**3GPP TSG-RAN WG2 Meeting #109-e *R2-200xxxx***

**Online, 24th Feb - 6th Mar, 2020**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **36.331** | **CR** | **4192** | **rev** | **1** | **Current version:** | **15.8.0** |  |
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| *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 additional enhancements for NB-IoT in TS 36.331 | | | | | | | | | |
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| ***Source to WG:*** | Huawei | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NB\_IOTenh3-Core | | | | |  | ***Date:*** | | | 2020-03-06 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *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-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
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| ***Reason for change:*** | | Introduction of additional enhancements for NB-IoT in TS 36.331 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Introduction of additional enhancements for NB-IoT in TS 36.331:   1. Connection to 5GC 2. Network management tool enhancement  * RACH report * RLF report * ANR  1. Inter-RAT cell selection 2. Improved multi-carrier operation  * DL channel quality reporting in MSG3 for non-anchor carrier * DL channel quality reporting in connected mode  1. MT-EDT 2. PUR 3. Multiple TBs scheduling 4. Co-existence with NR | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The additional NB-IoT enhancements are not captured in TS 36.331 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.1, 3.2, 4.1, 4.2.1, 5.2.1.7, 5.2.2.7, 5.2.2.9, 5.2.2.x (new), 5.3.1.1, 5.3.1.2, 5.3.1.4, 5.3.2.3, 5.3.3.1, 5.3.3.1b, 5.3.3.1x (new), 5.3.3.2, 5.3.3.3, 5.3.3.3a, 5.3.3.3b, 5.3.3.3c, 5.3.3.3x (new), 5.3.3.4, 5.3.3.4a, 5.3.3.5, 5.3.3.6, 5.3.3.8, 5.3.3.9a, 5.3.3.14, 5.3.3.16, 5.3.3.x (new), 5.3.5.8, 5.3.7.1, 5.3.7.2, 5.3.7.3, 5.3.7.4, 5.3.7.5, 5.3.8.1, 5.3.8.2, 5.3.8.3, 5.3.10.1, 5.3.10.2, 5.3.10.3, 5.3.11.3, 5.3.12, 5.3.13x (new), 5.3.16.1, 5.3.16.2, 5.3.16.4, 5.6.0, 5.6.5.3, 5.6.x1 (new), 5.6.x3 (new), 6.2.2, 6.3.1, 6.4, 6.7.1, 6.7.2, 6.7.3.1, 6.7.3.2, 6.7.3.5, 6.7.3.6, 6.7.4, 7.1a, 7.3.1, 11.2, A.6 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **Y** |  | Other core specifications | | | | TS 36.300 CR1259  TS 38.300 CR0176  TS 36.302 CR1202  TS 36.304 CRxxxx  TS 36.306 CR1731  TS 36.321 CR1466 | | |
| ***affected:*** | |  | **N** | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  | **N** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | 1. R2-1910161, initial version submitted to RAN2#107 2. R2-1911592, endorsed after RAN2#107 3. R2-1914101, endorsed after RAN2#107bis 4. R2-1916566, endorsed after RAN2#108 | | | | | | | | |

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| Start of change |

## 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].

**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.

**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.

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

**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.

**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.

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

**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].

**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.

**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.

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

**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 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" 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 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

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

CA Carrier Aggregation

CBR Channel Busy Ratio

CCCH Common Control Channel

CCO Cell Change Order

CE Coverage Enhancement

CG Cell Group

CIoT Cellular IoT

CMAS Commercial Mobile Alert Service

CP Control Plane

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

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

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

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

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

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

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

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

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

SI System Information

SIB System Information Block

SI-RNTI System Information RNTI

SL Sidelink

SLSS Sidelink Synchronisation Signal

SMC Security Mode Control

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

TM Transparent Mode

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.

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| Next change |

### 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.

**- 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;

- 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).

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.

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| Next change |

#### 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 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 (EPC) or *ab-Enabled-5GC* indication (5GC). 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*.

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| Next change |

#### 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*, 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;

1> else:

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

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

3> forward the *cellIdentity* to upper layers;

3> forward the *trackingAreaCode* to upper layers;

3> forward the PLMN identity to upper layers;

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

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

5> initiate an RNA update as specified in 5.3.17.2;

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

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

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

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

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

3> 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*:

4> 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*:

5> apply the *additionalPmax*;

4> else:

5> apply the *p-Max*;

3> else:

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

2> else:

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

3> 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*, 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> 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.

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

Upon receiving *SystemInformationBlockType2*, the UE shall:

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

1> if in RRC\_INACTIVE:

2> apply the shortest of the *ran-PagingCycle* (if configured), the (UE specific) paging cycle (if indicated by upper layers), and the *defaultPagingCycle* included in the *radioResourceConfigCommon*;

1> else if upper layers indicate that a (UE specific) paging cycle is configured:

2> apply the shortest of the (UE specific) paging cycle and the *defaultPagingCycle* included in the *radioResourceConfigCommon*;

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> 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.

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

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

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

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;

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

1> if c*p-PUR-5GC* is not included, the UE connected to 5GC in RRC\_IDLE without a suspended RRC connection is configured with *pur-Config*:

1> if c*p-PUR-5GC* is not included, the UE connected to EPC in RRC\_IDLE without a suspended RRC connection is configured with *pur-Config*:

2> release *pur-Config*;

2> instruct MAC to release PUR;

Editor’s Note: Handling of *cp-PUR* and *up-PUR* to be confirmed.

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| Next change |

#### 5.2.2.x Actions upon reception of *SystemInformationBlockTypeXX*

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

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#### 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.

Change to NR PDCP or vice versa, that in case of EN-DC may be done for both SRBs and DRBs, can be performed using an *RRCConnectionReconfiguration* message including the *mobilityControlInfo* (handover) by release and addition of the concerned RB (for DRBs) or of the concerned PDCP entity (for SRBs). 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-UTRAN. When the RRC connection is suspended, the UE stores the UE AS context and the *resumeIdentity*, 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-UTRAN 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-UTRAN. 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*. The request is not ciphered, but protected with a message authentication code.

In response to a request to resume the RRC connection, E-UTRAN 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-UTRAN 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.

#### 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).

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. 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 three 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). All three 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 four AS keys (KeNB, KRRCint, KRRCenc and KUPenc) 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. 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 TS 38.323 [83] for E-UTRA/5GC). The HFN needs to be synchronized between the UE and the eNB. 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. 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.

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 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, integrity protection is not enabled for DRBs terminated on 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.

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| Next change |

#### 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

|  |  |
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| Sub-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 |
| 5.3.13x | 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]).

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| Next change |

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

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';

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

3> 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: 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 *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;

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

1> 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 and the *mt-EDT* is included:

3> initiate EDT in accordance with conditions in 5.3.3.1b;

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| Next change |

#### 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 5.3.3.1-7x: 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.

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| Next change |

#### 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 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 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 in response to the Paging message including *mt-EDT* 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.

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| Next change |

#### 5.3.3.1x 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;

1> the UE has a valid timing alignment value as specified in 5.3.3.x;

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.

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| Next change |

#### 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:

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> 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*, if configured;

2> 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 *idc-Config*, if configured;

2> release *sps-AssistanceInfoReport*, if configured;

2> release *measSubframePatternPCell*, if configured;

2> 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;

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> 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> 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:

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;

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> 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> 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 5.3.3.1x:

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;

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.

Editor’s Note: Where to capture PUR release due to RACH initiation on a new cell.

#### 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 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*:

3> set the establishmentCause to mo-VoiceCall;

2> 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*:

3> set the establishmentCause to mo-VoiceCall;

2> else:

3> 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> 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].

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 5.3.3.1x; or

1> if field *useFullResumeID* is signalled in *SystemInformationBlockType2*:

2> set the *resumeID* to the stored *resumeIdentity*;

1> else:

2> 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 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> set *earlyContentionResolution* to TRUE;

1> restore the RRC configuration and security context from the stored UE AS context;

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 measurement s results 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 initiating UP-EDT 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 5.3.3.1x; or

1> if the UE is resuming a suspended RRC connection in 5GC:

2> if the UE is a NB-IoT UE resuming a suspended RRC connection in 5GC:

3> apply the default configuration for SRB1 as specified in 9.2.1.1;

3> resume SRB1;

2> else:

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> 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 originating 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:

3> apply the physical channel configuration in accordance with the stored *pur-Config*;

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 physical layer, MAC configuration and NR *pdcp-Config*;

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.

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 5.3.3.1x:

2> apply the physical channel configuration in accordance with the stored *pur-Config*;

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.

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| Next change |

5.3.3.3x UE actions upon receiving PUR completion indications from lower layers

Upon indication from lower layers that CP transmission using PUR is successfully completed, the UE shall perform the actions specified in 5.3.3.4b as if an empty *RRCEarlyDataComplete* message was received.

NOTE: UE actions upon reception of PUR fallback indication or PUR failure indication from lower layers (see TS 36.213 [23]) is left up to implementation.

Editor’s Note: Additional details is needed for the case if any RRC parameter is updated by L1 ACK.

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| Next change |

#### 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> if the *RRCConnectionSetup* is received in response to an *RRCConnectionResumeRequest* from a suspended RRC connection:

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;

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 *RRCConnectionResumeRequest* or *RRCEarlyDataRequest* for transmission using PUR:

2> if *newUE-Identity* is included:

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;

1> perform the radio resource configuration procedure in accordance with the received *radioResourceConfigDedicated* and as specified in 5.3.10;

1> if stored, discard the cell reselection priority information provided by the *idleModeMobilityControlInfo* or inherited from another RAT;

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> 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> 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> include *up-CIoT-5GS-Optimisation* 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 UE is connected to EPC:

3> except for NB-IoT:

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*;

4> if the UE has Bluetooth logged measurements available and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:

5> include *logMeasAvailableBT*;

4> if the UE has WLAN logged measurements available and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:

5> 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> stop T331, if running;

4> if the UE has flight path information available:

5> include *flightPathInfoAvailable*;

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*:

5> include *rlf-InfoAvailable*;

4> if the UE has ANR measurements results 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> except for NB-IoT:

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 IDLE mode measurement information available in *VarMeasIdleReport*:

4> include the *idleMeasAvailable*;

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].

1> submit the *RRCConnectionSetupComplete* message to lower layers for transmission;

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> except if the *RRCConnectionResume* is received in response to an *RRCConnectionResumeRequest* for EDT or transmission using PUR:

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> discard the stored UE AS context and *resumeIdentity*;

2> else if the *RRCConnectionResume* message includes the *fullConfig* (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 (for resuming an RRC connection from RRC\_INACTIVE):

3> restore the physical layer configuration, the MAC configuration, the RLC configuration and the PDCP configuration from the stored UE Inactive AS context;

3> discard the stored UE Inactive AS context;

3> release the *rrc-InactiveConfig*, except *ran-NotificationAreaInfo*;

1> else:

2> 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;

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* 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 and all DRBs, if any, including RBs configured with NR PDCP;

1> if stored, discard the cell reselection priority information provided by the *idleModeMobilityControlInfo* or inherited from another RAT;

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 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> if the *RRCConnectionResume* is received in response to an *RRCConnectionResumeRequest* for EDT orfor transmission using PUR orfor resuming a suspended RRC connection in 5GC or an *RRCConnectionResumeRequest* from RRC\_INACTIVE:

2> ignore the *nextHopChainingCount* value indicated in the *RRCConnectionResume* message;

2> if the *RRCConnectionResume* is received in response to an *RRCConnectionResumeRequest* for transmission using PUR:

3> if *newUE-Identity* is included:

4> apply the value of the *newUE-Identity* as the C-RNTI;

3> else:

4> apply the value of the *pur-RNTI* as the C-RNTI;

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;

4> if the UE has Bluetooth logged measurements available and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:

5> include logMeasAvailableBT;

4> if the UE has WLAN logged measurements available and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:

5> 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> stop T331, if running;

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 SIB2 contains *idleModeMeasurements*, and the UE has IDLE mode measurement information available in *VarMeasIdleReport*:

4> include the *idleMeasAvailable*;

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*;

1> submit the *RRCConnectionResumeComplete* message to lower layers for transmission;

1> the procedure ends.

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| Next change |

#### 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 has initiated UP-EDT or UP transmission using PUR or resumption of a suspended RRC connection in 5GC:

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 has initiated UP-EDT or UP transmission using PUR or resumption of a suspended RRC connection in 5GC:

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] and TS 25.304 [40];

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;

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 connection 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.

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| Next change |

#### 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* for EDT or transmission using PUR or for resuming a suspended RRC connection in 5GC:

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;

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| Next change |

#### 5.3.3.9a Abortion of UP-EDT or UP transmission using PUR or resuming a suspended RRC connection in 5GC

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.

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| Next change |

#### 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;

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| Next change |

#### 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 for UP-EDT or UP transmission using PUR or resuming a suspended RRC connection in 5GC:

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 connection failure';

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| Next change |

#### 5.3.3.x Timing alignment validation for transmission using PUR

A UE shall consider the timing alignment value for transmission using PUR to be valid when all of the following conditions are fulfilled:

1> if *pur-TimeAlignmentTimer* is configured:

2> *pur-TimeAlignmentTimer* is running as confirmed by lower layers;

1> if *pur-NRSRP-ChangeThreshold* is configured:

2>  since the last TA validation, the serving cell RSRP has not increased by more than *nrsrp-IncreaseThresh*; and

2>  since the last TA validation, the serving cell RSRP has not decreased by more than *nrsrp-DecreaseThresh*;

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| Next change |

#### 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;

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;

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 *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> 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> if the UE is a 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;

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| Next change |

### 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.

#### 5.3.7.2 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 optimisation. The UE initiates the procedure when one of the following conditions is met:

1> upon detecting radio link failure, 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 for UP-EDT, 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 5.3.5.5.

NOTE: For UP-EDT, 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 T307, if running;

1> start timer T311;

1> stop timer T370, if running;

1> release *uplinkDataCompression*, if configured;

1> suspend all RBs, including RBs configured with NR PDCP, except SRB0;

1> reset MAC;

1> release the MCG SCell(s), if configured, in accordance with 5.3.10.3a;

1> release the SCell group(s), if configured, in accordance with 5.3.10.3d;

1> apply the default physical channel configuration as specified in 9.2.4;

1> except for NB-IoT, for the MCG, apply the default semi-persistent scheduling configuration as specified in 9.2.3;

1> for NB-IoT, release *schedulingRequestConfig*, if configured;

1> for the MCG, apply the default MAC main configuration as specified in 9.2.2;

1> release *powerPrefIndicationConfig*, if configured and stop timer T340, if running;

1> release *reportProximityConfig*, if configured and clear any associated proximity status reporting timer;

1> release *obtainLocationConfig*, if configured;

1> release *idc-Config*, if configured;

1> release *sps-AssistanceInfoReport*, if configured;

1> release *measSubframePatternPCell*, if configured;

1> release the entire SCG configuration, if configured, except for the DRB configuration (as configured by *drb-ToAddModListSCG*);

1> if (NG)EN-DC is configured:

2> perform MR-DC release, as specified in TS 38.331[82], clause 5.3.5.10;

2> release *p-MaxEUTRA*, if configured;

2> release *p-MaxUE-FR1*, if configured;

2> release *tdm-PatternConfig*, if configured;

1> release *naics-Info* for the PCell, if configured;

1> if connected as an RN and configured with an RN subframe configuration:

2> release the RN subframe configuration;

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;

1> release *delayBudgetReportingConfig*, if configured and stop timer T342, if running;

1> perform cell selection in accordance with the cell selection process as specified in TS 36.304 [4];

1> release *bw-PreferenceIndicationTimer*, if configured and stop timer T341, if running;

1> release *overheatingAssistanceConfig*, if configured and stop timer T345, if running;

1> release *ailc-BitConfig*, if configured;

Editor’s Note: Where to capture PUR release due to RACH initiation on a new cell.

#### 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> start timer T301;

2> apply the *timeAlignmentTimerCommon* included in *SystemInformationBlockType2*;

2> if the UE is a NB-IoT UE and AS security has not been activated:

3> if the UE is connected to EPC, the UE supports RRC connection re-establishment for the Control Plane CIoT EPS optimisation and *cp-reestablishment* is included in *SystemInformationBlockType2-NB*; or

3> if the UE is connected to 5GC and the UE supports RRC connection re-establishment for the Control Plane CIoT 5GS optimisation:

4> initiate transmission of the *RRCConnectionReestablishmentRequest* message in accordance with 5.3.7.4;

3> else:

4> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'RRC connection failure';

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';

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| Next change |

#### 5.3.7.4 Actions related to transmission of *RRCConnectionReestablishmentRequest* message

Except for NB-IoT, if the procedure was initiated due to radio link failure or handover failure, the UE shall:

1> set the *reestablishmentCellId* in the *VarRLF-Report* to the global cell identity of the selected cell;

Editor’s Note: FFS: The re-establishment cell id is also included in the RLF report for NB-IoT.

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> set *earlyContentionResolution* to TRUE;

The UE shall submit the *RRCConnectionReestablishmentRequest* message to lower layers for transmission.

