL

}

UERadioPagingInformation-v1610-IEs ::= SEQUENCE {

accessStratumRelease-r16 ENUMERATED {true} OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *UERadioPagingInformation* field descriptions |
| --- |
| ***accessStratumRelease***  Indicates that the UE supports reception of *accessType-r16* in the Paging message. |
| ***supportedBandListEUTRAForPaging***  Indicates the UE supported frequency bands which is derived by the eNB from *UE-EUTRA-Capability*. |
| ***ue-RadioPagingInfo***  The field is used to transfer UE capability information used for paging. The eNB generates the *ue-RadioPagingInfo* andthe contained UE capability information is absent when not supported by the UE. |

## 10.3 Inter-node RRC information element definitions

#### – *AS-Config*

The *AS-Config* IE contains information about RRC configuration information in the source eNB which can be utilized by target eNB to determine the need to change the RRC configuration during the handover preparation phase. The information can also be used after the handover is successfully performed or during the RRC connection re-establishment or resume.

*AS-Config* information element

-- ASN1START

AS-Config ::= SEQUENCE {

sourceMeasConfig MeasConfig,

sourceRadioResourceConfig RadioResourceConfigDedicated,

sourceSecurityAlgorithmConfig SecurityAlgorithmConfig,

sourceUE-Identity C-RNTI,

sourceMasterInformationBlock MasterInformationBlock,

sourceSystemInformationBlockType1 SystemInformationBlockType1(WITH COMPONENTS

{..., nonCriticalExtension ABSENT}),

sourceSystemInformationBlockType2 SystemInformationBlockType2,

antennaInfoCommon AntennaInfoCommon,

sourceDl-CarrierFreq ARFCN-ValueEUTRA,

...,

[[ sourceSystemInformationBlockType1Ext OCTET STRING (CONTAINING

SystemInformationBlockType1-v890-IEs) OPTIONAL,

sourceOtherConfig-r9 OtherConfig-r9

-- sourceOtherConfig-r9 should have been optional. A target eNB compliant with this transfer

-- syntax should support receiving an AS-Config not including this extension addition group

-- e.g. from a legacy source eNB

]],

[[ sourceSCellConfigList-r10 SCellToAddModList-r10 OPTIONAL

]],

[[ sourceConfigSCG-r12 SCG-Config-r12 OPTIONAL

]],

[[ as-ConfigNR-r15 AS-ConfigNR-r15 OPTIONAL

]],

[[ as-Config-v1550 AS-Config-v1550 OPTIONAL

]],

[[ as-ConfigNR-v1570 AS-ConfigNR-v1570 OPTIONAL

]],

[[ as-ConfigNR-v1620 AS-ConfigNR-v1620 OPTIONAL

]]

}

AS-Config-v9e0 ::= SEQUENCE {

sourceDl-CarrierFreq-v9e0 ARFCN-ValueEUTRA-v9e0

}

AS-Config-v10j0 ::= SEQUENCE {

antennaInfoDedicatedPCell-v10i0 AntennaInfoDedicated-v10i0 OPTIONAL

}

AS-Config-v1250 ::= SEQUENCE {

sourceWlan-OffloadConfig-r12 WLAN-OffloadConfig-r12 OPTIONAL,

sourceSL-CommConfig-r12 SL-CommConfig-r12 OPTIONAL,

sourceSL-DiscConfig-r12 SL-DiscConfig-r12 OPTIONAL

}

AS-Config-v1320 ::= SEQUENCE {

sourceSCellConfigList-r13 SCellToAddModListExt-r13 OPTIONAL,

sourceRCLWI-Configuration-r13 RCLWI-Configuration-r13 OPTIONAL

}

AS-Config-v13c0 ::= SEQUENCE {

radioResourceConfigDedicated-v13c01 RadioResourceConfigDedicated-v1370 OPTIONAL,

radioResourceConfigDedicated-v13c02 RadioResourceConfigDedicated-v13c0 OPTIONAL,

sCellToAddModList-v13c0 SCellToAddModList-v13c0 OPTIONAL,

sCellToAddModListExt-v13c0 SCellToAddModListExt-v13c0 OPTIONAL

}

AS-Config-v1430 ::= SEQUENCE {

sourceSL-V2X-CommConfig-r14 SL-V2X-ConfigDedicated-r14 OPTIONAL,

sourceLWA-Config-r14 LWA-Config-r13 OPTIONAL,

sourceWLAN-MeasResult-r14 MeasResultListWLAN-r13 OPTIONAL

}

AS-ConfigNR-r15 ::= SEQUENCE {

sourceRB-ConfigNR-r15 OCTET STRING OPTIONAL,

sourceRB-ConfigSN-NR-r15 OCTET STRING OPTIONAL,

sourceOtherConfigSN-NR-r15 OCTET STRING OPTIONAL

}

AS-ConfigNR-v1570 ::= SEQUENCE {

sourceSCG-ConfiguredNR-r15 ENUMERATED {true}

}

AS-Config-v1550 ::= SEQUENCE {

tdm-PatternConfig-r15 SEQUENCE {

subframeAssignment-r15 SubframeAssignment-r15,

harq-Offset-r15 INTEGER (0.. 9)

} OPTIONAL,

p-MaxEUTRA-r15 P-Max OPTIONAL

}

AS-ConfigNR-v1620 ::= SEQUENCE {

tdm-PatternConfig2-r16 TDM-PatternConfig-r15

}

AS-Config-v1700 ::= SEQUENCE {

scg-State-r17 ENUMERATED { deactivated } OPTIONAL

}

-- ASN1STOP

NOTE: The *AS-Config* re-uses information elements primarily created to cover the radio interface signalling requirements. Consequently, the information elements may include some parameters that are not relevant for the target eNB e.g. the SFN as included in the *MasterInformationBlock*.