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| Next change |

#### 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;

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:

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> if the UE is connected to EPC:

4> set the content of *RRCConnectionReestablishmentComplete* message as follows:

5> 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*:

6> include the *rlf-InfoAvailable*;

5> 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:

6> include logMeasAvailableMBSFN;

5> else if the UE has logged measurements available for E-UTRA and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:

6> include the *logMeasAvailable*;

5> if the UE has Bluetooth logged measurements available and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:

6> include the logMeasAvailableBT;

5> if the UE has WLAN logged measurements available and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:

6> include the logMeasAvailableWLAN;

5> if the UE has connection establishment failure information available in *VarConnEstFailReport* and if the RPLMN is equal to *plmn-Identity* stored in *VarConnEstFailReport*:

6> include the connEstFailInfoAvailable;

5> if the UE has flight path information available:

6> 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 *anr-InfoAvailable*;

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;

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> submit the *RRCConnectionReestablishmentComplete* message to lower layers for transmission;

1> the procedure ends;

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| Next change |

#### 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 sub-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 sub-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 sub-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: 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.

1> stop T380, if running;

1> for NB -IoT, if the UE has reported *anr-InfoAvailable*, clear *VarANR-MeasConfig-NB* and *VarANR-MeasReport-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;

1> 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*; or

1> if the *RRCConnectionRelease* message includes *idleModeMobilityControlInfo* including *freqPriorityListGERAN*:

2> if AS security has not been activated; and

2> if upper layers indicate that redirect to GERAN without AS security is not allowed:

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> if the UE ignores the content of *redirectedCarrierInfo* or of *idleModeMobilityControlInfo*:

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:

2> apply the cell reselection priority information broadcast in the system information;

1> if the *RRCConnectionRelease* message includes the *measIdleConfig*:

2> clear *VarMeasIdleConfig* and *VarMeasIdleReport*;

2> store the received *measIdleDuration* in *VarMeasIdleConfig*;

2> start T331 with the value of *measIdleDuration*;

2> if the *measIdleConfig* contains *measIdleCarrierListEUTRA*:

3> store the received *measIdleCarrierListEUTRA* in *VarMeasIdleConfig*;

3> start performing idle mode measurements asspecified in5.6.20;

NOTE 2: If the *measIdleConfig* does not contain *measIdleCarrierListEUTRA*, UE may receive *measIdleCarrierListEUTRA* as specified in 5.2.2.12.

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> for NB-IoT, if the *RRCConnectionRelease* message includes the *anr-MeasConfig*:

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.x3;

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> configure MAC in accordance with the stored *pur-Config*;

2> else:

3> release *pur-Config*;

3> discard previously stored *pur-Config*, if any;

3> instruct MAC to release PUR;

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';

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| Next change |

#### 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: 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 DTCH 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*;

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| Next change |

#### 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:

2> if a DRB was configured with the same *pdu-Session* (fullConfig):

3> associate the established DRB with corresponding included *pdu-Session*;

2> else if the entry of *drb-ToAddModList* includes *pdcp-config* (establishment of bearer):

3> 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 *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*;

NOTE: 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*.

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| Next change |

#### 5.3.11.3 Detection of radio link failure

The UE shall:

1> upon T310 expiry; or

1> upon T312 expiry; 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> store the following radio link failure information in the *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 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> 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. Blacklisted 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*;

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 AS security has not been activated:

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

4> if the UE is connected to EPC and the UE supports RRC connection re-establishment for the Control Plane CIoT EPS optimisation; or

4> if the UE is connected to 5GC and the UE supports RRC connection re-establishment for the Control Plane CIoT 5GS optimisation:

5> initiate the RRC connection re-establishment procedure as specified in 5.3.7;

4> else:

5> perform the actions upon leaving RRC\_CONNECTED as specified in 5.3.12, with release cause 'RRC connection failure';

3> else:

4> 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;

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> initiate the SCG failure information procedure as specified in 5.6.13 to report SCG radio link failure;

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;

The UE may discard the radio link failure information, i.e. release the UE variable *VarRLF-Report*, 48 hours after the radio link failure is detected, upon power off or upon detach.

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| Next change |

### 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*:

2> stop the timer T320, if running;

2> if stored, discard the cell reselection priority information provided by the *idleModeMobilityControlInfo*;

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, T325, T330, T331;

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> 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;

2> store the following information provided by E-UTRAN:

3> 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> indicate the suspension of the RRC connection to upper layers;

2> configure lower layers to suspend integrity protection and ciphering;

NOTE 1: Except for UP-EDT, UP transmission using PUR and resumption of a suspended connection in 5GC, 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> release *rrc-InactiveConfig*, if configured;

3> discard the KeNB, the KRRCenc key, the KRRCint and the KUPenc key;

2> release *rrc-InactiveConfig*, if configured;

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;

2> indicate the release of the RRC connection to upper layers together with the release cause;

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> 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;

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| Next change |

### 5.3.13x Action upon receiving 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.

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| Next change |

#### 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.

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.

In NB-IoT, in RRC\_CONNECTED, the UE uses *MasterInformationBlock-NB* */ MasterInformationBlock-TDD-NB* and *SystemInformationBlockType14-NB,* if broadcasted,acquired when entering RRC\_CONNECTED.

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| Next change |

#### 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:

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;

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| Next change |

#### 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':

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;

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| Next change |

### 5.6.0 General

For NB-IoT, only a subset of the procedures described in this sub-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

| Sub-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 |
| 5.6.x1 | PUR Configuration Request |
|  |  |
| 5.6.x3 | Neighbour Relation Reporting for SON ANR in NB-IoT |

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| Next change |

#### 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 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;

3> if EDT fallback indication was received from lower layers for the last successfully completed random access procedure:

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* and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report*:

2> set *timeSinceFailure* in *VarRLF-Report* 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*;

2> discard the *rlf-Report* from *VarRLF-Report* 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 *VarLogMeasReport* starting from the entries logged first;

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*;

3> if the *VarLogMeasReport* includes one or more additional logged Bluetooth measurement entries that are not included in the *logMeasInfoList* within the *UEInformationResponse* message:

4> include the *logMeasAvailableBT*;

3> if the *VarLogMeasReport* includes one or more additional logged WLAN measurement entries that are not included in the *logMeasInfoList* within the *UEInformationResponse* message:

4> 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 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 UE has stored *VarMeasIdleReport*:

2> set the *measResultListIdle* in the *UEInformationResponse* message to the value of *measReportIdle* in the *VarMeasIdleReport*;

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 *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> 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;

|  |
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| Next change |

### 5.6.x1 PUR Configuration Request

#### 5.6.x1.1 General



Figure 5.6.x1.1-1: 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. The procedure is applicable only for BL UEs, UEs in CE or NB-IoT UEs.

#### 5.6.x1.2 Initiation

A NB-IoT 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.x1.3;

#### 5.6.x1.3 Actions related to transmission of *PURConfigurationRequest* message

The UE shall set the contents of the *PURConfigurationRequest* message as follows:

1> set *purConfigRequest* to its preferred configuration;

The UE shall submit the *PURConfigurationRequest* message to lower layers for transmission.

|  |
| --- |
| Next change |

|  |
| --- |
| Next change |

### 5.6.x3 Neighbour Relation Reporting for SON ANR in NB-IoT

#### 5.6.x3.0 General

This procedure only applies to a NB-IoT UE not using the Control Plane CIoT EPS optimisation.

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.x3.1 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*; or

3> for each carrier frequency signalled in *interFreqCarrierFreqList* in *SystemInformationBlockType5-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], subclause 4.6) are met. The measurement rules for cell re-selection and the relaxed monitoring measurement rules as specified in TS 36.304 [4] do not apply while performing an ANR measurement.

4> if the strongest cell is not identified by an entry within the *blackCellList*,if present, for the corresponding entry in *anr-CarrierList*:

5> set the *physCellId* to the physical cell identity of the cell;

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;

1> release the VarANR-MeasConfig.

The UE may discard the ANR measurements information, i.e. release the UE variables *VarANR-MeasConfig* and *VarANR-MeasReport*, [96] hours after the configuration was received, upon power off or upon detach.

|  |
| --- |
| Next change |

### 6.2.2 Message definitions

#### – *SystemInformation*

The *SystemInformation* message is used to convey one or more System Information Blocks or Positioning System Information Blocks. All the SIBs or posSIBs included are transmitted with the same periodicity. *SystemInformation-BR* and *SystemInformation-MBMS* use the same structure as *SystemInformation.*

Signalling radio bearer: N/A

RLC-SAP: TM

Logical channels: BCCH and BR-BCCH

Direction: E‑UTRAN to UE

*SystemInformation message*

-- ASN1START

SystemInformation-BR-r13 ::= SystemInformation

SystemInformation-MBMS-r14 ::= SystemInformation

SystemInformation ::= SEQUENCE {

criticalExtensions CHOICE {

systemInformation-r8 SystemInformation-r8-IEs,

criticalExtensionsFuture-r15 CHOICE {

posSystemInformation-r15 PosSystemInformation-r15-IEs,

criticalExtensionsFuture SEQUENCE {}

}

}

}

SystemInformation-r8-IEs ::= SEQUENCE {

sib-TypeAndInfo SEQUENCE (SIZE (1..maxSIB)) OF CHOICE {

sib2 SystemInformationBlockType2,

sib3 SystemInformationBlockType3,

sib4 SystemInformationBlockType4,

sib5 SystemInformationBlockType5,

sib6 SystemInformationBlockType6,

sib7 SystemInformationBlockType7,

sib8 SystemInformationBlockType8,

sib9 SystemInformationBlockType9,

sib10 SystemInformationBlockType10,

sib11 SystemInformationBlockType11,

...,

sib12-v920 SystemInformationBlockType12-r9,

sib13-v920 SystemInformationBlockType13-r9,

sib14-v1130 SystemInformationBlockType14-r11,

sib15-v1130 SystemInformationBlockType15-r11,

sib16-v1130 SystemInformationBlockType16-r11,

sib17-v1250 SystemInformationBlockType17-r12,

sib18-v1250 SystemInformationBlockType18-r12,

sib19-v1250 SystemInformationBlockType19-r12,

sib20-v1310 SystemInformationBlockType20-r13,

sib21-v1430 SystemInformationBlockType21-r14,

sib24-v1530 SystemInformationBlockType24-r15,

sib25-v1530 SystemInformationBlockType25-r15,

sib26-v1530 SystemInformationBlockType26-r15,

sibXX-v16xy SystemInformationBlockTypeXX-r16

},

nonCriticalExtension SystemInformation-v8a0-IEs OPTIONAL

}

SystemInformation-v8a0-IEs ::= SEQUENCE {

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

PosSystemInformation-r15-IEs ::= SEQUENCE {

posSIB-TypeAndInfo-r15 SEQUENCE (SIZE (1..maxSIB)) OF CHOICE {

posSib1-1-r15 SystemInformationBlockPos-r15,

posSib1-2-r15 SystemInformationBlockPos-r15,

posSib1-3-r15 SystemInformationBlockPos-r15,

posSib1-4-r15 SystemInformationBlockPos-r15,

posSib1-5-r15 SystemInformationBlockPos-r15,

posSib1-6-r15 SystemInformationBlockPos-r15,

posSib1-7-r15 SystemInformationBlockPos-r15,

posSib2-1-r15 SystemInformationBlockPos-r15,

posSib2-2-r15 SystemInformationBlockPos-r15,

posSib2-3-r15 SystemInformationBlockPos-r15,

posSib2-4-r15 SystemInformationBlockPos-r15,

posSib2-5-r15 SystemInformationBlockPos-r15,

posSib2-6-r15 SystemInformationBlockPos-r15,

posSib2-7-r15 SystemInformationBlockPos-r15,

posSib2-8-r15 SystemInformationBlockPos-r15,

posSib2-9-r15 SystemInformationBlockPos-r15,

posSib2-10-r15 SystemInformationBlockPos-r15,

posSib2-11-r15 SystemInformationBlockPos-r15,

posSib2-12-r15 SystemInformationBlockPos-r15,

posSib2-13-r15 SystemInformationBlockPos-r15,

posSib2-14-r15 SystemInformationBlockPos-r15,

posSib2-15-r15 SystemInformationBlockPos-r15,

posSib2-16-r15 SystemInformationBlockPos-r15,

posSib2-17-r15 SystemInformationBlockPos-r15,

posSib2-18-r15 SystemInformationBlockPos-r15,

posSib2-19-r15 SystemInformationBlockPos-r15,

posSib3-1-r15 SystemInformationBlockPos-r15,

...

},

lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

#### – *SystemInformationBlockType1*

*SystemInformationBlockType1* contains information relevant when evaluating if a UE is allowed to access a cell and defines the scheduling of other system information. *SystemInformationBlockType1-BR* uses the same structure as *SystemInformationBlockType1*.

Signalling radio bearer: N/A

RLC-SAP: TM

Logical channels: BCCH and BR-BCCH

Direction: E‑UTRAN to UE

*SystemInformationBlockType1 message*

-- ASN1START

SystemInformationBlockType1-BR-r13 ::= SystemInformationBlockType1

SystemInformationBlockType1 ::= SEQUENCE {

cellAccessRelatedInfo SEQUENCE {

plmn-IdentityList PLMN-IdentityList,

trackingAreaCode TrackingAreaCode,

cellIdentity CellIdentity,

cellBarred ENUMERATED {barred, notBarred},

intraFreqReselection ENUMERATED {allowed, notAllowed},

csg-Indication BOOLEAN,

csg-Identity CSG-Identity OPTIONAL -- Need OR

},

cellSelectionInfo SEQUENCE {

q-RxLevMin Q-RxLevMin,

q-RxLevMinOffset INTEGER (1..8) OPTIONAL -- Need OP

},

p-Max P-Max OPTIONAL, -- Need OP

freqBandIndicator FreqBandIndicator,

schedulingInfoList SchedulingInfoList,

tdd-Config TDD-Config OPTIONAL, -- Cond TDD

si-WindowLength ENUMERATED {

ms1, ms2, ms5, ms10, ms15, ms20,

ms40},

systemInfoValueTag INTEGER (0..31),

nonCriticalExtension SystemInformationBlockType1-v890-IEs OPTIONAL

}

SystemInformationBlockType1-v890-IEs::= SEQUENCE {

lateNonCriticalExtension OCTET STRING (CONTAINING SystemInformationBlockType1-v8h0-IEs) OPTIONAL,

nonCriticalExtension SystemInformationBlockType1-v920-IEs OPTIONAL

}

-- Late non critical extensions

SystemInformationBlockType1-v8h0-IEs ::= SEQUENCE {

multiBandInfoList MultiBandInfoList OPTIONAL, -- Need OR

nonCriticalExtension SystemInformationBlockType1-v9e0-IEs OPTIONAL

}

SystemInformationBlockType1-v9e0-IEs ::= SEQUENCE {

freqBandIndicator-v9e0 FreqBandIndicator-v9e0 OPTIONAL, -- Cond FBI-max

multiBandInfoList-v9e0 MultiBandInfoList-v9e0 OPTIONAL, -- Cond mFBI-max

nonCriticalExtension SystemInformationBlockType1-v10j0-IEs OPTIONAL

}

SystemInformationBlockType1-v10j0-IEs ::= SEQUENCE {

freqBandInfo-r10 NS-PmaxList-r10 OPTIONAL, -- Need OR

multiBandInfoList-v10j0 MultiBandInfoList-v10j0 OPTIONAL, -- Need OR

nonCriticalExtension SystemInformationBlockType1-v10l0-IEs OPTIONAL

}

SystemInformationBlockType1-v10l0-IEs ::= SEQUENCE {

freqBandInfo-v10l0 NS-PmaxList-v10l0 OPTIONAL, -- Need OR

multiBandInfoList-v10l0 MultiBandInfoList-v10l0 OPTIONAL, -- Need OR

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- Regular non critical extensions

SystemInformationBlockType1-v920-IEs ::= SEQUENCE {

ims-EmergencySupport-r9 ENUMERATED {true} OPTIONAL, -- Need OR

cellSelectionInfo-v920 CellSelectionInfo-v920 OPTIONAL, -- Cond RSRQ

nonCriticalExtension SystemInformationBlockType1-v1130-IEs OPTIONAL

}

SystemInformationBlockType1-v1130-IEs ::= SEQUENCE {

tdd-Config-v1130 TDD-Config-v1130 OPTIONAL, -- Cond TDD-OR

cellSelectionInfo-v1130 CellSelectionInfo-v1130 OPTIONAL, -- Cond WB-RSRQ

nonCriticalExtension SystemInformationBlockType1-v1250-IEs OPTIONAL

}

SystemInformationBlockType1-v1250-IEs ::= SEQUENCE {

cellAccessRelatedInfo-v1250 SEQUENCE {

category0Allowed-r12 ENUMERATED {true} OPTIONAL -- Need OP

},

cellSelectionInfo-v1250 CellSelectionInfo-v1250 OPTIONAL, -- Cond RSRQ2

freqBandIndicatorPriority-r12 ENUMERATED {true} OPTIONAL, -- Cond mFBI

nonCriticalExtension SystemInformationBlockType1-v1310-IEs OPTIONAL

}

SystemInformationBlockType1-v1310-IEs ::= SEQUENCE {

hyperSFN-r13 BIT STRING (SIZE (10)) OPTIONAL, -- Need OR

eDRX-Allowed-r13 ENUMERATED {true} OPTIONAL, -- Need OR

cellSelectionInfoCE-r13 CellSelectionInfoCE-r13 OPTIONAL, -- Need OP

bandwidthReducedAccessRelatedInfo-r13 SEQUENCE {

si-WindowLength-BR-r13 ENUMERATED {

ms20, ms40, ms60, ms80, ms120,

ms160, ms200, spare},

si-RepetitionPattern-r13 ENUMERATED {everyRF, every2ndRF, every4thRF,

every8thRF},

schedulingInfoList-BR-r13 SchedulingInfoList-BR-r13 OPTIONAL, -- Cond SI-BR

fdd-DownlinkOrTddSubframeBitmapBR-r13 CHOICE {

subframePattern10-r13 BIT STRING (SIZE (10)),

subframePattern40-r13 BIT STRING (SIZE (40))