| *AS-Config* field descriptions |
| --- |
| ***antennaInfoCommon***  This field provides information about the number of antenna ports in the source PCell. |
| ***p-MaxEUTRA***  Indicates the *p-MaxEUTRA* in the source PCell. |
| ***scg-State***  Indicates that the SCG is deactivated. |
| ***sourceOtherConfigSN-NR***  Other NR config set by SN (cell group, measurements) in case of (NG)EN-DC i.e. as defined by the *RRCReconfiguration* message in TS 38.331 [82]. |
| ***sourceRB-ConfigNR***  NR radio bearer config, as defined by *RadioBearerConfig* IE in TS 38.331 [82]. The field may e.g. be set by MN in case of (NG)EN-DC, by source eNB connected to 5GCN. |
| ***sourceRB-ConfigSN-NR***  NR radio bearer config set by SN in case of (NG)EN-DC or of SN terminated RB without SCG, as defined by *RadioBearerConfig* IE in TS 38.331 [82]. |
| ***sourceDL-CarrierFreq***  Provides the parameter Downlink EARFCN in the source PCell, see TS 36.101 [42]. If the source eNB provides *AS-Config-v9e0*, it sets *sourceDl-CarrierFreq* (i.e. without suffix) to *maxEARFCN*. |
| ***sourceLWA-Config***  LWA configuration in the source PCell when handover is triggered. |
| ***sourceOtherConfig***  Provides other configuration in the source PCell. |
| ***sourceMasterInformationBlock***  *MasterInformationBlock* transmitted in the source PCell. |
| ***sourceMeasConfig***  Measurement configuration in the source cell. The measurement configuration for all measurements existing in the source eNB when handover is triggered shall be included. See 10.5. |
| ***sourceRCLWI-Configuration***  RCLWI Configuration in the source PCell. |
| ***sourceSL-CommConfig***  This field covers the sidelink communication configuration. |
| ***sourceSL-DiscConfig***  This field covers the sidelink discovery configuration. |
| ***sourceRadioResourceConfig***  Radio configuration in the source PCell. The radio resource configuration for all radio bearers existing in the source PCell when handover is triggered shall be included. See 10.5. |
| ***sourceSCellConfigList***  Radio resource configuration (common and dedicated) of the SCells configured in the source eNB. |
| ***sourceSCG-ConfiguredNR***  Value *true* indicates that the UE is configured with NR SCG in source configuration. The field is included only if *sourceOtherConfigSN-NR* is not included. |
| ***sourceSecurityAlgorithmConfig***  This field provides the AS integrity protection (SRBs) and AS ciphering (SRBs and DRBs) algorithm configuration used in the source PCell. |
| ***sourceSystemInformationBlockType1***  *SystemInformationBlockType1* (or *SystemInformationBlockType1-BR*) transmitted in the source PCell. |
| ***sourceSystemInformationBlockType2***  *SystemInformationBlockType2* transmitted in the source PCell. |
| ***sourceSL-V2X-CommConfig***  Indicates the V2X sidelink communication related configurations configured in the source eNB. |
| ***sourceWLAN-MeasResult***  WLAN measurement results in the source PCell when handover is triggered. |
| ***tdm-PatternConfig***  Indicates the *tdm-PatternConfig* configured to the UE in the source PCell. |
| ***tdm-PatternConfig2***  Indicates the *tdm-PatternConfig2* configured to the UE in the source PCell. |

#### – *AS-Context*

The IE *AS-Context* is used to transfer local E-UTRAN context required by the target eNB.

*AS-Context* information element

-- ASN1START

AS-Context ::= SEQUENCE {

reestablishmentInfo ReestablishmentInfo OPTIONAL -- Cond HO

}

AS-Context-v1130 ::= SEQUENCE {

idc-Indication-r11 OCTET STRING (CONTAINING

InDeviceCoexIndication-r11) OPTIONAL, -- Cond HO2

mbmsInterestIndication-r11 OCTET STRING (CONTAINING

MBMSInterestIndication-r11) OPTIONAL, -- Cond HO2

ueAssistanceInformation-r11 OCTET STRING (CONTAINING

UEAssistanceInformation-r11) OPTIONAL, -- Cond HO2

...,

[[ sidelinkUEInformation-r12 OCTET STRING (CONTAINING

SidelinkUEInformation-r12) OPTIONAL -- Cond HO2

]],

[[ sourceContextEN-DC-r15 OCTET STRING OPTIONAL -- Cond HO2

]],

[[ selectedbandCombinationInfoEN-DC-v1540 OCTET STRING OPTIONAL -- Cond HO2

]]

}

AS-Context-v1320 ::= SEQUENCE {

wlanConnectionStatusReport-r13 OCTET STRING (CONTAINING

WLANConnectionStatusReport-r13) OPTIONAL -- Cond HO2

}

AS-Context-v1610 ::= SEQUENCE {

sidelinkUEInformationNR-r16 OCTET STRING OPTIONAL, -- Cond HO3

ueAssistanceInformationNR-r16 OCTET STRING OPTIONAL, -- Cond HO3

configRestrictInfoDAPS-r16 ConfigRestrictInfoDAPS-r16 OPTIONAL -- Cond HO2

}

AS-Context-v1620 ::= SEQUENCE {

ueAssistanceInformationNR-SCG-r16 OCTET STRING OPTIONAL -- Cond HO2

}

AS-Context-v1630 ::= SEQUENCE {

configRestrictInfoDAPS-v1630 ConfigRestrictInfoDAPS-v1630 OPTIONAL -- Cond HO2

}

ConfigRestrictInfoDAPS-r16 ::= SEQUENCE {

maxSCH-TB-BitsDL-r16 INTEGER (1..100) OPTIONAL, -- Cond HO2

maxSCH-TB-BitsUL-r16 INTEGER (1..100) OPTIONAL -- Cond HO2

}

ConfigRestrictInfoDAPS-v1630 ::= SEQUENCE {

daps-PowerCoordinationInfo-r16 DAPS-PowerCoordinationInfo-r16 OPTIONAL -- Cond HO2

}

-- ASN1STOP

| *AS-Context* field descriptions |
| --- |
| ***idc-Indication***  Including information used for handling the IDC problems. |
| ***maxSCH-TB-BitsXL***  Indicates the maximum DL-SCH/UL-SCH TB bits that may be scheduled in a TTI during DAPS HO. Specified as a percentage of the value defined for the applicable UE category. |
| ***reestablishmentInfo***  Including information needed for the RRC connection re-establishment. |
| ***sourceContextEN-DC***  (NG)EN-DC related context information, in particular regarding the UE capability coordination, as defined by the *ConfigRestrictInfoSCG* IE specified in TS 38.331 [82]. |
| ***selectedBandCombinationInfoEN-DC***  Including the *BandCombinationInfoSN* IE specified in TS 38.331 [82]. See NOTE 1. |
| ***sidelinkUEInformationNR***  Including sidelink UE information as defined by the *SidelinkUEInformationNR* message specified in TS 38.331 [82]. |
| ***ueAssistanceInformation***  Including UE assistance information as defined by the *UEAssistanceInformation* message e.g. concerning power preference, overheating. |
| ***ueAssistanceInformationNR***  Including sidelink UE assistance information as defined by the *UEAssistanceInformation* message specified in TS 38.331 [82]. |
| ***ueAssistanceInformationNR-SCG***  Includes for each UE assistance feature associated with the NR SCG as specified in TS 38.331 [82], the information last reported by the UE in the NR *UEAssistanceInformation* message for the NR SCG, if any. |

| Conditional presence | Explanation |
| --- | --- |
| *HO* | The field is mandatory present in case of handover within E-UTRA; otherwise the field is not present. |
| *HO2* | The field is optional present in case of handover within E-UTRA; otherwise the field is not present. |
| *HO3* | The field is optional present in case of handover within E-UTRA, or handover from NR to E-UTRA; otherwise the field is not present. |

NOTE 1: If the field is present, it is used to help target MN to decide appropriate LTE band for SCell frequency measurement in case of inter-MN handover without SN change.

#### – *ReestablishmentInfo*

The *ReestablishmentInfo* IE contains information needed for the RRC connection re-establishment.

*ReestablishmentInfo* information element

-- ASN1START

ReestablishmentInfo ::= SEQUENCE {

sourcePhysCellId PhysCellId,

targetCellShortMAC-I ShortMAC-I,

additionalReestabInfoList AdditionalReestabInfoList OPTIONAL,

...

}

AdditionalReestabInfoList ::= SEQUENCE ( SIZE (1..maxReestabInfo) ) OF AdditionalReestabInfo

AdditionalReestabInfo ::= SEQUENCE{

cellIdentity CellIdentity,

key-eNodeB-Star Key-eNodeB-Star,

shortMAC-I ShortMAC-I

}

Key-eNodeB-Star ::= BIT STRING (SIZE (256))

-- ASN1STOP

| *ReestablishmentInfo field descriptions* |
| --- |
| ***additionalReestabInfoList***  Contains a list of shortMAC-I and KeNB\* for cells under control of the target eNB, required for potential re-establishment by the UE in these cells to succeed. |
| ***Key-eNodeB-Star***  Parameter KeNB\*: See TS 33.401 [32], clause 7.2.8.4. If the cell identified by *cellIdentity* belongs to multiple frequency bands, the source eNB selects the DL-EARFCN for the KeNB\* calculation using the same logic as UE uses when selecting the DL-EARFCN in IDLE as defined in clause 6.2.2. This parameter is only used for X2 handover, and for S1 handover, it shall be ignored by target eNB. |
| ***sourcePhyCellId***  The physical cell identity of the source PCell, used to determine the UE context in the target eNB at re-establishment. |
| ***targetCellShortMAC-I***  The ShortMAC-I for the handover target PCell, in order for potential re-establishment to succeed. |

#### – *RRM-Config*

The *RRM-Config* IE contains information about UE specific RRM information before the handover which can be utilized by target eNB.

*RRM-Config* information element

-- ASN1START

RRM-Config ::= SEQUENCE {

ue-InactiveTime ENUMERATED {

s1, s2, s3, s5, s7, s10, s15, s20,

s25, s30, s40, s50, min1, min1s20c, min1s40,

min2, min2s30, min3, min3s30, min4, min5, min6,

min7, min8, min9, min10, min12, min14, min17, min20,

min24, min28, min33, min38, min44, min50, hr1,

hr1min30, hr2, hr2min30, hr3, hr3min30, hr4, hr5, hr6,

hr8, hr10, hr13, hr16, hr20, day1, day1hr12, day2,

day2hr12, day3, day4, day5, day7, day10, day14, day19,

day24, day30, dayMoreThan30} OPTIONAL,

...,

[[ candidateCellInfoList-r10 CandidateCellInfoList-r10 OPTIONAL

]],

[[ candidateCellInfoListNR-r15 MeasResultServFreqListNR-r15 OPTIONAL

]]