} OPTIONAL, -- Need OP

fdd-UplinkSubframeBitmapBR-r13 BIT STRING (SIZE (10)) OPTIONAL, -- Need OP

startSymbolBR-r13 INTEGER (1..4),

si-HoppingConfigCommon-r13 ENUMERATED {on,off},

si-ValidityTime-r13 ENUMERATED {true} OPTIONAL, -- Need OP

systemInfoValueTagList-r13 SystemInfoValueTagList-r13 OPTIONAL -- Need OR

} OPTIONAL, -- Cond BW-reduced

nonCriticalExtension SystemInformationBlockType1-v1320-IEs OPTIONAL

}

SystemInformationBlockType1-v1320-IEs ::= SEQUENCE {

freqHoppingParametersDL-r13 SEQUENCE {

mpdcch-pdsch-HoppingNB-r13 ENUMERATED {nb2, nb4} OPTIONAL, -- Need OR

interval-DLHoppingConfigCommonModeA-r13 CHOICE {

interval-FDD-r13 ENUMERATED {int1, int2, int4, int8},

interval-TDD-r13 ENUMERATED {int1, int5, int10, int20}

} OPTIONAL, -- Need OR

interval-DLHoppingConfigCommonModeB-r13 CHOICE {

interval-FDD-r13 ENUMERATED {int2, int4, int8, int16},

interval-TDD-r13 ENUMERATED { int5, int10, int20, int40}

} OPTIONAL, -- Need OR

mpdcch-pdsch-HoppingOffset-r13 INTEGER (1..maxAvailNarrowBands-r13) OPTIONAL -- Need OR

} OPTIONAL, -- Cond Hopping

nonCriticalExtension SystemInformationBlockType1-v1350-IEs OPTIONAL

}

SystemInformationBlockType1-v1350-IEs ::= SEQUENCE {

cellSelectionInfoCE1-r13 CellSelectionInfoCE1-r13 OPTIONAL, -- Need OP

nonCriticalExtension SystemInformationBlockType1-v1360-IEs OPTIONAL

}

SystemInformationBlockType1-v1360-IEs ::= SEQUENCE {

cellSelectionInfoCE1-v1360 CellSelectionInfoCE1-v1360 OPTIONAL, -- Cond QrxlevminCE1

nonCriticalExtension SystemInformationBlockType1-v1430-IEs OPTIONAL

}

SystemInformationBlockType1-v1430-IEs ::= SEQUENCE {

eCallOverIMS-Support-r14 ENUMERATED {true} OPTIONAL, -- Need OR

tdd-Config-v1430 TDD-Config-v1430 OPTIONAL, -- Cond TDD-OR

cellAccessRelatedInfoList-r14 SEQUENCE (SIZE (1..maxPLMN-1-r14)) OF

CellAccessRelatedInfo-r14 OPTIONAL, -- Need OR

nonCriticalExtension SystemInformationBlockType1-v1450-IEs OPTIONAL

}

SystemInformationBlockType1-v1450-IEs ::= SEQUENCE {

tdd-Config-v1450 TDD-Config-v1450 OPTIONAL, -- Cond TDD-OR

nonCriticalExtension SystemInformationBlockType1-v1530-IEs OPTIONAL

}

SystemInformationBlockType1-v1530-IEs ::= SEQUENCE {

hsdn-Cell-r15 ENUMERATED {true} OPTIONAL, -- Need OR

cellSelectionInfoCE-v1530 CellSelectionInfoCE-v1530 OPTIONAL, -- Need OP

crs-IntfMitigConfig-r15 CHOICE {

crs-IntfMitigEnabled-15 NULL,

crs-IntfMitigNumPRBs-r15 ENUMERATED {n6, n24}

} OPTIONAL, -- Need OR

cellBarred-CRS-r15 ENUMERATED {barred, notBarred},

plmn-IdentityList-v1530 PLMN-IdentityList-v1530 OPTIONAL, -- Need OR

posSchedulingInfoList-r15 PosSchedulingInfoList-r15 OPTIONAL, -- Need OR

cellAccessRelatedInfo-5GC-r15 SEQUENCE {

cellBarred-5GC-r15 ENUMERATED {barred, notBarred},

cellBarred-5GC-CRS-r15 ENUMERATED {barred, notBarred},

cellAccessRelatedInfoList-5GC-r15 SEQUENCE (SIZE (1..maxPLMN-r11)) OF

CellAccessRelatedInfo-5GC-r15

} OPTIONAL, -- Need OP

ims-EmergencySupport5GC-r15 ENUMERATED {true} OPTIONAL, -- Need OR

eCallOverIMS-Support5GC-r15 ENUMERATED {true} OPTIONAL, -- Need OR

nonCriticalExtension SystemInformationBlockType1-v1540-IEs OPTIONAL

}

SystemInformationBlockType1-v1540-IEs ::= SEQUENCE {

si-posOffset-r15 ENUMERATED {true} OPTIONAL, -- Need ON

nonCriticalExtension SEQUENCE {} OPTIONAL

}

PLMN-IdentityList ::= SEQUENCE (SIZE (1..maxPLMN-r11)) OF PLMN-IdentityInfo

PLMN-IdentityInfo ::= SEQUENCE {

plmn-Identity PLMN-Identity,

cellReservedForOperatorUse ENUMERATED {reserved, notReserved}

}

PLMN-IdentityList-v1530 ::= SEQUENCE (SIZE (1..maxPLMN-r11)) OF PLMN-IdentityInfo-v1530

PLMN-IdentityInfo-v1530 ::= SEQUENCE {

cellReservedForOperatorUse-CRS-r15 ENUMERATED {reserved, notReserved}

}

PLMN-IdentityList-r15::= SEQUENCE (SIZE (1..maxPLMN-r11)) OF PLMN-IdentityInfo-r15

PLMN-IdentityInfo-r15 ::= SEQUENCE {

plmn-Identity-5GC-r15 CHOICE{

plmn-Identity-r15 PLMN-Identity,

plmn-Index-r15 INTEGER (1..maxPLMN-r11)

},

cellReservedForOperatorUse-r15 ENUMERATED {reserved, notReserved},

cellReservedForOperatorUse-CRS-r15 ENUMERATED {reserved, notReserved}

}

SchedulingInfoList ::= SEQUENCE (SIZE (1..maxSI-Message)) OF SchedulingInfo

SchedulingInfo ::= SEQUENCE {

si-Periodicity ENUMERATED {rf8, rf16, rf32, rf64, rf128, rf256, rf512},

sib-MappingInfo SIB-MappingInfo

}

SchedulingInfoList-BR-r13 ::= SEQUENCE (SIZE (1..maxSI-Message)) OF SchedulingInfo-BR-r13

SchedulingInfo-BR-r13 ::= SEQUENCE {

si-Narrowband-r13 INTEGER (1..maxAvailNarrowBands-r13),

si-TBS-r13 ENUMERATED {b152, b208, b256, b328, b408, b504, b600, b712, b808, b936}

}

SIB-MappingInfo ::= SEQUENCE (SIZE (0..maxSIB-1)) OF SIB-Type

SIB-Type ::= ENUMERATED {

sibType3, sibType4, sibType5, sibType6,

sibType7, sibType8, sibType9, sibType10,

sibType11, sibType12-v920, sibType13-v920,

sibType14-v1130, sibType15-v1130,

sibType16-v1130, sibType17-v1250, sibType18-v1250,

..., sibType19-v1250, sibType20-v1310, sibType21-v1430,

sibType24-v1530, sibType25-v1530, sibType26-v1530,

sibTypeXX-v16xy}

SystemInfoValueTagList-r13 ::= SEQUENCE (SIZE (1..maxSI-Message)) OF SystemInfoValueTagSI-r13

SystemInfoValueTagSI-r13 ::= INTEGER (0..3)

CellSelectionInfo-v920 ::= SEQUENCE {

q-QualMin-r9 Q-QualMin-r9,

q-QualMinOffset-r9 INTEGER (1..8) OPTIONAL -- Need OP

}

CellSelectionInfo-v1130 ::= SEQUENCE {

q-QualMinWB-r11 Q-QualMin-r9

}

CellSelectionInfo-v1250 ::= SEQUENCE {

q-QualMinRSRQ-OnAllSymbols-r12 Q-QualMin-r9

}

CellAccessRelatedInfo-r14 ::= SEQUENCE {

plmn-IdentityList-r14 PLMN-IdentityList,

trackingAreaCode-r14 TrackingAreaCode,

cellIdentity-r14 CellIdentity

}

CellAccessRelatedInfo-5GC-r15 ::= SEQUENCE {

plmn-IdentityList-r15 PLMN-IdentityList-r15,

ran-AreaCode-r15 RAN-AreaCode-r15 OPTIONAL, -- Need OR

trackingAreaCode-5GC-r15 TrackingAreaCode-5GC-r15,

cellIdentity-5GC-r15 CellIdentity-5GC-r15

}

CellIdentity-5GC-r15 ::= CHOICE{

cellIdentity-r15 CellIdentity,

cellId-Index-r15 INTEGER (1..maxPLMN-r11)

}

PosSchedulingInfoList-r15 ::= SEQUENCE (SIZE (1..maxSI-Message)) OF PosSchedulingInfo-r15

PosSchedulingInfo-r15 ::= SEQUENCE {

posSI-Periodicity-r15 ENUMERATED {rf8, rf16, rf32, rf64, rf128, rf256, rf512},

posSIB-MappingInfo-r15 PosSIB-MappingInfo-r15

}

PosSIB-MappingInfo-r15 ::= SEQUENCE (SIZE (1..maxSIB)) OF PosSIB-Type-r15

PosSIB-Type-r15 ::= SEQUENCE {

encrypted-r15 ENUMERATED { true } OPTIONAL, -- Need OP

gnss-id-r15 GNSS-ID-r15 OPTIONAL, -- Need OP

sbas-id-r15 SBAS-ID-r15 OPTIONAL, -- Need OP

posSibType-r15 ENUMERATED { posSibType1-1,

posSibType1-2,

posSibType1-3,

posSibType1-4,

posSibType1-5,

posSibType1-6,

posSibType1-7,

posSibType2-1,

posSibType2-2,

posSibType2-3,

posSibType2-4,

posSibType2-5,

posSibType2-6,

posSibType2-7,

posSibType2-8,

posSibType2-9,

posSibType2-10,

posSibType2-11,

posSibType2-12,

posSibType2-13,

posSibType2-14,

posSibType2-15,

posSibType2-16,

posSibType2-17,

posSibType2-18,

posSibType2-19,

posSibType3-1,

...},

...