}

CandidateCellInfoList-r10 ::= SEQUENCE (SIZE (1..maxFreq)) OF CandidateCellInfo-r10

CandidateCellInfo-r10 ::= SEQUENCE {

-- cellIdentification

physCellId-r10 PhysCellId,

dl-CarrierFreq-r10 ARFCN-ValueEUTRA,

-- available measurement results

rsrpResult-r10 RSRP-Range OPTIONAL,

rsrqResult-r10 RSRQ-Range OPTIONAL,

...,

[[ dl-CarrierFreq-v1090 ARFCN-ValueEUTRA-v9e0 OPTIONAL

]],

[[ rsrqResult-v1250 RSRQ-Range-v1250 OPTIONAL

]],

[[ rs-sinr-Result-r13 RS-SINR-Range-r13 OPTIONAL

]]

}

-- ASN1STOP

| *RRM-Config* field descriptions |
| --- |
| ***candidateCellInfoList***  A list of the best cells on each frequency for which measurement information was available, in order of decreasing RSRP. |
| ***candidateCellInfoListNR***  A list of NR cells including serving cells and best neighbour cells on each SSB requency, for which measurement results were available, and for each cell the best beams. |
| ***dl-CarrierFreq***  The source includes *dl-CarrierFreq-v1090* if and only if *dl-CarrierFreq-r10* is set to *maxEARFCN*. |
| ***ue-InactiveTime***  Duration while UE has not received or transmitted any user data. Thus the timer is still running in case e.g., UE measures the neighbour cells for the HO purpose. Value s1 corresponds to 1 second, s2 corresponds to 2 seconds and so on. Value min1 corresponds to 1 minute, value min1s20 corresponds to 1 minute and 20 seconds, value min1s40 corresponds to 1 minute and 40 seconds and so on. Value hr1 corresponds to 1 hour, hr1min30 corresponds to 1 hour and 30 minutes and so on. |

## 10.4 Inter-node RRC multiplicity and type constraint values

### – Multiplicity and type constraints definitions

-- ASN1START

maxReestabInfo INTEGER ::= 32 -- Maximum number of KeNB\* and shortMAC-I forwarded

-- at handover for re-establishment preparation

-- ASN1STOP

### – End of *EUTRA-InterNodeDefinitions*

-- ASN1START

END

-- ASN1STOP

## 10.5 Mandatory information in *AS-Config*

The *AS-Config* transferred between source eNB and target-eNB shall include all IEs necessary to describe the AS context. The conditional presence in clause 6 is only applicable for eNB to UE communication.

The "need" or "cond" statements are not applied in case of sending the IEs from source eNB to target eNB. Some fields shall be included regardless of the "need" or "cond" e.g. *discardTimer*. The *AS-Config* re-uses information elements primarily created to cover the radio interface signalling requirements. The information elements may include some parameters that are not relevant for the target eNB e.g. the SFN as included in the *MasterInformationBlock*.

All the fields in the *AS-Config* as defined in 10.3 that are introduced after v9.2.0 and that are optional for eNB to UE communication shall be included, if the functionality is configured, except for the fields *sourceOtherConfigSN-NR* and *sourceRB-ConfigSN-NR* in AS*-ConfigNR*. The fields in the *AS-Config* that are defined before and including v9.2.0 shall be included as specified in the following.

Within the *sourceRadioResourceConfig,* *sourceMeasConfig* and *sourceOtherConfig*, the source eNB shall include fields that are optional for eNB to UE communication, if the functionality is configured unless explicitly specified otherwise in the following:

- in accordance with a condition that is explicitly stated to be applicable; or

- a default value is defined for the concerned field; and the configured value is the same as the default value that is defined; or

- the need of the field is OP and the current UE configuration corresponds with the behaviour defined for absence of the field;

The following fields, if the functionality is configured, are not mandatory for the source eNB to include in the *AS-Config* since delta signalling by the target eNB for these fields is not supported:

- *semiPersistSchedC-RNTI*

*- measGapConfig*

For the measurement configuration, a corresponding operation as 5.5.6.1 and 5.5.2.2a is executed by target eNB.

## 10.6 Inter-node NB-IoT messages

### 10.6.1 General

This clause specifies NB-IoT RRC messages that are sent either across the X2- or the S1-interface, either to or from the eNB, i.e. a single 'logical channel' is used for all NB-IoT RRC messages transferred across network nodes.

### – *NB-IoT-InterNodeDefinitions*

This ASN.1 segment is the start of the NB-IoT inter-node PDU definitions.

-- ASN1START

NBIOT-InterNodeDefinitions DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS

C-RNTI,

PhysCellId,

SecurityAlgorithmConfig,

ShortMAC-I

FROM EUTRA-RRC-Definitions

AdditionalReestabInfoList

FROM EUTRA-InterNodeDefinitions

CarrierFreq-NB-r13,

CarrierFreq-NB-v1550,

RadioResourceConfigDedicated-NB-r13,

UECapabilityInformation-NB,

UE-Capability-NB-r13,

UE-Capability-NB-Ext-r14-IEs,

UE-RadioPagingInfo-NB-r13

FROM NBIOT-RRC-Definitions;

-- ASN1STOP

### 10.6.2 Message definitions

#### – *HandoverPreparationInformation-NB*

This message is used to transfer the UE context from the eNB where the RRC connection has been suspended and transfer it to the eNB where the RRC Connection has been requested to be resumed.