}

-- ASN1STOP

| *SystemInformationBlockType1* field descriptions |
| --- |
| ***bandwithReducedAccessRelatedInfo***  Access related information for BL UEs and UEs in CE. NOTE 3. |
| ***category0Allowed***  The presence of this field indicates category 0 UEs are allowed to access the cell. |
| ***cellAccessRelatedInfoList***  This field contains a list allowing signalling of access related information per PLMN. One PLMN can be included in only one entry of this list. NOTE 4. |
| ***cellAccessRelatedInfoList-5GC***  This field contains a PLMN list and a list allowing signalling of access related information per PLMN for PLMNs that provides connectivity to 5GC. One PLMN can be included in only one entry of this list. NOTE4 |
| ***cellBarred, cellBarred-CRS***  barred means the cell is barred, as defined in TS 36.304 [4]. |
| ***cellBarred-5GC, cellBarred-5GC-CRS***  barred means the cell is barred for connectivity to 5GC, as defined in TS 36.304 [4]. |
| ***cellIdentity***  Indicates the cell identity. NOTE 2. |
| ***cellId-Index***  The index of the cell ID in the PLMN lists for EPC, indicates UE the corresponding cell ID is used for 5GC. Value 1 indicates the cell ID of the 1st PLMN list for EPC in the SIB1. Value 2 indicates the cell ID of the 2nd PLMN list for EPC, and so on. |
| ***cellReservedForOperatorUse, cellReservedForOperatorUse-CRS***  As defined in TS 36.304 [4]. |
| ***cellSelectionInfoCE***  Cell selection information for BL UEs and UEs in CE. If absent, coverage enhancement S criteria is not applicable. NOTE 3. |
| ***cellSelectionInfoCE1***  Cell selection information for BL UEs and UEs in CE supporting CE Mode B. E-UTRAN includes this IE only if *cellSelectionInfoCE* is present in *SystemInformationBlockType1-BR*. NOTE 3. | |
| ***crs-IntfMitigConfig***  *crs-IntfMitigEnabled* indicates CRS interference mitigation is enabled for the cell, as specified in TS 36.133 [16], clause 3.6.1.1. For BL UEs or UEs in CE supporting *ce-CRS-IntfMitig,* presence of *crs-IntfMitigNumPRBs* indicates CRS interference mitigation is enabled in the cell, as specified in TS 36.133 [16], clauses 3.6.1.2 and 3.6.1.3, and the value of *crs-IntfMitigNumPRBs* indicates number of PRBs, i.e. 6 or 24 PRBs, for CRS transmission in the central cell BW when CRS interference mitigation is enabled. For UEs not supporting this feature, the behaviour is undefined if this field is configured and the field *cellBarred* in *SystemInformationBlockType1* (*SystemInformationBlockType1-BR* for BL UEs or UEs in CE) is set to *notbarred*. | |
| ***csg-Identity***  Identity of the Closed Subscriber Group the cell belongs to. |
| ***csg-Indication***  If set to TRUE the UE is only allowed to access the cell if it is a CSG member cell, if selected during manual CSG selection or to obtain limited service, see TS 36.304 [4]. |
| ***eCallOverIMS-Support***  Indicates whether the cell supports eCall over IMS services via EPC for UEs as defined in TS 23.401 [41]. If absent, eCall over IMS via EPC is not supported by the network in the cell.NOTE 2. |
| ***eCallOverIMS-Support5GC***  Indicates whether the cell supports eCall over IMS services via 5GC as defined in TS 23.401 [41]. If absent, eCall over IMS via 5GC is not supported by the network in the cell.NOTE 2. |
| ***eDRX-Allowed***  The presence of this field indicates if idle mode extended DRX is allowed in the cell. The UE shall stop using extended DRX in idle mode if *eDRX-Allowed* is not present. |
| ***encrypted***  The presence of this field indicates that the posSibType is encrypted as specified in TS 36.355 [54]. |
| ***fdd-DownlinkOrTddSubframeBitmapBR***  The set of valid subframes for FDD downlink or TDD transmissions, see TS 36.213 [23].  If this field is present, *SystemInformationBlockType1-BR-r13* is transmitted in *RRCConnectionReconfiguration*, and if *RRCConnectionReconfiguration* does not include *systemInformationBlockType2Dedicated*, UE may assume the valid subframes in fdd-*DownlinkOrTddSubframeBitmapBR* are not indicated as MBSFN subframes. If this field is not present, the set of valid subframes is the set of non-MBSFN subframes as indicated by *mbsfn-SubframeConfigList*. If neither this field nor *mbsfn-SubframeConfigList* is present, all subframes are considered as valid subframes for FDD downlink transmission, all DL subframes according to the uplink-downlink configuration (see TS 36.211 [21]) are considered as valid subframes for TDD DL transmission, and all UL subframes according to the uplink-downlink configuration (see TS 36.211 [21]) are considered as valid subframes for TDD UL transmission.  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. |
| ***fdd-UplinkSubframeBitmapBR***  The set of valid subframes for FDD uplink transmissions for BL UEs, see TS 36.213 [23].  If the field is not present, then UE considers all uplink subframes as valid subframes for FDD uplink transmissions.  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. |
| ***freqBandIndicatorPriority***  If the field is present and supported by the UE, the UE shall prioritize the frequency bands in the *multiBandInfoList* field in decreasing priority order. Only if the UE does not support any of the frequency band in *multiBandInfoList,* the UE shall use the value in *freqBandIndicator* field. Otherwise, the UE applies frequency band according to the rules defined in *multiBandInfoList.* NOTE 2. |
| ***freqBandInfo***  A list of *additionalPmax* and *additionalSpectrumEmission* values, as defined in TS 36.101 [42], table 6.2.4-1, for UEs neither in CE nor BL UEs and TS 36.101 [42], table 6.2.4E-1, for UEs in CE or BL UEs, for the frequency band in *freqBandIndicator*. If E-UTRAN includes *freqBandInfo-v10l0* it includes the same number of entries, and listed in the same order, as in *freqBandInfo-r10*. |
| ***freqHoppingParametersDL***  Downlink frequency hopping parameters for BR versions of SI messages, MPDCCH/PDSCH of paging, MPDCCH/PDSCH of RAR/Msg4 and unicast MPDCCH/PDSCH. If not present, the UE is not configured downlink frequency hopping. |
| ***gnss-ID***  The presence of this field indicates that the *posSibType* is for a specific GNSS. |
| ***hsdn-Cell***  This field indicates this is a HSDN cell as specified in TS 36.304 [4]. |
| ***hyperSFN***  Indicates hyper SFN which increments by one when the SFN wraps around. |
| ***ims-EmergencySupport***  Indicates whether the cell supports IMS emergency bearer services via EPC for UEs in limited service mode. If absent, IMS emergency call via EPC is not supported by the network in the cell for UEs in limited service mode.NOTE 2. |
| ***ims-EmergencySupport5GC***  Indicates whether the cell supports IMS emergency bearer services for UEs in limited service mode via 5GC. If absent, IMS emergency call via 5GC is not supported by the network in the cell for UEs in limited service mode. NOTE 2. |
| ***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].NOTE 2. |
| ***multiBandInfoList***  A list of additional frequency band indicators, as defined in TS 36.101 [42], table 5.5-1, that the cell belongs to. If the UE supports the frequency band in the *freqBandIndicator* field it shall apply that frequency band. Otherwise, the UE shall apply the first listed band which it supports in the *multiBandInfoList* field. If E-UTRAN includes *multiBandInfoList-v9e0* it includes the same number of entries, and listed in the same order, as in *multiBandInfoList* (i.e. without suffix). See Annex D for more descriptions. The UE shall ignore the rule defined in this field description if *freqBandIndicatorPriority*is present and supported by the UE. |
| ***multiBandInfoList-v10j0***  A list of *additionalPmax* and *additionalSpectrumEmission* values, as defined in TS 36.101 [42], table 6.2.4-1, for UEs neither in CE nor BL UEs and TS 36.101 [42], table 6.2.4E-1, for UEs in CE or BL UEs, for the frequency bands in *multiBandInfoList* (i.e. without suffix) and *multiBandInfoList-v9e0*. If E-UTRAN includes *multiBandInfoList-v10j0*, it includes the same number of entries, and listed in the same order, as in *multiBandInfoList* (i.e. without suffix). If E-UTRAN includes *multiBandInfoList-v10l0* it includes the same number of entries, and listed in the same order, as in *multiBandInfoList-v10j0*. |
| ***plmn-IdentityList***  List of PLMN identities. The first listed *PLMN-Identity* is the primary PLMN.If *plmn-IdentityList-v1530* is included, E-UTRAN includes the same number of entries, and listed in the same order, as in *plmn-IdentityList* (without suffix). NOTE 2. |
| ***plmn-Index***  Index of the PLMN in the *plmn-IdentityList* fields included in SIB1 for EPC, indicating the same PLMN ID is connected to 5GC. Value 1 indicates the 1st PLMN in the 1st *plmn-IdentityList* included in SIB1, value 2 indicates the 2nd PLMN in the same *plmn-IdentityList*, or when no more PLMNs are present within the same *plmn-IdentityList*, then the PLMN listed 1st in the subsequent *plmn-IdentityList* within the same SIB1 and so on. NOTE 6. |
| ***p-Max***  Value applicable for the cell. If absent the UE applies the maximum power according to its capability as specified in TS 36.101 [42], clause 6.2.2.NOTE 2. |
| ***posSIB-MappingInfo***  List of the posSIBs mapped to this *SystemInformation* message. |
| ***posSibType***  The positioning SIB type is defined in TS 36.355 [54]. |
| ***q-QualMin***  Parameter "Qqualmin" in TS 36.304 [4]. If *cellSelectionInfo-v920* is not present, the UE applies the (default) value of negative infinity for Qqualmin. NOTE 1. |
| ***q-QualMinRSRQ-OnAllSymbols***  If this field is present and supported by the UE, the UE shall, when performing RSRQ measurements, perform RSRQ measurement on all OFDM symbols in accordance with TS 36.214 [48]. NOTE 1. |
| ***q-QualMinOffset***  Parameter "Qqualminoffset" in TS 36.304 [4]. Actual value Qqualminoffset = field value [dB]. If *cellSelectionInfo-v920* is not present or the field is not present, the UE applies the (default) value of 0 dB for Qqualminoffset.Affects the minimum required quality level in the cell. |
| ***q-QualMinWB***  If this field is present and supported by the UE, the UE shall, when performing RSRQ measurements, use a wider bandwidth in accordance with TS 36.133 [16]. NOTE 1. |
| ***q-RxLevMinOffset***  Parameter Qrxlevminoffset in TS 36.304 [4]. Actual value Qrxlevminoffset = field value \* 2 [dB]. If absent, the UE applies the (default) value of 0 dB for Qrxlevminoffset*.* Affects the minimum required Rx level in the cell. |
| ***sbas-ID***  The presence of this field indicates that the *posSibType* is for a specific SBAS. |
| ***sib-MappingInfo***  List of the SIBs mapped to this *SystemInformation* message. There is no mapping information of SIB2; it is always present in the first *SystemInformation* message listed in the *schedulingInfoList* list. |
| ***si-HoppingConfigCommon***  Frequency hopping activation/deactivation for BR versions of SI messages and MPDCCH/PDSCH of paging. |
| ***si-Narrowband***  This field indicates the index of a narrowband used to broadcast the SI message towards BL UEs and UEs in CE, see TS 36.211 [21], clause 6.4.1 and TS 36.213 [23], clause 7.1.6. Field values (1..*maxAvailNarrowBands-r13*) correspond to narrowband indices (0..[*maxAvailNarrowBands-r13*-1]) as specified in TS 36.211 [21]. |
| ***si-RepetitionPattern***  Indicates the radio frames within the SI window used for SI message transmission. Value everyRF corresponds to every radio frame, value every2ndRF corresponds to every 2 radio frames, and so on. The first transmission of the SI message is transmitted from the first radio frame of the SI window. |
| ***si-Periodicity, posSI-Periodicity***  Periodicity of the SI-message in radio frames, such that rf8 denotes 8 radio frames, rf16 denotes 16 radio frames, and so on. If the *si-posOffset* is configured, the *posSI-Periodicity* of rf8 cannot be used. |
| ***si-posOffset***  This field, if present and set to *true* indicates that the SI messages in *PosSchedulingInfoList* are scheduled with an offset of 8 radio frames compared to SI messages in *SchedulingInfoList*. *si-posOffset* may be present only if the shortest configured SI message periodicity for SI messages in *SchedulingInfoList* is 80ms. |
| ***si-TBS***  This field indicates the transport block size information used to broadcast the SI message towards BL UEs and UEs in CE, see TS 36.213 [23], Table 7.1.7.2.1-1, for a 6 PRB bandwidth and a QPSK modulation. |
| ***schedulingInfoList-BR***  Indicates additional scheduling information of SI messages for BL UEs and UEs in CE. It includes the same number of entries, and listed in the same order, as in *schedulingInfoList* (without suffix). |
| ***si-ValidityTime***  Indicates system information validity timer. If set to TRUE, the timer is set to 3h, otherwise the timer is set to 24h. |
| ***si-WindowLength, si-WindowLength-BR***  Common SI scheduling window for all SIs. Unit in milliseconds, where ms1 denotes 1 millisecond, ms2 denotes 2 milliseconds and so on. In case s*i-WindowLength-BR-r13* is present and the UE is a BL UE or a UE in CE, the UE shall use s*i-WindowLength-BR-r13* and ignore the original field *si-WindowLength* (without suffix). UEs other than BL UEs or UEs in CE shall ignore the extension field s*i-WindowLength-BR-r13.* |
| ***startSymbolBR***  For BL UEs and UEs in CE, indicates the OFDM starting symbol for any MPDCCH, PDSCH scheduled on the same cell except the PDSCH carrying *SystemInformationBlockType1-BR*, see TS 36.213 [23]. Values 1, 2, and 3 are applicable for *dl-Bandwidth* greater than 10 resource blocks. Values 2, 3, and 4 are applicable otherwise. |
| ***systemInfoValueTagList***  Indicates SI message specific value tags for BL UEs and UEs in CE. It includes the same number of entries, and listed in the same order, as in *schedulingInfoList* (without suffix). |
| ***systemInfoValueTagSI***  SI message specific value tag as specified in clause 5.2.1.3. Common for all SIBs within the SI message other than MIB, SIB1, SIB10, SIB11, SIB12 and SIB14. |
| ***systemInfoValueTag***  Common for all SIBs other than MIB, MIB-MBMS, SIB1, SIB1-MBMS, SIB10, SIB11, SIB12 and SIB14. Change of MIB, MIB-MBMS, SIB1 and SIB1-MBMS is detected by acquisition of the corresponding message. |
| ***tdd-Config***  Specifies the TDD specific physical channel configurations. NOTE 2. |
| ***trackingAreaCode/trackingAreaCode-5GC***  A *trackingAreaCode* that is common for all the PLMNs listed. NOTE2. NOTE 5. |

NOTE 1: The value the UE applies for parameter "Qqualmin" in TS 36.304 [4] depends on the *q-QualMin* fields signalled by E-UTRAN and supported by the UE. In case multiple candidate options are available, the UE shall select the highest priority candidate option according to the priority order indicated by the following table (top row is highest priority).

|  |  |  |
| --- | --- | --- |
| q-QualMinRSRQ-OnAllSymbols | q-QualMinWB | Value of parameter "Qqualmin" in TS 36.304 [4] |
| Included | Included | *q-QualMinRSRQ-OnAllSymbols* – (*q-QualMin* – *q-QualMinWB*) |
| Included | Not included | *q-QualMinRSRQ-OnAllSymbols* |
| Not included | Included | *q-QualMinWB* |
| Not included | Not included | *q-QualMin* |

NOTE 2: E-UTRAN sets this field to the same value for all instances of SIB1 message that are broadcasted within the same cell.

NOTE 3: E-UTRAN configures this field only in the BR version of SIB1 message.

NOTE 4: E-UTRAN configures at most 6 EPC PLMNs in total (i.e. across all the PLMN lists except for PLMN lists in *cellAccessRelatedInfoList-5GC* in SIB1). E-UTRAN configures at most 6 5GC PLMNs in total (i.e. across all the PLMN lists in *cellAccessRelatedInfoList-5GC* in SIB1).

NOTE 5: E-UTRAN configures only one value for this parameter per PLMN.

NOTE 6: E-UTRAN configures *plmn-Index* only if the *cellBarred* is set to *notBarred.*

| Conditional presence | Explanation |
| --- | --- |
| *BW-reduced* | The field is optional present, Need OR, if *schedulingInfoSIB1-BR* in MIB is set to a value greater than 0. Otherwise the field is not present. |
| *FBI-max* | The field is mandatory present if *freqBandIndicator* (i.e. without suffix) is set to *maxFBI*. Otherwise the field is not present. |
| *mFBI* | The field is optional present, Need OR, if *multiBandInfoList* is present. Otherwise the field is not present. |
| *mFBI-max* | The field is mandatory present if one or more entries in *multiBandInfoList* (i.e. without suffix, introduced in -v8h0) is set to *maxFBI*. Otherwise the field is not present. |
| *RSRQ* | The field is mandatory present if SIB3 is being broadcast and *threshServingLowQ* is present in SIB3; otherwise optionally present, Need OP. |
| *RSRQ2* | The field is mandatory present if *q-QualMinRSRQ-OnAllSymbols* is present in SIB3; otherwise it is not present and the UE shall delete any existing value for this field. |
| *Hopping* | The field is mandatory present if *si-HoppingConfigCommon* field is broadcasted and set to *on*. Otherwise the field is optionally present, need OP. |
| *QrxlevminCE1* | The field is optionally present, Need OR, if *q-RxLevMinCE1-r13* is set below -140 dBm. Otherwise the field is not present. |
| *TDD* | This field is mandatory present for TDD; it is not present for FDD and the UE shall delete any existing value for this field. |
| *TDD-OR* | The field is optional present for TDD, need OR; it is not present for FDD. |
| *WB-RSRQ* | The field is optionally present, need OP if the measurement bandwidth indicated by *allowedMeasBandwidth* in *systemInformationBlockType3* is 50 resource blocks or larger; otherwise it is not present. |
| *SI-BR* | The field is mandatory present if *schedulingInfoSIB1-BR* is included in MIB with a value greater than 0. Otherwise the field is not present. |

|  |
| --- |
| Next change |

### 6.3.1 System information blocks

#### – SystemInformationBlockTypeXX

The IE *SystemInformationBlockTypeXX* contains assistance information relevant only for inter-RAT cell selection i.e. assistance information about NB-IoT frequencies for cell selection.

*SystemInformationBlockTypeXX* information element

-- ASN1START

SystemInformationBlockTypeXX-r16 ::= SEQUENCE {

carrierFreqListNBIOT-r16 CarrierFreqListNBIOT-r16 OPTIONAL, -- Need OR

lateNonCriticalExtension OCTET STRING OPTIONAL,

...

}

CarrierFreqListNBIOT-r16 ::= SEQUENCE (SIZE (1.. maxFreqNBIOT-r16)) OF CarrierFreqNBIOT-r16

CarrierFreqNBIOT-r16 ::= SEQUENCE {

carrierFreq-r16 ARFCN-ValueEUTRA-r9,

carrierFreqOffset-r16 ENUMERATED {v-10, v-9, v-8dot5, v-8, v-7, v-6, v-5, v-4dot5,

v-4,v-3, v-2, v-1, v-0dot5, v0, v1, v2, v3, v3dot5,

v4, v5, v6, v7, v7dot5, v8, v9}

}

-- ASN1STOP

| *SystemInformationBlockTypeXX* field descriptions |
| --- |
| ***carrierFreqListNBIOT***  Provides a list of neighbouring NB-IoT carrier frequencies, which may be searched for neighbouring NB-IoT cells. |
| ***carrierFreqNBIOT***  NB-IoT carrier frequency. |
| ***carrierFreq***  Provides the ARFCN applicable for the NB-IoT carrier frequency as defined in TS 36.101 [42], Table 5.7.3-1. |
| ***carrierFreqOffset***  Offset of the NB-IoT channel number to EARFCN as defined in TS 36.101 [42], clause 5.7.3F. Value *v-10* means -10, *v-9* means -9, and so on. The values *v-8dot5*, *v-4dot5*, *v3dot5* and *v7dot5* are only applicable for a carrier in a TDD band. |

|  |
| --- |
| Next change |

## 6.4 RRC multiplicity and type constraint values

### – Multiplicity and type constraint definitions

-- ASN1START

maxAccessCat-1-r15 INTEGER ::= 63 -- Maximum number of Access Categories - 1

maxACDC-Cat-r13 INTEGER ::= 16 -- Maximum number of ACDC categories (per PLMN)

maxAvailNarrowBands-r13 INTEGER ::= 16 -- Maximum number of narrowbands

maxBandComb-r10 INTEGER ::= 128 -- Maximum number of band combinations.

maxBandComb-r11 INTEGER ::= 256 -- Maximum number of additional band combinations.

maxBandComb-r13 INTEGER ::= 384 -- Maximum number of band combinations in Rel-13

maxBands INTEGER ::= 64 -- Maximum number of bands listed in EUTRA UE caps

maxBandsNR-r15 INTEGER ::= 1024 -- Maximum number of NR bands listed in EUTRA UE caps

maxBandwidthClass-r10 INTEGER ::= 16 -- Maximum number of supported CA BW classes per band

maxBandwidthCombSet-r10 INTEGER ::= 32 -- Maximum number of bandwidth combination sets per

-- supported band combination

maxBarringInfoSet-r15 INTEGER ::= 8 -- Maximum number of UAC barring information sets

maxBT-IdReport-r15 INTEGER ::= 32 -- Maximum number of Bluetooth IDs to report

maxBT-Name-r15 INTEGER ::= 4 -- Maximum number of Bluetooth name

maxCBR-Level-r14 INTEGER ::= 16 -- Maximum number of CBR levels

maxCBR-Level-1-r14 INTEGER ::= 15

maxCBR-Report-r14 INTEGER ::= 72 -- Maximum number of CBR results in a report

maxCDMA-BandClass INTEGER ::= 32 -- Maximum value of the CDMA band classes

maxCE-Level-r13 INTEGER ::= 4 -- Maximum number of CE levels

maxCellBlack INTEGER ::= 16 -- Maximum number of blacklisted physical cell identity

-- ranges listed in SIB type 4 and 5

maxCellHistory-r12 INTEGER ::= 16 -- Maximum number of visited EUTRA cells reported

maxCellInfoGERAN-r9 INTEGER ::= 32 -- Maximum number of GERAN cells for which system in-

-- formation can be provided as redirection assistance

maxCellInfoUTRA-r9 INTEGER ::= 16 -- Maximum number of UTRA cells for which system

-- information can be provided as redirection

-- assistance

maxCellMeasIdle-r15 INTEGER ::= 8 -- Maximum number of neighbouring inter-frequency

-- cells per carrier measured in IDLE mode

maxCombIDC-r11 INTEGER ::= 128 -- Maximum number of reported UL CA or

-- MR-DC combinations

maxCSI-IM-r11 INTEGER ::= 3 -- Maximum number of CSI-IM configurations

-- (per carrier frequency)

maxCSI-IM-r12 INTEGER ::= 4 -- Maximum number of CSI-IM configurations

-- (per carrier frequency)

minCSI-IM-r13 INTEGER ::= 5 -- Minimum number of CSI IM configurations from which

-- REL-13 extension is used

maxCSI-IM-r13 INTEGER ::= 24 -- Maximum number of CSI-IM configurations

-- (per carrier frequency)

maxCSI-IM-v1310 INTEGER ::= 20 -- Maximum number of additional CSI-IM configurations

-- (per carrier frequency)

maxCSI-Proc-r11 INTEGER ::= 4 -- Maximum number of CSI processes (per carrier

-- frequency)

maxCSI-RS-NZP-r11 INTEGER ::= 3 -- Maximum number of CSI RS resource

-- configurations using non-zero Tx power

-- (per carrier frequency)

minCSI-RS-NZP-r13 INTEGER ::= 4 -- Minimum number of CSI RS resource from which

-- REL-13 extension is used

maxCSI-RS-NZP-r13 INTEGER ::= 24 -- Maximum number of CSI RS resource

-- configurations using non-zero Tx power

-- (per carrier frequency)

maxCSI-RS-NZP-v1310 INTEGER ::= 21 -- Maximum number of additional CSI RS resource

-- configurations using non-zero Tx power

-- (per carrier frequency)

maxCSI-RS-ZP-r11 INTEGER ::= 4 -- Maximum number of CSI RS resource

-- configurations using zero Tx power(per carrier

-- frequency)

maxCQI-ProcExt-r11 INTEGER ::= 3 -- Maximum number of additional periodic CQI

-- configurations (per carrier frequency)

maxFreqUTRA-TDD-r10 INTEGER ::= 6 -- Maximum number of UTRA TDD carrier frequencies for

-- which system information can be provided as

-- redirection assistance

maxCellInter INTEGER ::= 16 -- Maximum number of neighbouring inter-frequency

-- cells listed in SIB type 5

maxCellIntra INTEGER ::= 16 -- Maximum number of neighbouring intra-frequency

-- cells listed in SIB type 4

maxCellListGERAN INTEGER ::= 3 -- Maximum number of lists of GERAN cells

maxCellMeas INTEGER ::= 32 -- Maximum number of entries in each of the

-- cell lists in a measurement object

maxCellReport INTEGER ::= 8 -- Maximum number of reported cells/CSI-RS resources

maxCellSFTD INTEGER ::= 3 -- Maximum number of cells for SFTD reporting

maxConfigSPS-r14 INTEGER ::= 8 -- Maximum number of simultaneous SPS configurations

maxConfigSPS-r15 INTEGER ::= 6 -- Maximum number of simultaneous SPS configurations

-- configured with SPS C-RNTI

maxCSI-RS-Meas-r12 INTEGER ::= 96 -- Maximum number of entries in the CSI-RS list

-- in a measurement object

maxDRB INTEGER ::= 11 -- Maximum number of Data Radio Bearers

maxDRBExt-r15 INTEGER ::= 4 -- Maximum number of additional DRBs

maxDRB-r15 INTEGER ::= 15 -- Highest value of extended maximum number of DRBs

maxDS-Duration-r12 INTEGER ::= 5 -- Maximum number of subframes in a discovery signals

-- occasion

maxDS-ZTP-CSI-RS-r12 INTEGER ::= 5 -- Maximum number of zero transmission power CSI-RS for

-- a serving cell concerning discovery signals

maxEARFCN INTEGER ::= 65535 -- Maximum value of EUTRA carrier frequency

maxEARFCN-Plus1 INTEGER ::= 65536 -- Lowest value extended EARFCN range

maxEARFCN2 INTEGER ::= 262143 -- Highest value extended EARFCN range

maxEPDCCH-Set-r11 INTEGER ::= 2 -- Maximum number of EPDCCH sets

maxFBI INTEGER ::= 64 -- Maximum value of fequency band indicator

maxFBI-NR-r15 INTEGER ::= 1024 -- Highest value FBI range for NR.

maxFBI-Plus1 INTEGER ::= 65 -- Lowest value extended FBI range

maxFBI2 INTEGER ::= 256 -- Highest value extended FBI range

maxFeatureSets-r15 INTEGER ::= 256 -- Total number of feature sets (size of pool)

maxPerCC-FeatureSets-r15 INTEGER ::= 32 -- Total number of CC-specific feature sets

-- (size of the pool)

maxFreq INTEGER ::= 8 -- Maximum number of carrier frequencies

maxFreqIDC-r11 INTEGER ::= 32 -- Maximum number of carrier frequencies that are

-- affected by the IDC problems

maxFreqIdle-r15 INTEGER ::= 8 -- Maximum number of carrier frequencies for

-- IDLE mode measurements configured by eNB

maxFreqMBMS-r11 INTEGER ::= 5 -- Maximum number of carrier frequencies for which an

-- MBMS capable UE may indicate an interest

maxFreqNBIOT-r16 INTEGER ::= 8 -- Maximum number of NB-IoT carrier frequencies that can

-- be provided as assistance information for inter-RAT

-- cell selection

maxFreqNR-r15 INTEGER ::= 5 -- Maximum number of NR carrier frequencies for

-- which a UE may provide measurement results upon

-- NR SCG failure

maxFreqV2X-r14 INTEGER ::= 8 -- Maximum number of carrier frequencies for which V2X

-- sidelink communication can be configured

maxFreqV2X-1-r14 INTEGER ::= 7 -- Highest index of frequencies

maxGERAN-SI INTEGER ::= 10 -- Maximum number of GERAN SI blocks that can be

-- provided as part of NACC information

maxGNFG INTEGER ::= 16 -- Maximum number of GERAN neighbour freq groups

maxIdleMeasCarriers-r15 INTEGER ::= 3 -- Maximum number of neighbouring inter-

-- frequency carriers measured in IDLE mode

maxLCG-r13 INTEGER ::= 4 -- Maximum number of logical channel groups

maxLogMeasReport-r10 INTEGER ::= 520 -- Maximum number of logged measurement entries

-- that can be reported by the UE in one message

maxMBSFN-Allocations INTEGER ::= 8 -- Maximum number of MBSFN frame allocations with

-- different offset

maxMBSFN-Area INTEGER ::= 8

maxMBSFN-Area-1 INTEGER ::= 7

maxMBMS-ServiceListPerUE-r13 INTEGER ::= 15 -- Maximum number of services which the UE can

-- include in the MBMS interest indication

maxMeasId INTEGER ::= 32

maxMeasId-Plus1 INTEGER ::= 33

maxMeasId-r12 INTEGER ::= 64

maxMultiBands INTEGER ::= 8 -- Maximum number of additional frequency bands

-- that a cell belongs to

maxMultiBandsNR-r15 INTEGER ::= 32 -- Maximum number of additional NR frequency bands

-- that a cell belongs to

maxMultiBandsNR-1-r15 INTEGER ::= 31

maxNS-Pmax-r10 INTEGER ::= 8 -- Maximum number of NS and P-Max values per band

maxNAICS-Entries-r12 INTEGER ::= 8 -- Maximum number of supported NAICS combination(s)

maxNeighCell-r12 INTEGER ::= 8 -- Maximum number of neighbouring cells in NAICS

-- configuration (per carrier frequency)

maxNeighCell-SCPTM-r13 INTEGER ::= 8 -- Maximum number of SCPTM neighbour cells

maxNrofS-NSSAI-r15 INTEGER ::= 8 -- Maximum number of S-NSSAI

maxObjectId INTEGER ::= 32

maxObjectId-Plus1-r13 INTEGER ::= 33

maxObjectId-r13 INTEGER ::= 64

maxP-a-PerNeighCell-r12 INTEGER ::= 3 -- Maximum number of power offsets for a neighbour cell

-- in NAICS configuration

maxPageRec INTEGER ::= 16 --

maxPhysCellIdRange-r9 INTEGER ::= 4 -- Maximum number of physical cell identity ranges

maxPLMN-r11 INTEGER ::= 6 -- Maximum number of PLMNs

maxPLMN-1-r14 INTEGER ::= 5 -- Maximum number of PLMNs minus one

maxPLMN-r15 INTEGER ::= 8 -- Maximum number of PLMNs for RNA configuration

maxPLMN-NR-r15 INTEGER ::= 12 -- Maximum number of NR PLMNs

maxPNOffset INTEGER ::= 511 -- Maximum number of CDMA2000 PNOffsets

maxPMCH-PerMBSFN INTEGER ::= 15

maxPSSCH-TxConfig-r14 INTEGER ::= 16 -- Maximum number of PSSCH TX configurations

maxQuantSetsNR-r15 INTEGER ::= 2 -- Maximum number of NR quantity configuration sets

maxQCI-r13 INTEGER ::= 6 -- Maximum number of QCIs

maxRAT-Capabilities INTEGER ::= 8 -- Maximum number of interworking RATs (incl EUTRA)

maxRE-MapQCL-r11 INTEGER ::= 4 -- Maximum number of PDSCH RE Mapping configurations

-- (per carrier frequency)

maxReportConfigId INTEGER ::= 32

maxReservationPeriod-r14 INTEGER ::= 16 -- Maximum number of resource reservation periodicities

-- for sidelink V2X communication

maxRS-Index-r15 INTEGER ::= 64 -- Maximum number of RS indices

maxRS-Index-1-r15 INTEGER ::= 63 -- Highest value of RS index as used to identify

-- RS index in RRM reports.

maxRS-IndexCellQual-r15 INTEGER ::= 16 -- Maximum number of RS indices averaged to derive

-- cell quality for RRM.

maxRS-IndexReport-r15 INTEGER ::= 32 -- Maximum number of RS indices for RRM.

maxRSTD-Freq-r10 INTEGER ::= 3 -- Maximum number of frequency layers for RSTD

-- measurement

maxSAI-MBMS-r11 INTEGER ::= 64 -- Maximum number of MBMS service area identities

-- broadcast per carrier frequency

maxSCell-r10 INTEGER ::= 4 -- Maximum number of SCells

maxSCell-r13 INTEGER ::= 31 -- Highest value of extended number range of SCells

maxSCellGroups-r15 INTEGER ::= 4 -- Maximum number of SCell common parameter groups

maxSC-MTCH-r13 INTEGER ::= 1023 -- Maximum number of SC-MTCHs in one cell

maxSC-MTCH-BR-r14 INTEGER ::= 128 -- Maximum number of SC-MTCHs in one cell for feMTC

maxSL-CommRxPoolNFreq-r13 INTEGER ::= 32 -- Maximum number of individual sidelink communication

-- Rx resource pools on neighbouring freq

maxSL-CommRxPoolPreconf-v1310 INTEGER ::= 12 -- Maximum number of additional preconfigured

-- sidelink communication Rx resource pool entries

maxSL-TxPool-r12Plus1-r13 INTEGER ::= 5 -- First additional individual sidelink

-- Tx resource pool

maxSL-TxPool-v1310 INTEGER ::= 4 -- Maximum number of additional sidelink

-- Tx resource pool entries

maxSL-TxPool-r13 INTEGER ::= 8 -- Maximum number of individual sidelink

-- Tx resource pools

maxSL-CommTxPoolPreconf-v1310 INTEGER ::= 7 -- Maximum number of additional preconfigured

-- sidelink Tx resource pool entries

maxSL-Dest-r12 INTEGER ::= 16 -- Maximum number of sidelink destinations

maxSL-DiscCells-r13 INTEGER ::= 16 -- Maximum number of cells with similar sidelink

-- configurations

maxSL-DiscPowerClass-r12 INTEGER ::= 3 -- Maximum number of sidelink power classes

maxSL-DiscRxPoolPreconf-r13 INTEGER ::= 16 -- Maximum number of preconfigured sidelink

-- discovery Rx resource pool entries

maxSL-DiscSysInfoReportFreq-r13 INTEGER ::= 8 -- Maximum number of frequencies to include in a

-- SidelinkUEInformation for SI reporting

maxSL-DiscTxPoolPreconf-r13 INTEGER ::= 4 -- Maximum number of preconfigured sidelink

-- discovery Tx resource pool entries

maxSL-GP-r13 INTEGER ::= 8 -- Maximum number of gap patterns that can be requested

-- for a frequency or assigned

maxSL-PoolToMeasure-r14 INTEGER ::= 72 -- Maximum number of TX resource pools for CBR

-- measurement and report

maxSL-Prio-r13 INTEGER ::= 8 -- Maximum number of entries in sidelink priority list

maxSL-RxPool-r12 INTEGER ::= 16 -- Maximum number of individual sidelink Rx resource pools

maxSL-Reliability-r15 INTEGER ::= 8 -- Maximum number of entries in sidelink reliability list

maxSL-SyncConfig-r12 INTEGER ::= 16 -- Maximum number of sidelink Sync configurations

maxSL-TF-IndexPair-r12 INTEGER ::= 64 -- Maximum number of sidelink Time Freq resource index

-- pairs

maxSL-TxPool-r12 INTEGER ::= 4 -- Maximum number of individual sidelink Tx resource pools

maxSL-V2X-RxPool-r14 INTEGER ::= 16 -- Maximum number of RX resource pools for

-- V2X sidelink communication

maxSL-V2X-RxPoolPreconf-r14 INTEGER ::= 16 -- Maximum number of RX resource pools for

-- V2X sidelink communication

maxSL-V2X-TxPool-r14 INTEGER ::= 8 -- Maximum number of TX resource pools for

-- V2X sidelink communication

maxSL-V2X-TxPoolPreconf-r14 INTEGER ::= 8 -- Maximum number of TX resource pools for

-- V2X sidelink communication

maxSL-V2X-SyncConfig-r14 INTEGER ::= 16 -- Maximum number of sidelink Sync configurations

-- for V2X sidelink communication

maxSL-V2X-CBRConfig-r14 INTEGER ::= 4 -- Maximum number of CBR range configurations

-- for V2X sidelink communication congestion

-- control

maxSL-V2X-CBRConfig-1-r14 INTEGER ::= 3

maxSL-V2X-TxConfig-r14 INTEGER ::= 64 -- Maximum number of TX parameter configurations

-- for V2X sidelink communication congestion

-- control

maxSL-V2X-TxConfig-1-r14 INTEGER ::= 63

maxSL-V2X-CBRConfig2-r14 INTEGER ::= 8 -- Maximum number of CBR range configurations in

-- pre-configuration for V2X sidelink

-- communication congestion control

maxSL-V2X-CBRConfig2-1-r14 INTEGER ::= 7

maxSL-V2X-TxConfig2-r14 INTEGER ::= 128 -- Maximum number of TX parameter

-- configurations in pre-configuration for V2X

-- sidelink communication congestion control

maxSL-V2X-TxConfig2-1-r14 INTEGER ::= 127

maxSTAG-r11 INTEGER ::= 3 -- Maximum number of STAGs

maxServCell-r10 INTEGER ::= 5 -- Maximum number of Serving cells

maxServCell-r13 INTEGER ::= 32 -- Highest value of extended number range of Serving cells

maxServCellNR-r15 INTEGER ::= 16 -- Maximum number of NR serving cells

maxServiceCount INTEGER ::= 16 -- Maximum number of MBMS services that can be included

-- in an MBMS counting request and response

maxServiceCount-1 INTEGER ::= 15

maxSessionPerPMCH INTEGER ::= 29

maxSessionPerPMCH-1 INTEGER ::= 28

maxSIB INTEGER ::= 32 -- Maximum number of SIBs

maxSIB-1 INTEGER ::= 31

maxSI-Message INTEGER ::= 32 -- Maximum number of SI messages

maxSimultaneousBands-r10 INTEGER ::= 64 -- Maximum number of simultaneously aggregated bands

maxSubframePatternIDC-r11 INTEGER ::= 8 -- Maximum number of subframe reservation patterns

-- that the UE can simultaneously recommend to the

-- E-UTRAN for use.

maxTrafficPattern-r14 INTEGER ::= 8 -- Maximum number of periodical traffic patterns

-- that the UE can simultaneously report to the

-- E-UTRAN.

maxUTRA-FDD-Carrier INTEGER ::= 16 -- Maximum number of UTRA FDD carrier frequencies

maxUTRA-TDD-Carrier INTEGER ::= 16 -- Maximum number of UTRA TDD carrier frequencies

maxWayPoint-r15 INTEGER ::= 20 -- Maximum number of flight path information waypoints

maxWLAN-Id-r12 INTEGER ::= 16 -- Maximum number of WLAN identifiers

maxWLAN-Bands-r13 INTEGER ::= 8 -- Maximum number of WLAN bands

maxWLAN-Id-r13 INTEGER ::= 32 -- Maximum number of WLAN identifiers

maxWLAN-Channels-r13 INTEGER ::= 16 -- maximum number of WLAN channels used in

-- WLAN-CarrierInfo

maxWLAN-CarrierInfo-r13 INTEGER ::= 8 -- Maximum number of WLAN Carrier Information

maxWLAN-Id-Report-r14 INTEGER ::= 32 -- Maximum number of WLAN IDs to report

maxWLAN-Name-r15 INTEGER ::= 4 -- Maximum number of WLAN name

-- ASN1STOP

NOTE: The value of maxDRB aligns with SA2.

Editor’s Note: The value of maxFreqNBIOT-r16 is FFS.