Direction: source eNB to target eNB

*HandoverPreparationInformation-NB* message

-- ASN1START

HandoverPreparationInformation-NB ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE{

handoverPreparationInformation-r13 HandoverPreparationInformation-NB-IEs,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

HandoverPreparationInformation-NB-IEs ::= SEQUENCE {

ue-RadioAccessCapabilityInfo-r13 UE-Capability-NB-r13,

as-Config-r13 AS-Config-NB,

rrm-Config-r13 RRM-Config-NB OPTIONAL,

as-Context-r13 AS-Context-NB OPTIONAL,

nonCriticalExtension HandoverPreparationInformation-NB-v1380-IEs OPTIONAL

}

HandoverPreparationInformation-NB-v1380-IEs ::= SEQUENCE {

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension HandoverPreparationInformation-NB-Ext-r14-IEs OPTIONAL

}

HandoverPreparationInformation-NB-Ext-r14-IEs ::= SEQUENCE {

ue-RadioAccessCapabilityInfoExt-r14 OCTET STRING (CONTAINING UE-Capability-NB-Ext-r14-IEs) OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *HandoverPreparationInformation-NB* field descriptions |
| --- |
| ***as-Config***  The radio resource configuration. |
| ***as-Context***  The local E-UTRAN context required by the target eNB. |
| ***rrm-Config***  The local E-UTRAN context used depending on the target node's implementation, which is mainly used for the RRM purpose. |
| ***ue-RadioAccessCapabilityInfo, ue-RadioAccessCapabilityInfoExt***  The NB-IoT UE Radio Access Capability Parameters, see TS 36.306 [5]. |

#### – *UEPagingCoverageInformation-NB*

This message is used to transfer UE paging coverage information for NB-IoT, covering both upload to and download from the EPC/5GC.

Direction: eNB to/from EPC, ng-eNB to/from 5GC

*UEPagingCoverageInformation-NB* message

-- ASN1START

UEPagingCoverageInformation-NB ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE{

uePagingCoverageInformation-r13 UEPagingCoverageInformation-NB-IEs,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

UEPagingCoverageInformation-NB-IEs ::= SEQUENCE {

-- the possible value(s) can differ from those sent on Uu

npdcch-NumRepetitionPaging-r13 INTEGER (1..2048) OPTIONAL,

nonCriticalExtension UEPagingCoverageInformation-NB-v1700-IEs OPTIONAL

}

UEPagingCoverageInformation-NB-v1700-IEs ::= SEQUENCE {

cbp-Index-r17 INTEGER (1..2) OPTIONAL, -- Cond CBP

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *UEPagingCoverageInformation-NB* field descriptions |
| --- |
| ***cbp-Index***  Index to the coverage-based paging configuration signalled to the UE during RRC connection release. Value 1 corresponds to the first entry in *cbp-ConfigList* and value 2, corresponds to the second entry in *cbp-ConfigList*. |
| ***npdcch-NumRepetitionPaging***  Number of repetitions for NPDCCH, see TS 36.211 [21].This value is an estimate of the required number of repetitions for NPDCCH. |

| Conditional presence | Explanation |
| --- | --- |
| *CBP* | This field is mandatory present if *cbp-Index* has been provided to UE via dedicated signaling (see *RRCConnectionRelease-NB* and *RRCEarlyDataComplete-NB*). Otherwise this field is not present. |

#### – *UERadioAccessCapabilityInformation-NB*

This message is used to transfer UE NB-IoT Radio Access capability information, covering both upload to and download from the EPC/5GC.

Direction: eNB to/from EPC, ng-eNB to/from 5GC

*UERadioAccessCapabilityInformation-NB* message

-- ASN1START

UERadioAccessCapabilityInformation-NB ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE{

ueRadioAccessCapabilityInformation-r13

UERadioAccessCapabilityInformation-NB-IEs,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

UERadioAccessCapabilityInformation-NB-IEs ::= SEQUENCE {

ue-RadioAccessCapabilityInfo-r13 OCTET STRING (CONTAINING UE-Capability-NB-r13),

nonCriticalExtension UERadioAccessCapabilityInformation-NB-v1380-IEs OPTIONAL

}

UERadioAccessCapabilityInformation-NB-v1380-IEs ::= SEQUENCE {

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension UERadioAccessCapabilityInformation-NB-r14-IEs OPTIONAL

}

UERadioAccessCapabilityInformation-NB-r14-IEs ::= SEQUENCE {

ue-RadioAccessCapabilityInfo-r14 OCTET STRING (CONTAINING UECapabilityInformation-NB) OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *UERadioAccessCapabilityInformation-NB* field descriptions |
| --- |
| ***ue-RadioAccessCapabilityInfo***  The NB-IoT UE Radio Access Capability Parameters, see TS 36.306 [5]. |

#### – *UERadioPagingInformation-NB*

This message is used to transfer NB-IoT radio paging information, covering both upload to and download from the EPC/5GC.

Direction: eNB to/from EPC, ng-eNB to/from 5GC

*UERadioPagingInformation-NB* message

-- ASN1START

UERadioPagingInformation-NB ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE{

ueRadioPagingInformation-r13 UERadioPagingInformation-NB-IEs,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

UERadioPagingInformation-NB-IEs ::= SEQUENCE {

ue-RadioPagingInfo-r13 OCTET STRING (CONTAINING UE-RadioPagingInfo-NB-r13),

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *UERadioPagingInformation-NB* field descriptions |
| --- |
| ***ue-RadioPagingInfo***  The field is used to transfer UE NB-IoT capability information used for paging. The eNB generates the *ue-RadioPagingInfo* andthe contained UE capability information is absent when not supported bythe UE. |

## 10.7 Inter-node NB-IoT RRC information element definitions

#### – *AS-Config-NB*

The *AS-Config-NB* IE contains information about NB-IoT RRC configuration information in the source eNB which can be utilized by target eNB.