### – End of EUTRA-RRC-Definitions

-- ASN1START

END

-- ASN1STOP

|  |
| --- |
| Next change |

## 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,

InitialUE-Identity,

IntraFreqBlackCellList,

IntraFreqNeighCellList,

I-RNTI-r15,

LocationInfo-r10,

maxAccessCat-1-r15,

maxBands,

maxCellBlack,

maxCellInter,

maxCellIntra,

maxFBI2,

maxFreq,

maxMultiBands,

maxNrofS-NSSAI-r15,

maxPageRec,

maxPLMN-r11,

maxSAI-MBMS-r11,

maxSIB,

maxSIB-1,

MBMS-SAI-r11,

MBMS-SAI-List-r11,

MBMSSessionInfo-r13,

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,

ShortMAC-I,

S-NSSAI-r15,

S-TMSI,

SystemInformationBlockType16-r11,

SystemInfoValueTagSI-r13,

T-Reordering,

TimeAlignmentTimer,

TimeSinceFailure-r11,

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,

spare BIT STRING (SIZE (9))

}

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. |
| ***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 and SIB16-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 SEQUENCE {} OPTIONAL

}

PagingRecordList-NB-r13 ::= SEQUENCE (SIZE (1..maxPageRec)) OF PagingRecord-NB-r13

PagingRecord-NB-r13 ::= SEQUENCE {

ue-Identity-r13 PagingUE-Identity,

...,

[[

mt-EDT-r16 ENUMERATED {true} OPTIONAL -- Need ON

]]

}

-- ASN1STOP

| *Paging-NB* field descriptions |
| --- |
| ***mt-EDT***  Indication of mobile-terminated EDT. |
| ***systemInfoModification***  If present: indication of a BCCH modification other than for *SystemInformationBlockType14-NB* (SIB14-NB) and *SystemInformationBlockType16-NB* (SIB16-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) and *SystemInformationBlockType16-NB* (SIB16-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 {

purConfigRequest-r16 PURConfigRequest-NB-r16 OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

PURConfigRequest-NB-r16 ::= CHOICE{

pur-ReleaseReq-r16 NULL,

pur-ConfigReq-r16 SEQUENCE {

requestedNumOccasions-r16 ENUMERATED {value1, value2, value3, infinity},

requestedPeriodicity-r16 ENUMERATED {periodicity1, periodicity2, periodicity3,

periodicity4},

requestedTBS-r16 ENUMERATED {tbs1, tbs2, tbs3, tbs4},

requestedTimeOffset-r16 ENUMERATED {value1, value2, value3, value4} OPTIONAL,

l1-Ack-r16 ENUMERATED {true} OPTIONAL,

...

}

}

-- ASN1STOP

Editor’s Note: FFS detailed values for the assistance information.

Editor’s Note: FFS other information.

| *PURConfigurationRequest-NB* field descriptions |
| --- |
| ***l1-Ack***  This field indicates that if RRC response message for transmission using PUR is not needed, using L1 ACK to conclude the PUR procedure and move the UE to IDLE is sufficient. |
| ***requestedNumOccasions***  This field indicates the UE’s preference on PUR configuration corresponding to the number PUR occasions. Value *value1* corresponds to value1 occasions, value *value2* corresponds to value2 occasions and so on. |
| ***requestedPeriodicity***  This field indicates the UE’s preference on PUR configuration corresponding to the periodicity of PUR occasions. Value in FFS. |
| ***requestedTBS***  This field indicates the UE’s preference on PUR configuration corresponding to the TBS. Value in bits. Value *tbs1* corresponds to tbs1 bits, value *tbs2* corresponds to tbs2 bits and so on. |
| ***requestedTimeOffset***  This field indicates the UE’s preference on the time offset for the first PUR occasion, i.e. the preferred time gap from transmission of D-PUR request to the first PUR occasion. Value in FFS. |

#### – *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 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 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-v16xy-IEs OPTIONAL

}

RRCConnectionReestablishmentComplete-NB-v16xy-IEs ::= SEQUENCE {

rlf-InfoAvailable-r16 ENUMERATED {true} OPTIONAL,

anr-InfoAvailable-r16 ENUMERATED {true} OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *RRCConnectionReestablishmentComplete-NB field descriptions* |
| --- |
| ***anr-InfoAvailable***  This field is used to indicate the availability of ANR measurement information. |
| ***measResultServCell***  This field refers to the last idle mode measurement results taken of the serving cell. |
| ***rlf-InfoAvailable***  This field is used to indicate 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-v16xy-IEs OPTIONAL

}

RRCConnectionRelease-NB-v16xy-IEs ::= SEQUENCE {

resumeIdentity-r16 I-RNTI-r15 OPTIONAL, -- Need OR

anr-MeasConfig-r16 ANR-MeasConfig-NB-r16 OPTIONAL, -- Need ON

pur-Config-r16 PUR-Config-NB-r16 OPTIONAL, -- Need ON

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 |
| --- |
| ***anr-MeasConfig***  Configuration of the measurements to be performed by the UE in RRC\_IDLE for ANR. |
| ***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]. |
| ***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. The network should not set the *releaseCause* to *loadBalancingTAURequired* if 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 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-v16xy-IEs OPTIONAL

}

RRCConnectionResume-NB-v16xy-IEs ::= SEQUENCE {

fullConfig-r16 ENUMERATED {true} OPTIONAL, -- Cond 5GC

newUE-Identity-r16 C-RNTI OPTIONAL, -- Need OP

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

Editor’s Note: FFS whether to have Cond PUR for newUE-Identity-r16.

| *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. |
| ***newUE-Identity***  C-RNTI used in RRC connection, see TS 36.321 [6]. |

| 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-v16xy-IEs OPTIONAL

}

RRCConnectionResumeComplete-NB-v16xy-IEs ::= SEQUENCE {

rlf-InfoAvailable-r16 ENUMERATED {true} OPTIONAL,

anr-InfoAvailable-r16 ENUMERATED {true} OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *RRCConnectionResumeComplete-NB* field descriptions |
| --- |
| ***anr-InfoAvailable***  This field is used to indicate the availability of ANR measurement information. |
| ***measResultServCell***  This field refers to the last idle mode measurement results taken of the serving cell. |
| ***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-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***  This field is used to indicate 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-v16xy-IEs OPTIONAL

}

RRCConnectionSetup-NB-v16xy-IEs ::= SEQUENCE {

dedicatedInfoNAS-r16 DedicatedInfoNAS OPTIONAL, -- Need ON

newUE-Identity-r16 C-RNTI OPTIONAL, -- Need OP

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

Editor’s Note: FFS whether to have Cond PUR for newUE-Identity-r16 and dedicatedInfoNAS-r16.

| *RRCConnectionSetup-NB* field descriptions |
| --- |
| ***newUE-Identity***  C-RNTI used in RRC connection, see TS 36.321 [6]. |

#### – *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-v16xy-IEs OPTIONAL

}

RRCConnectionSetupComplete-NB-v16xy-IEs ::= SEQUENCE {

ng-5G-S-TMSI-r16 NG-5G-S-TMSI-r15 OPTIONAL,

registeredAMF-r16 RegisteredAMF-r15 OPTIONAL,

gummei-Type-v16xy 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,

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-v16xy*. |
| ***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 SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *RRCEarlyDataComplete-NB* field descriptions |
| --- |
| ***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},

cqi-NPDCCH-r15 CQI-NPDCCH-NB-r14 OPTIONAL,

dedicatedInfoNAS-r15 DedicatedInfoNAS,

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,

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-v16xy OPTIONAL

}

SCPTMConfiguration-NB-v16xy ::= 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 TBs scheduling in the current cell. |
| ***sc-mtch-InfoListMultiTB***  Provides the configuration of each SC-MTCH using multiple TBs 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,

sibXX-v16xy SystemInformationBlockTypeXX-NB-r16

},

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-v16xy OPTIONAL

}

SystemInformationBlockType1-NB-v16xy ::= 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 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-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

}

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, sibTypeXX-NB-r16, spare6, spare5,

spare4, 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]. |
| ***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 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. 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***  If present, the field indicates that 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. |
| ***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. |
| ***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* list. |
| ***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. |
| ***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. |
| ***up-CIoT-5GS-Optimisation***  This field indicates if 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 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 or SRB1bis

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,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *UEInformationRequest-NB* field descriptions |
| --- |
| ***anr-ReportReq***  This field is used to indicate whether the UE shall report, if available, ANR measurement results. |
| ***rach-ReportReq***  This field is used to indicate whether the UE shall report, if available, information about the random access procedure. |
| ***rlf-ReportReq***  This field is used to indicate 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 or SRB1bis

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,

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

Editor’s Note: FFS: The re-establishment cell id is also included in the RLF report for NB-IoT.

| *UEInformationResponse-NB* field descriptions |
| --- |
| ***anr-MeasReport***  This field indicates the ANR measurement information. |
| ***contentionDetected***  This field is used to indicate 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***  This field is used to indicate the PCell in which RLF is detected. |
| ***initialNRSRP-Level***  Indicates the NRSRP level of the NPRACH resource selected for the first preamble transmission. |
| ***measResultLastServCell***  This field refers to the last measurement results taken in the PCell, where radio link failure happened. |
| ***numberOfPreamblesSent***  This field is used to indicate the number of RACH preambles that were transmitted. Corresponds to parameter PREAMBLE\_TRANSMISSION\_COUNTER in TS 36.321 [6]. |
| ***reestablishmentCellId***  This field is used to indicate the cell in which the re-establishment attempt was made after connection failure. |
| ***timeSinceFailure***  This field is used to indicate 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

]],

[[ 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-EPC-r16 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. |
| ***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-EPC, cp-PUR-5GC***  This field indicates whether transmission using PUR is enabled in the cell for the Control Plane CIoT EPS/5GS optimisations respectively. |
| ***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 and RRCConnectionResumeRequest-NB message* is allowed. |
| ***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]. |
| ***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-EPC***  This field indicates whether the UE is allowed to report the Release Assistance Indication (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. 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-EPC, up-PUR-5GC***  This field indicates whether transmission using PUR is enabled in the cell for the Control Plane CIoT EPS/5GS optimisations respectively. |

| 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

]]

}

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}

}

-- 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, 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-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. |
| ***t-Reselection***  Parameter "TreselectionNB-IoT\_Intra" in TS 36.304 [4]. |

| 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

intraFreqBlackCellList-r13 IntraFreqBlackCellList 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 |
| --- |
| ***intraFreqBlackCellList***  List of blacklisted 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-NB-r13 ::= SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo-NB-r13

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

interFreqBlackCellList-r13 InterFreqBlackCellList-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

]]

}

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

}

InterFreqBlackCellList-NB-r13 ::= SEQUENCE (SIZE (1..maxCellBlack)) 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*. |
| ***interFreqBlackCellList***  List of blacklisted 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]. |
| ***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-r16 UAC-Barring-NB-r16,

uac-BarringPerPLMN-List-r16 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-accessCategory***  The Access Category according to TS 22.261 [96]. |
| ***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-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 minimum time before a new access attempt is to be performed after an access attempt was barred at access barring check for the same access category. |
| ***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]. |
| ***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

]]

}

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

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

]]

}

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,

...

}

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

]]

}

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 |
| --- |
| ***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. |
| ***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. |
| ***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.* |
| ***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. |
| ***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. |
| ***ul-CarrierFreq***  For FDD: UL carrier frequency of the non-anchor carrier as defined in TS 36.101 [42], clause 5.7.3F.  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-ConfigPerCarrier***  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. |
| *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. |
| *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.  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. |

#### – SystemInformationBlockTypeXX-NB

The IE *SystemInformationBlockTypeXX-NB* contains assistance information relevant only for inter-RAT cell selection i.e. assistance information about E-UTRA frequencies and/ or GERAN frequencies for cell selection.

*SystemInformationBlockTypeXX-NB* information element

-- ASN1START

SystemInformationBlockTypeXX-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

| SystemInformationBlockTypeXX-NB field descriptions |
| --- |
| ***carrierFreqListEUTRA***  Provides a list of neighbouring E-UTRA carrier frequencies, which may be searched for neighbouring E-UTRAN cells. |
| ***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***  This field indicates that the GERAN carrier frequencies support EC-GSM-IOT. |
| ***carrierFreq***  E-UTRAN carrier frequency. |
| ***carrierFreqs***  The list of GERAN carrier frequencies organised into one group of GERAN carrier frequencies. |
| ***peo***  This field indicates that the GERAN carrier frequencies support Power Efficient Operation (PEO). |
| ***sib1***  This field indicates that SIB1 is scheduled in the E-UTRAN cells. |
| ***sib1-BR***  This field indicates that SIB1-BR is scheduled in the E-UTRAN cells. |

#### 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. |
| ***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. 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].

*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. |
| ***carrierFreqOffset***  Offset of the NB-IoT channel number to EARFCN as defined in TS 36.101 [42], clause 5.7.3F. 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. |
| ***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.  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. |

#### – *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

]]

}

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}

}

}

-- 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. |
| ***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]. |

#### *– MultiTB-Config-NB*

The IE *MultiTB-Config-NB* is used to specify the multiple TBs scheduling configuration for unicast transmission.

*MultiTB-Config-NB information element*

-- ASN1START

MultiTB-Config-NB-r16 ::= SEQUENCE {

ul-MultiTB-Config-r16 ENUMERATED {interleaving, non-interleaving}

OPTIONAL, -- Need OR

dl-MultiTB-Config-r16 ENUMERATED {interleaving, non-interleaving}

OPTIONAL, -- Need OR

dl-HARQ-ACK-Bundling-r16 ENUMERATED {true} OPTIONAL, -- Cond dl-interleaving

...

}

-- ASN1STOP

| *MultiTB-Config-NB* field descriptions |
| --- |
| ***dl-MultiTB-Config, ul-MultiTB-Config***  Indicates whether multiple TBs scheduling is enabled in DL and UL respectively, see TS 36.213 [23]. Value *interleaving* indicates that multiple TBs scheduling with interleaved transmission is enabled, value *non-interleaving* indicates that multiple TBs scheduling without interleaved transmission is enabled. |
| ***dl-HARQ-ACK-Bundling***  Indicates whether HARQ ACK bundling for DL multiple TBs scheduling with interleaved transmission is enabled, see TS 36.213 [23]. |

| **Conditional presence** | **Explanation** |
| --- | --- |
| *dl-interleaving* | The field is optionally present, Need OR, if *dl-MultiTB-Config* is set to *interleaving*; otherwise the field is not present and the UE shall delete any existing value for this field. |

#### – *NR-ResourceReservationConfig-NB*

The IE *NR-ResourceReservationConfig-NB* is used to specify the reserved downlink or uplink resources on a NB-IoT carrier deployedwithin a NR carrier.

*NR-ResourceReservationConfig-NB* information element

-- ASN1START

NR-ResourceResvConfig-NB-r16::= SEQUENCE {

release NULL,

setup SEQUENCE {

periodicity-r16 ENUMERATED {ms10, ms20, ms40, ms80, ms160, spare3, spare2,

spare1},

startPosition-r16 INTEGER (0..15),

resourceReservation-r16 CHOICE {

subframeBitmap-r16 CHOICE {

subframePattern10ms-r16 BIT STRING (SIZE (10)),

subframePattern40ms-r16 BIT STRING (SIZE (40))

},

slotConfig-r16 SEQUENCE {

slotBitmap-r16 CHOICE {

slotPattern10ms-r16 BIT STRING (SIZE (20)),

slotPattern40ms-r16 BIT STRING (SIZE (80))

},

symbolBitmap-r16 CHOICE {

symbolBitmapFddDl-r16 SEQUENCE {

symbolBitmap1-r16 BIT STRING (SIZE (5)) OPTIONAL,

symbolBitmap2-r16 BIT STRING (SIZE (5)) OPTIONAL

},

symbolBitmapFddUlOrTdd-r16 SEQUENCE {

symbolBitmap1-r16 BIT STRING (SIZE (7)) OPTIONAL,

symbolBitmap2-r16 BIT STRING (SIZE (7)) OPTIONAL

}

}

}

}

}

}

-- ASN1STOP

| *NR-ResourceReservationConfig* field descriptions |
| --- |
| ***periodicity***  Periodicity of the reserved resource. Unit in millisecond. 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 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. Two bits for each subframe coded as:  00: both slots is 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***  Provides the symbol-level resource reservation for one subframe*.*  E-UTRAN configures *symbolConfigFddDl* for a DL FDD NB-IoT carrier. E-UTRAN configures *symbolConfigFddULOrTdd* for a UL FDD NB-IoT carrier or a TDD NB-IoT carrier. |
| ***symbolBitmapFddDl***  For FDD: Downlink 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. Symbols that carry NRS are not reserved. |
| ***symbolBitmapFddUlOrTdd***  For FDD: Uplink symbol-level resource reservation over the first or the second slot of one subframe, see TS 36.211 [21].  For TDD: Uplink or downlink 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. Symbols that carry NRS are not reserved. |

#### – *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.  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-ConfigCommon-NB*

The IE *NPDSCH-ConfigCommon-NB* is used to specify the common NPDSCH configuration.

*NPDSCH-ConfigCommon-NB* information element

-- ASN1START

NPDSCH-ConfigCommon-NB-r13 ::= SEQUENCE {

nrs-Power-r13 INTEGER (-60..50)

}

-- ASN1STOP

| *NPDSCH-ConfigCommon-NB* field descriptions |
| --- |
| ***nrs-Power***  Provides the downlink narrowband reference-signal EPRE, see TS 36.213 [23], clause 16.2. The actual value in dBm. |

#### – *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

}

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.  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.  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.  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.  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. |
| ***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 1, the second element corresponds to RSRP threshold 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

}

ACK-NACK-NumRepetitions-NB-r13 ::= ENUMERATED {r1, r2, r4, r8, r16, r32, r64, r128}

-- 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-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. |
| ***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. |

| 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

},

...

}

},

...