*AS-Config-NB* information element

-- ASN1START

AS-Config-NB ::= SEQUENCE {

sourceRadioResourceConfig-r13 RadioResourceConfigDedicated-NB-r13,

sourceSecurityAlgorithmConfig-r13 SecurityAlgorithmConfig,

sourceUE-Identity-r13 C-RNTI,

sourceDl-CarrierFreq-r13 CarrierFreq-NB-r13,

...,

[[ sourceDL-CarrierFreq-v1550 CarrierFreq-NB-v1550 OPTIONAL -- Cond TDD

]]

}

-- ASN1STOP

| *AS-Config-NB* field descriptions |
| --- |
| ***sourceDL-CarrierFreq***  Provides the parameter Downlink EARFCN in the source PCell, see TS 36.101 [42]. |
| ***sourceRadioResourceConfig***  Radio configuration in the source PCell. The radio resource configuration for all radio bearers existing in the source PCell shall be included. See 10.9. |
| ***sourceSecurityAlgorithmConfig***  This field provides the AS integrity protection (SRBs) and AS ciphering (SRBs and DRBs) algorithm configuration used in the source PCell. |

| Conditional presence | Explanation |
| --- | --- |
| *TDD* | The field is optionally present in case of TDD; otherwise the field is not present. |

#### – *AS-Context-NB*

The IE *AS-Context-NB* is used to transfer the UE context required by the target eNB.

*AS-Context-NB* information element

-- ASN1START

AS-Context-NB ::= SEQUENCE {

reestablishmentInfo-r13 ReestablishmentInfo-NB OPTIONAL,

...

}

-- ASN1STOP

| *AS-Context-NB* field descriptions |
| --- |
| ***reestablishmentInfo***  Including information needed for the RRC connection re-establishment. |

#### – *ReestablishmentInfo-NB*

The *ReestablishmentInfo-NB* IE contains information needed for the RRC connection re-establishment.

*ReestablishmentInfo-NB* information element

-- ASN1START

ReestablishmentInfo-NB ::= SEQUENCE {

sourcePhysCellId-r13 PhysCellId,

targetCellShortMAC-I-r13 ShortMAC-I,

additionalReestabInfoList-r13 AdditionalReestabInfoList OPTIONAL,

...

}

-- ASN1STOP

| *ReestablishmentInfo-NB field descriptions* |
| --- |
| ***additionalReestabInfoList***  Contains a list of shortMAC-I and KeNB\* for cells under control of the target eNB, required for potential re-establishment by the UE in these cells to succeed. |
| ***sourcePhyCellId***  The physical cell identity of the source PCell, used to determine the UE context in the target eNB at re-establishment. |
| ***targetCellShortMAC-I***  The ShortMAC-I for the target PCell, in order for potential re-establishment to succeed. |

#### – *RRM-Config-NB*

The *RRM-Config-NB* IE contains information about UE specific RRM information which can be utilized by target eNB.

*RRM-Config-NB* information element

-- ASN1START

RRM-Config-NB ::= SEQUENCE {

ue-InactiveTime ENUMERATED {

s1, s2, s3, s5, s7, s10, s15, s20,

s25, s30, s40, s50, min1, min1s20, min1s40,

min2, min2s30, min3, min3s30, min4, min5, min6,

min7, min8, min9, min10, min12, min14, min17, min20,

min24, min28, min33, min38, min44, min50, hr1,

hr1min30, hr2, hr2min30, hr3, hr3min30, hr4, hr5, hr6,

hr8, hr10, hr13, hr16, hr20, day1, day1hr12, day2,

day2hr12, day3, day4, day5, day7, day10, day14, day19,

day24, day30, dayMoreThan30} OPTIONAL,

...

}

-- ASN1STOP

| *RRM-Config-NB* field descriptions |
| --- |
| ***ue-InactiveTime***  Duration while UE has not received or transmitted any user data. Value s1 corresponds to 1 second, s2 corresponds to 2 seconds and so on. Value min1 corresponds to 1 minute, value min1s20 corresponds to 1 minute and 20 seconds, value min1s40 corresponds to 1 minute and 40 seconds and so on. Value hr1 corresponds to 1 hour, hr1min30 corresponds to 1 hour and 30 minutes and so on. |

## 10.8 Inter-node RRC multiplicity and type constraint values

### – Multiplicity and type constraints definitions

### – End of *NB-IoT-InterNodeDefinitions*

-- ASN1START

END

-- ASN1STOP

## 10.9 Mandatory information in *AS-Config-NB*

The *AS-Config-NB* transferred between source eNB and target-eNB shall include all IEs necessary to describe the AS context. The conditional presence in clause 6 is only applicable for eNB to UE communication.

The "Need" or "Cond" statements are not applied in case of sending the IEs from source eNB to target eNB. Some information elements shall be included regardless of the "Need" or "Cond" e.g. *discardTimer*. The *AS-Config-NB* re-uses information elements primarily created to cover the radio interface signalling requirements.

Within the *sourceRadioResourceConfig,* the source eNB shall include fields that are optional for eNB to UE communication, if the functionality is configured unless explicitly specified otherwise in the following:

- in accordance with a condition that is explicitly stated to be applicable; or

- a default value is defined for the concerned field; and the configured value is the same as the default value that is defined; or

- the need of the field is OP and the current UE configuration corresponds with the behaviour defined for absence of the field;

# 11 UE capability related constraints and performance requirements

## 11.1 UE capability related constraints

The following table lists constraints regarding the UE capabilities that E-UTRAN is assumed to take into account.

| Parameter | Description | Value | NB-IoT |
| --- | --- | --- | --- |
| #DRBs | The number of DRBs that a UE shall support | 8, 15  NOTE2  NOTE3 | (0, 1, 2)  NOTE1 |
| #RLC-AM | The number of RLC AM entities that a UE shall support | 10, 17 | (2, 3)  NOTE1 |
| #minCellperMeasObjectEUTRA | The minimum number of neighbour cells (excluding exclude-listed cells) that a UE shall be able to store within a MeasObjectEUTRA. NOTE. | 32 | N/A |
| #minExcludedCellRangesperMeasObjectEUTRA | The minimum number of exclude-listed cell PCI ranges that a UE shall be able to store within a MeasObjectEUTRA | 32 | N/A |
| #minCellperMeasObjectUTRA | The minimum number of neighbour cells that a UE shall be able to store within a MeasObjectUTRA. NOTE. | 32 | N/A |
| #minCellperMeasObjectGERAN | The minimum number of neighbour cells that a UE shall be able to store within a measObjectGERAN. NOTE. | 32 | N/A |
| #minCellperMeasObjectCDMA2000 | The minimum number of neighbour cells that a UE shall be able to store within a measObjectCDMA2000. NOTE. | 32 | N/A |
| #minExcludedCellperMeasObjectNR | The minimum number of exclude-listed cells that a UE shall be able to store within a MeasObjectNR | 32 | N/A |
| #minCellTotal | The minimum number of neighbour cells (excluding exclude-listed cells) that UE shall be able to store in total in all measurement objects configured | 256 | N/A |
| NOTE: In case of CGI reporting, the limit regarding the cells E-UTRAN can configure includes the cell for which the UE is requested to report CGI i.e. the amount of neighbour cells that can be included is at most (# minCellperMeasObjectRAT - 1), where RAT represents EUTRA/UTRA/GERAN/CDMA2000 respectively.  NOTE 1: #DRBs based on UE capability, #RLC-AM =#DRBs + 2.  NOTE 2: '15' applies when the UE supports *extendedNumberOfDRBs-r15*. For one MAC entity, the maximum number of DRBs configured with PDCP duplication and with RLC entity(ies) associated with this MAC entity is 8.  NOTE 3: The requirement is applicable in EN-DC, NGEN-DC and LTE standalone. | | | |

## 11.2 Processing delay requirements for RRC procedures

The UE performance requirements for RRC procedures are specified in the following tables, by means of a value N:

N = the number of 1ms subframes from the end of reception of the E-UTRAN -> UE message on the UE physical layer up to when the UE shall be ready for the reception of uplink grant for the UE -> E-UTRAN response message with no access delay other than the TTI-alignment (e.g. excluding delays caused by scheduling, the random access procedure or physical layer synchronisation).

NOTE: No processing delay requirements are specified for RN-specific procedures.



Figure 11.2-1: Illustration of RRC procedure delay

Table 11.2-1: UE performance requirements for RRC procedures for UEs other than NB-IoT UEs