}

-- ASN1STOP

| *PDCP-Config-NB* field descriptions |
| --- |
| ***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** |
| --- | --- |
| *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

]],

[[ multiTB-Config-r16 MultiTB-Config-NB-r16 OPTIONAL, -- Need OR

dl-NR-ResourceReservationConfig-r16 NR-ResourceReservationConfig-NB-r16

OPTIONAL, -- Cond DL-NR-COEX-NonAnchor

ul-NR-ResourceReservationConfig-r16 NR-ResourceReservationConfig-NB-r16

OPTIONAL -- Cond UL-NR-COEX-NonAnchor

]]

}

-- ASN1STOP

| *PhysicalConfigDedicated-NB* field descriptions |
| --- |
| ***carrierConfigDedicated***  Anchor/ non-anchor carrier used for all unicast transmissions. |
| ***dl-NR-ResourceReservationConfig***  Configuration of downlink reserved resources for NB-IoT co-existence with NR, see TS 36.211 [21], TS 36.212 [22], and TS 36.213 [22]. |
| ***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. |
| ***npusch-ConfigDedicated***  UL unicast configuration. |
| ***twoHARQ-ProcessesConfig***  Activation of two HARQ processes, see TS 36.212 [22] and TS 36.213 [23]. |
| ***ul-NR-ResourceReservationConfig***  Configuration of uplink reserved resources for NB-IoT co-existence with NR, see TS 36.211 [21], TS 36.212 [22], and TS 36.213 [22]. |
| ***uplink-PowerControlDedicated***  UL power control parameter. |
| ***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. |

| Conditional presence | Explanation |
| --- | --- |
| *DL-NR-COEX-NonAnchor* | The field is optionally present, Need ON, for a DL non-anchor carrier deployed within a NR carrier; otherwise the field is not present and the UE shall delete any existing value for this field. |
| *UL-NR-COEX-NonAnchor* | The field is optionally present, Need ON, for a UL non-anchor carrier deployed within a NR carrier; 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. |
| *additionalSIB1* | This field is optionally present, Need OR, if *additionalTransmissionSIB1* is set to TRUE in *MasterInformationBlock-NB*; otherwise it is not present. |

#### – *PUR-Config-NB-r16*

The IE *PUR-Config-NB* is used to specify PUR configuration.

*PUR-Config-NB* information element

-- ASN1START

PUR-Config-NB-r16 ::= CHOICE {

release NULL,

setup SEQUENCE {

pur-TimeAlignmentTimer-r16 INTEGER (1..8) OPTIONAL, --Need ON

pur-NRSRP-ChangeThreshold-r16 SEQUENCE {

nrsrp-IncreaseThresh-r16 NRSRP-ChangeThresh-NB-r16,

nrsrp-DecreaseThresh-r16 NRSRP-ChangeThresh-NB-r16 OPTIONAL --Need OP

} OPTIONAL, --Need OR

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-StartTime-r16 PUR-Period-NB-r16 OPTIONAL, --Need ON

pur-Periodicity-r16 PUR-Period-NB-r16 OPTIONAL, --Need ON

pur-NumOccasions-r16 ENUMERATED {one, infinite} OPTIONAL, --Need ON

pur-PhysicalConfig-r16 SEQUENCE {

dl-CarrierConfig-r16 DL-CarrierConfigCommon-NB-r14,

ul-CarrierFreq-r16 CarrierFreq-NB-r13,

npusch-NumRUsIndex-r16 INTEGER (0..7),

npusch-NumRepetitionsIndex-r16 INTEGER (0..7),

npusch-SubCarrierSetIndex-r16 CHOICE {

khz15-r16 INTEGER (0..18},

khz3dot75-r16 INTEGER (0..47)

},

npusch-MCS-r16 CHOICE {

khz15-r16 INTEGER (0..10},

khz3dot75-r16 INTEGER (0..13)

},

p0-UE-NPUSCH-r16 UplinkPowerControlDedicated-NB-r13,

alpha-r16 ENUMERATED {al0, al04, al05, al06,

al07, al08, al09, al1},

npusch-CyclicShift-r16 INTEGER (0..6),

npdcch-Config-r16 NPDCCH-ConfigDedicated-NB-r13

} OPTIONAL, -- Need ON

...

}

NRSRP-ChangeThresh-NB-r16 ::= ENUMERATED {dB4, dB6, dB8, dB10, dB14, dB18, dB22, dB26, dB30, dB34, spare6, spare5, spare4, spare3, spare2, spare1}

PUR-Period-NB-r16 ::= ENUMERATED {hsf8, hsf16, hsf32, hsf64, hsf128, hsf256, hsf512, hsf1024, hsf2048, hsf4096, hsf8192, spare5, spare4, spare3, spare2, spare1}

-- ASN1STOP

| *PUR-Config-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. |
| ***dl-CarrierConfig***  Downlink carrier used for PUR. |
| ***npdcch-Config***  NPDCCH configuration for PUR. |
| ***npusch-CyclicShift***  Parameter: . See TS 36.211 [21], clause 10.1.4.1.2. |
| ***npusch-MCS***  This field contains an index to tables specified in TS 36.213 [23], Table 16.5.1.2-1 and Table 16.5.1.2-2 for subcarrier spacing 3.75 kHz and 15 kHz respectively, that defines modulation and TBS index for NPUSCH for PUR. |
| ***npusch-NumRepetitionsIndex***  This field contains an 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***  This field contains an 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, this field indicates the subcarrier used for PUR specified in TS 36.213 [23].  For NPUSCH transmission with subcarrier spacing 15 kHz, this field contains an 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, unit dB. |
| ***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***  Indicates the threshold(s) of change in serving cell RSRP in dB for TA validation. Value *dB4* corresponds to 4 dB, value *dB6* corresponds to 6 dB and so on. When *nrsrp-ChangeThrsh* is included, if *nrsrp-DecreaseThrsh* is absent the value of *nrsrp-IncreaseThresh* is also used for *nrsrp-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-Periodicity***  Periodicity of PUR resource in number of hyper frames in TS 36.321 [6].  Value *hsf8* corresponds to 8 hyper frames, value *hsf16* corresponds to 16 hyper frames and so on. |
| ***pur-ResponseWindowTimer***  Duration of the PUR 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.  The value considered by the UE is: *pur-ResponseWindowSize* = Min (signaled value x PDCCH period, 10.24s). |
| ***pur-RNTI***  PUR-RNTI. |
| ***pur-TimeAlignmentTimer***  Indicates the value of the time alignment timer for PUR. Value in number of *pur-Periodicity*. |
| ***pur-StartTime***  Indicates the value of the time offset for the first PUR occasion, i.e. the time gap from reception of D-PUR configuration to the first PUR occasion. Value *hsf8* corresponds to 8 hyper frames, value *hsf16* corresponds to 16 hyper frames and so on. |
| ***ul-CarrierFreq***  UL carrier frequency of the uplink carrier used for PUR as defined in TS 36.101 [42], clause 5.7.3F. |

Editor’s Note: FFS on exact values for TA timer and whether offset is applied so that e.g. retransmissions are covered.

Editor’s Note: Maximum PUR time offset range should be the same as maximum PUR periodicity. FFS further details e.g. how exact PUR start time is configured.

#### – *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: 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: 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

]],

[[

pcch-Config-v16xy PCCH-Config-NB-v16xy OPTIONAL -- Need OR

]]

}

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}

}

PCCH-Config-NB-v16xy ::= SEQUENCE {

ue-SpecificDRX-Allowed-EPC-r16 ENUMERATED {true}

}

-- 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. |
| ***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. |
| ***ue-SpecificDRX-Allowed-EPC***  This field indicates if the NB-IoT UE is allowed to use UE specific DRX for paging when connected to EPC. |
| ***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. |
| *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

]]

}

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

]]

}

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

]]

}

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 |
| --- |
| ***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. |
| ***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. |

| **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. |

#### – *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

}

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. |

| **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-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-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}

}

}

-- 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-SPS-BSR-Config***  Activation of SR with SPS BSR, see TS 36.321 [6].  E-UTRAN cannot configure *sr-SPS-BSR* together with *sr-WithoutHARQ-ACK-Config*. |
| ***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. |
| ***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*. |

#### *– 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)

}

-- 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. |
| ***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.

*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, 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 OPTIONAL, -- Need OP

...

}

ANR-CarrierList-NB-r16 ::= SEQUENCE (SIZE (1..maxFreqANR-NB-r16)) OF ANR-Carrier-NB-r16

ANR-Carrier-NB-r16::= SEQUENCE {

carrierFreqIndex-r16 INTEGER (1..maxFreqANR-NB-r16),

blackCellList-r16 ANR-BlackCellList-NB-r16 OPTIONAL, -- Need OP

...

}

ANR-BlackCellList-NB-r16 ::= SEQUENCE (SIZE (1.. maxCellBlack)) OF PhysCellId

-- ASN1STOP

| *ANR-MeasConfig-NB* field descriptions |
| --- |
| ***anr-CarrierList***  List of NB-IoT carriers to be measured for ANR.  If the field is absent, the carriers in *interFreqCarrierFreqList* in *SystemInformationBlockType5-NB* are to be measured. |
| ***anr-QualityThreshold***  Indicates the quality threshold for reporting the CGI of the strongest cell. |
| ***BlackCellList***  List of blacklisted neighbouring cells for ANR reporting. |
| ***carrierFreqIndex***  Index of the carrier frequency in *interFreqCarrierFreqList* in *SystemInformationBlockType5-NB*. |

– *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 SEQUENCE {

nrsrpResult-r16 NRSRP-Range-NB-r14,

nrsrqResult-r16 NRSRQ-Range-NB-r14

},

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,

measResult-r16 SEQUENCE {

nrsrpResult-r16 NRSRP-Range-NB-r14,

nrsrqResult-r16 NRSRQ-Range-NB-r14

} OPTIONAL,

cgi-Info-r16 SEQUENCE {

cellGlobalId-r16 CellGlobalIdEUTRA,

trackingAreaCode-r16 TrackingAreaCode,

plmn-IdentityList-r16 PLMN-IdentityList2 OPTIONAL

} OPTIONAL

}

-- ASN1STOP

Editor’s Note: FFS: Whether a time indication of when the ANR measurements were performed is included in the report, and whether it is a time stamp or a simple indication “immediately after going to IDLE, immediately before going to CONNECTED, in between”.

| ***ANR-MeasReport-NB* field descriptions** |
| --- |
| ***carrierFreq***  Indicates the carrier frequency of the reported cell. |
| ***cgi-info***  Broadcast information of the reported cell. |
| ***measResult***  Measured results of the reported cell. |
| ***measResultList***  List of measured results for the maximum number of reported carrier frequencies. |
| ***measResultServingCell***  Measured results of the serving cell. |
| ***plmn-IdentityList***  The list of PLMN Identity read from the broadcast information of the reported cell. |
| ***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-r16, 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-v16xy-IEs OPTIONAL

}

UE-Capability-NB-v16xy-IEs ::= SEQUENCE {

earlyData-UP-5GC-r16 ENUMERATED {supported} OPTIONAL,

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,

tdd-UE-Capability-v16xy TDD-UE-Capability-NB-v16xy OPTIONAL,

mac-Parameters-v16xy MAC-Parameters-NB-v16xy,

phyLayerParameters-v16xy PhyLayerParameters-NB-v16xy,

son-Parameters-r16 SON-Parameters-NB-r16,

meas-Parameters-r16 Meas-Parameters-NB-r16,

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-v16xy ::= SEQUENCE {

ul-NR-ResourceReservation-r16 ENUMERATED {supported} OPTIONAL,

dl-NR-ResourceReservation-r16 ENUMERATED {supported} OPTIONAL

}

AccessStratumRelease-NB-r13 ::= ENUMERATED {rel13, rel14, rel15, rel16, spare4, spare3, 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-v16xy ::= SEQUENCE {

rai-EPC-r16 ENUMERATED {supported} OPTIONAL

}

Meas-Parameters-NB-r16 ::= SEQUENCE {

dl-ChannelQualityReporting-r16 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-v16xy ::= SEQUENCE {

multiTB-UL-r16 ENUMERATED {supported} OPTIONAL,

multiTB-DL-r16 ENUMERATED {supported} OPTIONAL,

multiTB-UL-Interleaving-r16 ENUMERATED {supported} OPTIONAL,

multiTB-DL-Interleaving-r16 ENUMERATED {supported} OPTIONAL,

multiTB-HARQ-ACK-Bundling-r16 ENUMERATED {supported} OPTIONAL,

ul-NR-ResourceReservation-r16 ENUMERATED {supported} OPTIONAL,

dl-NR-ResourceReservation-r16 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

}

SupportedBandList-NB-r13 ::= SEQUENCE (SIZE (1..maxBands)) OF SupportedBand-NB-r13

SupportedBand-NB-r13 ::= SEQUENCE {

band-r13 FreqBandIndicator-NB-r13,

powerClassNB-20dBm-r13 ENUMERATED {supported} OPTIONAL

}

SON-Parameters-NB-r16 ::= SEQUENCE {

anr-Report-r16 ENUMERATED {supported} OPTIONAL,

rach-Report-r16 ENUMERATED {supported} OPTIONAL

}

-- ASN1STOP

| *UE-Capability-NB* field descriptions | *FDD/TDD appl* | *FDD/TDD diff* |
| --- | --- | --- |
| ***accessStratumRelease***  Set to rel15 in this version of the specification. | 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*.* | FFS | FFS |
| ***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 | - |
| ***dl-NR-ResourceReservation***  Defines whether the UE supports DL resource reservation for NB-IoT coexistence with NR. | FDD/TDD | Yes |
| ***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 24.501 [95] respectively. | FDD | - |
|  |  |  |
| ***interferenceRandomisation***  For FDD: Indicates whether the UE supports interference randomisation in connected mode as defined in TS.36.211 [21]. | FDD | - |
| ***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-DL, multiTB-UL***  Defines whether the UE supports multiple TBs scheduling in RRC\_CONNECTED for DL and UL.  If *multiTB-DL* or *multiTB-UL* is included, the UE shall also indicate support for *twoHARQ-Processes*. | FFS | FFS |
|  |  |  |
| ***multiTB-DL-Interleaving, multiTB-UL-Interleaving***  Defines whether the UE supports interleaved transmission when multiple TBs is scheduled in RRC\_CONNECTED for DL and UL respectively.  If *multiTB-DL-Interleaving* or *multiTB-UL-Interleaving* is included, the UE shall also indicate support for *multiTB-DL* or *multiTB-UL* respectively. | FFS | FFS |
| ***multiTB-HARQ-ACK-Bundling***  Defines whether the UE supports HARQ ACK bundling for interleaved transmission for DL.  If *multiTB-HARQ-ACK-Bundling* is included, the UE shall also indicate support for *multiTB-DL-Interleaving*. | FFS | FFS |
| ***multiTone***  Defines whether the UE supports UL multi-tone transmissions on NPUSCH. | FDD/TDD | Yes |
| ***nprach-Format2***  Defines whether the UE supports NPRACH resources using preamble format 2. | FDD | - |
| ***npusch-3dot75kHz-SCS-TDD***  Indicates whether the UE supports NPUSCH with 3.75kHz SCS for TDD. | TDD | - |
| ***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]. 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-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.* | FFS | FFS |
| ***rai-EPC***  Indicates whether the UE supports Release Aassistance indication (RAI) MAC CE as specified in TS 36.321 [6] when connected to EPC*.* | FFS | FFS |
| ***rai-Support***  Defines whether the UE supports release assistance indication (RAI) 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 |
| ***supportedBandList***  Includes the supported NB-IoT bands as defined in TS 36.101 [42]. | 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 | - |
| ***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 |
| ***ul-NR-ResourceReservation***  Defines whether the UE supports UL resource reservation for NB-IoT coexistence with NR. | 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*.

Editor's Note: Working assumption: Introduce two UE capabilities for handling resources reservation on DL or UL in PhyLayerParameters-NB-v16xy.

#### Editor's Note: Working assumption: Two UE capabilities for handling resources reservation on DL or UL in PhyLayerParameters-NB-v16xy can be applied to both FDD and TDD, e.g., with separate values for FDD or TDD. – *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

]]

}

-- ASN1STOP

Editor’s Note: FFS how the use of UE category information is captured in the specifications..

Editor’s Note: Working assumption: Support of Release 16 WUS is independent to support of Release 15 WUS.

| *UE-RadioPagingInfo-NB field descriptions* |
| --- |
| ***groupWakeUpSignal***  Indicates whether the UE supports GWUS 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]. |
| ***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

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

-- ASN1STOP

Editor’s Note: The value of maxFreqEUTRA-NB-r16 and maxFreqsGERAN-NB-r16 are FFS.

### – 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

## 7.1 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.

#### – *EUTRA-UE-Variables*

This ASN.1 segment is the start of the E‑UTRA UE variable definitions.

-- ASN1START

EUTRA-UE-Variables DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS

AbsoluteTimeInfo-r10,

AreaConfiguration-r10,

AreaConfiguration-v1130,

ARFCN-ValueNR-r15,

BT-NameList-r15,

CarrierFreqGERAN,

CellIdentity,

CellList-r15,

ConnEstFailReport-r11,

EUTRA-CarrierList-r15,

SpeedStateScaleFactors,

C-RNTI,

LoggingDuration-r10,

LoggingInterval-r10,

LogMeasInfo-r10,

MeasCSI-RS-Id-r12,

MeasId,

MeasId-v1250,

MeasIdToAddModList,

MeasIdToAddModListExt-r12,

MeasIdToAddModList-v1310,

MeasIdToAddModListExt-v1310,

MeasObjectToAddModList,

MeasObjectToAddModList-v9e0,

MeasObjectToAddModListExt-r13,

MeasResultListIdle-r15,

MeasScaleFactor-r12,

MobilityStateParameters,

NeighCellConfig,

PhysCellId,

PhysCellIdCDMA2000,

PhysCellIdGERAN,

PhysCellIdUTRA-FDD,

PhysCellIdUTRA-TDD,

PLMN-Identity,

PLMN-IdentityList3-r11,

QuantityConfig,

ReportConfigToAddModList,

RLF-Report-r9,

TargetMBSFN-AreaList-r12,

TraceReference-r10,

Tx-ResourcePoolMeasList-r14,

VisitedCellInfoList-r12,

maxCellMeas,

maxCSI-RS-Meas-r12,

maxMeasId,

maxMeasId-r12,

maxRS-Index-r15,

PhysCellIdNR-r15,

RS-IndexNR-r15,

UL-DelayConfig-r13,

WLAN-CarrierInfo-r13,

WLAN-Identifiers-r12,

WLAN-Id-List-r13,

WLAN-NameList-r15,

WLAN-Status-r13,

WLAN-Status-v1430,

WLAN-SuspendConfig-r14

FROM EUTRA-RRC-Definitions;

-- ASN1STOP

#### – *VarConnEstFailReport*

The UE variable *VarConnEstFailReport* includes the connection establishment failure information.