| **Procedure title:** | **E-UTRAN -> UE** | **UE -> E-UTRAN** | **N** | **Notes** |
| --- | --- | --- | --- | --- |
| **RRC Connection Control Procedures** | | | | |
| RRC connection establishment | *RRCConnectionSetup or RRCConnectionResume* | *RRCConnectionSetupComplete or RRCConnectionResumeComplete* | 15 or 3 | N = 3 applies for the case of reception of *RRCConnectionResume* if *reducedCP-LatencyEnabled* is configured, the UE supports reduced CP latency, and the RRC message only includes MAC and PHY (re-)configurations and does not include (re-)configurations of DRX, SPS, SCells, and MIMO. Further, the UL grant is sent using PDCCH DCI format 0 in common search space. In this scenario, the RRC procedure delay can extend beyond the reception of the UL grant, up to 7 ms.  For other cases N = 15 applies. |
| RRC connection release | *RRCConnectionRelease* |  | NA |  |
| RRC connection re-configuration (radio resource configuration, possibly including configuration of conditional reconfigurations) | *RRCConnectionReconfiguration* | *RRCConnectionReconfigurationComplete* | 15 | Same requirement is applicable regardless of the number of target candidates being configured, if conditional reconfigurations are included in the message, |
| RRC connection re-configuration (measurement configuration) | *RRCConnectionReconfiguration* | *RRCConnectionReconfigurationComplete* | 15 |  |
| RRC connection re-configuration (intra-LTE mobility) | *RRCConnectionReconfiguration* | *RRCConnectionReconfigurationComplete* | 15 |  |
| RRC connection reconfiguration (SCell addition/release) | *RRCConnectionReconfiguration* | *RRCConnectionReconfigurationComplete* | 20 |  |
| RRC connection reconfiguration (SCG establishment/ release, SCG cell addition/ release) | *RRCConnectionReconfiguration* | *RRCConnectionReconfigurationComplete* | 20 |  |
| RRC connection re-configuration (NR measurement configuration) | *RRCConnectionReconfiguration* | *RRCConnectionReconfigurationComplete* | 15 |  |
| RRC connection reconfiguration (NR SCG establishment/ /modification/release) | *RRCConnectionReconfiguration* | *RRCConnectionReconfigurationComplete* | 20 |  |
| RRC connection re-configuration (intra-LTE mobility with NR SCG establishment/ /modification/release) | *RRCConnectionReconfiguration* | *RRCConnectionReconfigurationComplete* | 20 |  |
| RRC connection re-configuration | *DLDedicatedMessageSegment* | *RRCConnectionReconfigurationComplete* | 20+( Nseg  -1)\*10 | Nseg  is number of RRC segments |
| RRC connection re-establishment | *RRCConnectionReestablishment* | *RRCConnectionReestablishmentComplete* | 15 |  |
| Initial security activation | *SecurityModeCommand* | *SecurityModeCommandComplete/SecurityModeCommandFailure* | 10 |  |
| Initial security activation + RRC connection re-configuration (RB establishment) | *SecurityModeCommand, RRCConnectionReconfiguration* | *RRCConnectionReconfigurationComplete* | 20 | The two DL messages are transmitted in the same TTI |
| EDT or transmission using PUR | *RRCEarlyDataComplete* or *RRCConnectionRelease* |  | NA |  |
| Paging | *Paging* |  | NA |  |
| RRC connection resume (SCG establishment/ restoration/release) | *RRCConnectionResume* | *RRCConnectionResumeComplete* | 20 |  |
| RRC connection resume (MCG SCell addition/restoration/release) | *RRCConnectionResume* | *RRCConnectionResumeComplete* | 20 |  |
| RRC connection resume | *DLDedicatedMessageSegment* | *RRCConnectionResumeComplete* | 20+( Nseg  -1)\*10 | Nseg  is number of RRC segments |
| **Inter RAT mobility** | | | | |
| Handover to E-UTRA | *RRCConnectionReconfiguration (sent by other RAT)* | *RRCConnectionReconfigurationComplete* | NA | The performance of this procedure is specified in TS 45.010 [50] in case of handover from GSM and TS 25.133 [29], TS 25.123 [30] in case of handover from UTRA, and TS 38.133 [84] in case of handover from NR. |
| Handover from E-UTRA | *MobilityFromEUTRACommand* |  | NA | The performance of this procedure is specified in TS 36.133 [16] |
| Handover from E-UTRA to CDMA2000 | *HandoverFromEUTRAPreparationRequest (CDMA2000)* |  | NA | Used to trigger the handover preparation procedure with a CDMA2000 RAT.  The performance of this procedure is specified in TS 36.133 [16] |
| **Measurement procedures** | | | | |
| Measurement Reporting |  | *MeasurementReport* | NA |  |
| **Other procedures** | | | | |
| UE capability transfer | *UECapabilityEnquiry* | *UECapabilityInformation* | 10/ 80 | N = 80 applies in case the UE has to report at least one of the following UE capabilities.  - MR-DC band combinations.  - NR band combinations  - EUTRA feature sets |
| UE capability transfer | *UECapabilityEnquiry* | *ULDedicatedMessageSegment* | 80 | Applicable when UL RRC segmentation is enabled by the field *rrc-SegAllowed*. |
| UE capability transfer | *UECapabilityEnquiry* | *ULDedicatedMessageSegment* | 560+max (0, Nseg-7)\*80 | Applicable when UL RRC segmentation is enabled by the field *rrc-MaxCapaSegAllowed*.  Nseg is the value indicated by *rrc-MaxCapaSegAllowed*. |
| Counter check | *CounterCheck* | *CounterCheckResponse* | 10 |  |
| Proximity indication |  | *ProximityIndication* | NA |  |
| UE information | *UEInformationRequest* | *UEInformationResponse* | 15 |  |
| MBMS counting | *MBMSCountingRequest* | *MBMSCountingResponse* | NA |  |
| MBMS interest indication |  | *MBMSInterestIndication* | NA |  |
| In-device coexistence indication |  | *InDeviceCoexIndication* | NA |  |
| UE assistance information |  | *UEAssistanceInformation* | NA |  |
| SCG failure information |  | *SCGFailureInformation* | NA |  |
| NR SCG failure information |  | *SCGFailureInformationNR* | NA |  |
| Sidelink UE information |  | *SidelinkUEInformation* | NA |  |
| WLAN Connection Status Reporting |  | *WLANConnectionStatusReport* | NA |  |
| PUR Configuration Request |  | *PURConfigurationRequest* | NA |  |

Table 11.2-2: UE performance requirements for RRC procedures for NB-IoT UEs

| **Procedure title:** | **E-UTRAN -> UE** | **UE -> E-UTRAN** | **N** | **Notes** |
| --- | --- | --- | --- | --- |
| **RRC Connection Control Procedures** | | | | |
| RRC connection establishment | *RRCConnectionSetup-NB or RRCConnectionResume-NB* | *RRCConnectionSetupComplete-NB or RRCConnectionResumeComplete-NB* | 45 |  |
| RRC connection release | *RRCConnectionRelease-NB* |  | NA |  |
| RRC connection re-configuration (radio resource configuration) | *RRCConnectionReconfiguration-NB* | *RRCConnectionReconfigurationComplete-NB* | 45 |  |
| RRC connection re-establishment | *RRCConnectionReestablishment-NB* | *RRCConnectionReestablishmentComplete-NB* | 45 |  |
| Initial security activation | *SecurityModeCommand* | *SecurityModeCommandComplete/SecurityModeCommandFailure* | 35 |  |
| Initial security activation + RRC connection re-configuration (RB establishment) | *SecurityModeCommand, RRCConnectionReconfiguration-NB* | *RRCConnectionReconfigurationComplete-NB* | 55 | The two DL messages are transmitted in the same TTI |
| EDT or transmission using PUR | *RRCEarlyDataComplete-NB* or *RRCConnectionRelease-NB* |  | NA |  |
| Paging | *Paging-NB* |  | NA |  |
| **Other procedures** | | | | |
| UE capability transfer | *UECapabilityEnquiry-NB* | *UECapabilityInformation-NB* | 35 |  |
| UE information | *UEInformationRequest-NB* | *UEInformationResponse-NB* | 45 |  |
| PUR Configuration Request |  | *PURConfigurationRequest-NB* | NA |  |

## 11.3 Void