*VarConnEstFailReport* UE variable

-- ASN1START

VarConnEstFailReport-r11 ::= SEQUENCE {

connEstFailReport-r11 ConnEstFailReport-r11,

plmn-Identity-r11 PLMN-Identity

}

-- ASN1STOP

#### – *VarLogMeasConfig*

The UE variable *VarLogMeasConfig* includes the configuration of the logging of measurements to be performed by the UE while in RRC\_IDLE, covering intra-frequency, inter-frequency, inter-RAT mobility and MBSFN related measurements. If MBSFN logging is configured, the UE performs logging of measurements while in both RRC\_IDLE and RRC\_CONNECTED. Otherwise, the UE performs logging of measurements only while in RRC\_IDLE.

*VarLogMeasConfig* UE variable

-- ASN1START

VarLogMeasConfig-r10 ::= SEQUENCE {

areaConfiguration-r10 AreaConfiguration-r10 OPTIONAL,

loggingDuration-r10 LoggingDuration-r10,

loggingInterval-r10 LoggingInterval-r10

}

VarLogMeasConfig-r11 ::= SEQUENCE {

areaConfiguration-r10 AreaConfiguration-r10 OPTIONAL,

areaConfiguration-v1130 AreaConfiguration-v1130 OPTIONAL,

loggingDuration-r10 LoggingDuration-r10,

loggingInterval-r10 LoggingInterval-r10

}

VarLogMeasConfig-r12 ::= SEQUENCE {

areaConfiguration-r10 AreaConfiguration-r10 OPTIONAL,

areaConfiguration-v1130 AreaConfiguration-v1130 OPTIONAL,

loggingDuration-r10 LoggingDuration-r10,

loggingInterval-r10 LoggingInterval-r10,

targetMBSFN-AreaList-r12 TargetMBSFN-AreaList-r12 OPTIONAL

}

VarLogMeasConfig-r15 ::= SEQUENCE {

areaConfiguration-r10 AreaConfiguration-r10 OPTIONAL,

areaConfiguration-v1130 AreaConfiguration-v1130 OPTIONAL,

loggingDuration-r10 LoggingDuration-r10,

loggingInterval-r10 LoggingInterval-r10,

targetMBSFN-AreaList-r12 TargetMBSFN-AreaList-r12 OPTIONAL,

bt-NameList-r15 BT-NameList-r15 OPTIONAL,

wlan-NameList-r15 WLAN-NameList-r15 OPTIONAL

}

-- ASN1STOP

#### – *VarLogMeasReport*

The UE variable *VarLogMeasReport* includes the logged measurements information.

*VarLogMeasReport* UE variable

-- ASN1START

VarLogMeasReport-r10 ::= SEQUENCE {

traceReference-r10 TraceReference-r10,

traceRecordingSessionRef-r10 OCTET STRING (SIZE (2)),

tce-Id-r10 OCTET STRING (SIZE (1)),

plmn-Identity-r10 PLMN-Identity,

absoluteTimeInfo-r10 AbsoluteTimeInfo-r10,

logMeasInfoList-r10 LogMeasInfoList2-r10

}

VarLogMeasReport-r11 ::= SEQUENCE {

traceReference-r10 TraceReference-r10,

traceRecordingSessionRef-r10 OCTET STRING (SIZE (2)),

tce-Id-r10 OCTET STRING (SIZE (1)),

plmn-IdentityList-r11 PLMN-IdentityList3-r11,

absoluteTimeInfo-r10 AbsoluteTimeInfo-r10,

logMeasInfoList-r10 LogMeasInfoList2-r10

}

LogMeasInfoList2-r10 ::= SEQUENCE (SIZE (1..maxLogMeas-r10)) OF LogMeasInfo-r10

-- ASN1STOP

#### – *VarMeasConfig*

The UE variable *VarMeasConfig* includes the accumulated configuration of the measurements to be performed by the UE, covering intra-frequency, inter-frequency and inter-RAT mobility related measurements.

NOTE: The amount of measurement configuration information, which a UE is required to store, is specified in clause 11.1. If the number of frequencies configured for a particular RAT exceeds the minimum performance requirements specified in TS 36.133 [16], it is up to UE implementation which frequencies of that RAT are measured. If the total number of frequencies for all RATs provided to the UE in the measurement configuration exceeds the minimum performance requirements specified in TS 36.133 [16], it is up to UE implementation which frequencies/RATs are measured.

*VarMeasConfig* UE variable

-- ASN1START

VarMeasConfig ::= SEQUENCE {

-- Measurement identities

measIdList MeasIdToAddModList OPTIONAL,

measIdListExt-r12 MeasIdToAddModListExt-r12 OPTIONAL,

measIdList-v1310 MeasIdToAddModList-v1310 OPTIONAL,

measIdListExt-v1310 MeasIdToAddModListExt-v1310 OPTIONAL,

-- Measurement objects

measObjectList MeasObjectToAddModList OPTIONAL,

measObjectListExt-r13 MeasObjectToAddModListExt-r13 OPTIONAL,

measObjectList-v9i0 MeasObjectToAddModList-v9e0 OPTIONAL,

-- Reporting configurations

reportConfigList ReportConfigToAddModList OPTIONAL,

-- Other parameters

quantityConfig QuantityConfig OPTIONAL,

measScaleFactor-r12 MeasScaleFactor-r12 OPTIONAL,

s-Measure INTEGER (-140..-44) OPTIONAL,

speedStatePars CHOICE {

release NULL,

setup SEQUENCE {

mobilityStateParameters MobilityStateParameters,

timeToTrigger-SF SpeedStateScaleFactors

}

} OPTIONAL,

allowInterruptions-r11 BOOLEAN OPTIONAL

}

-- ASN1STOP

#### – *VarMeasIdleConfig*

The UE variable *VarMeasIdleConfig* includes the configuration of the measurements to be performed by the UE while in RRC\_IDLE for E-UTRA inter-frequency measurements. The UE performs logging of these measurements only while in RRC\_IDLE.

*VarMeasIdleConfig* UE variable

-- ASN1START

VarMeasIdleConfig-r15 ::= SEQUENCE {

measIdleCarrierListEUTRA-r15 EUTRA-CarrierList-r15 OPTIONAL,

measIdleDuration-r15 ENUMERATED {sec10, sec30, sec60, sec120,

sec180, sec240, sec300}

}

-- ASN1STOP

#### – *VarMeasIdleReport*

The UE variable *VarMeasIdleReport* includes the logged measurements information.

*VarMeasIdleReport* UE variable

-- ASN1START

VarMeasIdleReport-r15 ::= SEQUENCE {

measReportIdle-r15 MeasResultListIdle-r15

}

-- ASN1STOP

#### – *VarMeasReportList*

The UE variable *VarMeasReportList* includes information about the measurements for which the triggering conditions have been met.

*VarMeasReportList* UE variable

-- ASN1START

VarMeasReportList ::= SEQUENCE (SIZE (1..maxMeasId)) OF VarMeasReport

VarMeasReportList-r12 ::= SEQUENCE (SIZE (1..maxMeasId-r12)) OF VarMeasReport

VarMeasReport ::= SEQUENCE {

-- List of measurement that have been triggered

measId MeasId,

measId-v1250 MeasId-v1250 OPTIONAL,

cellsTriggeredList CellsTriggeredList OPTIONAL,

csi-RS-TriggeredList-r12 CSI-RS-TriggeredList-r12 OPTIONAL,

poolsTriggeredList-r14 Tx-ResourcePoolMeasList-r14 OPTIONAL,

numberOfReportsSent INTEGER

}

CellsTriggeredList ::= SEQUENCE (SIZE (1..maxCellMeas)) OF CHOICE {

physCellIdEUTRA PhysCellId,

physCellIdUTRA CHOICE {

fdd PhysCellIdUTRA-FDD,

tdd PhysCellIdUTRA-TDD

},

physCellIdGERAN SEQUENCE {

carrierFreq CarrierFreqGERAN,

physCellId PhysCellIdGERAN

},

physCellIdCDMA2000 PhysCellIdCDMA2000,

wlan-Identifiers-r13 WLAN-Identifiers-r12,

physCellIdNR-r15 SEQUENCE {

carrierFreq ARFCN-ValueNR-r15,

physCellId PhysCellIdNR-r15,

rs-IndexList-r15 SSB-IndexList-r15 OPTIONAL

}

}

CSI-RS-TriggeredList-r12 ::= SEQUENCE (SIZE (1..maxCSI-RS-Meas-r12)) OF MeasCSI-RS-Id-r12

SSB-IndexList-r15::= SEQUENCE (SIZE (1..maxRS-Index-r15)) OF RS-IndexNR-r15

-- ASN1STOP

#### – *VarMobilityHistoryReport*

The UE variable *VarMobilityHistoryReport* includes the mobility history information.

-- ASN1START

VarMobilityHistoryReport-r12 ::= VisitedCellInfoList-r12

-- ASN1STOP

#### – *VarPendingRnaUpdate*

The UE variable *VarPendingRnaUpdate* indicates whether there is a pending RNAU procedure or not. The setting of this BOOLEAN variable to TRUE means that there is a pending RANU procedure.

*VarPendingRnaUpdate* UE *variable*

-- ASN1START

VarPendingRnaUpdate-r15 ::= SEQUENCE {

pendingRnaUpdate BOOLEAN OPTIONAL

}

-- ASN1STOP

#### – *VarRLF-Report*

The UE variable *VarRLF-Report* includes the radio link failure information or handover failure information.

*VarRLF-Report* UE variable

-- ASN1START

VarRLF-Report-r10 ::= SEQUENCE {

rlf-Report-r10 RLF-Report-r9,

plmn-Identity-r10 PLMN-Identity

}

VarRLF-Report-r11 ::= SEQUENCE {

rlf-Report-r10 RLF-Report-r9,

plmn-IdentityList-r11 PLMN-IdentityList3-r11

}

-- ASN1STOP

#### – *VarShortINACTIVE-MAC-Input*

The UE variable *VarShortINACTIVE-MAC-Input* specifies the input used to generate the *shortResume-MAC-I* during RRC Connection Resume procedure for RRC\_INACTIVE.

*VarShortINACTIVE-MAC-Input* UE variable

-- ASN1START

VarShortINACTIVE*-*MAC-Input-r15 ::= SEQUENCE {

cellIdentity-r15 CellIdentity,

physCellId-r15 PhysCellId,

c-RNTI-r15 C-RNTI

}

-- ASN1STOP

| *VarShortINACTIVE-MAC-Input field descriptions* |
| --- |
| ***cellIdentity***  An input variable used to calculate the *shortResume-MAC-I.* Set to CellIdentity included in *cellIdentity* (without suffix) in SIB1 of the current cell. |
| ***c-RNTI***  Set to C-RNTI that the UE had in the PCell it was connected to prior to suspension of the RRC connection. |
| ***physCellId***  Set to the physical cell identity of the PCell the UE was connected to prior to suspension of the RRC connection. |

#### – *VarShortMAC-Input*

The UE variable *VarShortMAC-Input* specifies the input used to generate the shortMAC-I.

*VarShortMAC-Input* UE variable

-- ASN1START

VarShortMAC-Input ::= SEQUENCE {

cellIdentity CellIdentity,

physCellId PhysCellId,

c-RNTI C-RNTI

}

-- ASN1STOP

| *VarShortMAC-Input* field descriptions |
| --- |
| ***cellIdentity***  An input variable used to calculate the *shortMAC-I.* Set to CellIdentity included in *cellIdentity* (without suffix) in SIB1 of the current cell. |
| ***c-RNTI***  Set to C-RNTI that the UE had in the PCell it was connected to prior to the failure. |
| ***physCellId***  Set to the physical cell identity of the PCell the UE was connected to prior to the failure. |

#### – *VarShortResumeMAC-Input*

The UE variable *VarShortResumeMAC-Input* specifies the input used to generate the *shortResumeMAC-I* during RRC Connection Resume procedure.

*VarShortResumeMAC-Input* UE variable

-- ASN1START

VarShortResumeMAC-Input-r13 ::= SEQUENCE {

cellIdentity-r13 CellIdentity,

physCellId-r13 PhysCellId,

c-RNTI-r13 C-RNTI,

resumeDiscriminator-r13 BIT STRING(**SIZE(1)**)

}

-- ASN1STOP

| *VarShortResumeMAC-Input field descriptions* |
| --- |
| ***cellIdentity***  An input variable used to calculate the *shortResumeMAC-I.* Set to CellIdentity included in *cellIdentity* (without suffix) in SIB1 of the current cell. |
| ***c-RNTI***  Set to C-RNTI that the UE had in the PCell it was connected to prior to suspension of the RRC connection. |
| ***physCellId***  Set to the physical cell identity of the PCell the UE was connected to prior to suspension of the RRC connection. |
| ***resumeDiscriminator***  A constant that allows differentiation in the calculation of the MAC-I for *shortResumeMAC-I*  The resumeDiscriminator is set to '1' |

#### – *VarWLAN-MobilityConfig*

The UE variable *VarWLAN-MobilityConfig* includes information about WLAN for access selection and mobility.

*VarWLAN-MobilityConfig* UE variable

-- ASN1START

VarWLAN-MobilityConfig ::= SEQUENCE {

wlan-MobilitySet-r13 WLAN-Id-List-r13 OPTIONAL,

successReportRequested ENUMERATED {true} OPTIONAL,

wlan-SuspendConfig-r14 WLAN-SuspendConfig-r14 OPTIONAL

}

-- ASN1STOP

| *VarWLAN-MobilityConfig* field descriptions |
| --- |
| ***wlan-MobilitySet***  Indicates the WLAN mobility set configured. |
| ***successReportRequested***  Indicates whether the UE shall report successful connection to WLAN. Applicable to LWA and LWIP. |

#### – *VarWLAN-Status*

The UE variable *VarWLAN-Status* includes information about the status of WLAN connection for LWA, RCLWI or LWIP.

*VarWLAN-Status* UE variable

-- ASN1START

VarWLAN-Status-r13 ::= SEQUENCE {

status-r13 WLAN-Status-r13,

status-r14 WLAN-Status-v1430 OPTIONAL

}

-- ASN1STOP

| *VarWLAN-Status* field descriptions |
| --- |
| ***status***  Indicates the connection status to WLAN and causes for connection failures. |

#### – Multiplicity and type constraint definitions

This clause includes multiplicity and type constraints applicable (only) for UE variables.

-- ASN1START

maxLogMeas-r10 INTEGER ::= 4060-- Maximum number of logged measurement entries

-- that can be stored by the UE

-- ASN1STOP

#### – End of *EUTRA-UE-Variables*

-- ASN1START

END

-- ASN1STOP

## 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,

NRSRP-Range-NB-r14,

NRSRQ-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 OPTIONAL -- Need OP

}

-- 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 SEQUENCE {

nrsrpResult-r16 NRSRP-Range-NB-r14,

nrsrqResult-r16 NRSRQ-Range-NB-r14

},

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

|  |
| --- |
| Next change |

### 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 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 | 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* | 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. |
| 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 | 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 | 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 | 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 and upon initiating the connection re-establishment procedure | 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 |
| T311  NOTE1 | Upon initiating the RRC connection re-establishment procedure | Selection of a suitable E-UTRA cell or a cell using another RAT. | Enter RRC\_IDLE |
| T312  NOTE2 | Upon triggering a measurement report for a measurement identity for which T312 has been configured, 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, and upon the expiry of T310 | If security is not activated: go to RRC\_IDLE else: initiate the connection re-establishment procedure |
| 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. |
| 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 | 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 | Release *redirectedCarrierOffsetDedicated*. |
| T325 | Timer (re)started upon receiving *RRCConnectionReject* message with *deprioritisationTimer*. |  | Stop deprioritisation of all frequencies or E-UTRA signalled by *RRCConnectionReject.* |
| 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* or, if *validityArea* is configured, upon reselecting to cell that does not belong to *validityArea*. | Release the stored *VarMeasIdleConfig.* |
| T340  NOTE2 | Upon transmitting *UEAssistanceInformation* message with *powerPrefIndication* set to *normal* | Upon initiating the connection re-establishment procedure | No action. |
| T341  NOTE2 | Upon transmitting *UEAssistanceInformation* message with *bw-Preference.* | Upon resuming an RRC connection or upon initiating the connection re-establishment procedure | No action. |
| T342  NOTE2 | Upon transmitting *DelayBudgetReport* message. | Upon initiating the connection re-establishment and connection resume procedures | 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*. |
| 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. |
| 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 initiating the connection re-establishment procedure | No action. |
| T380 | Upon reception of *periodic-RNAU-timer* in RRCConnectionRelease. | Upon reception of *RRCConnectionResume*, *RRCConnectionRelease* or *RRCConnectionSetup*. | Initiate the RAN notification area update procedure |
| NOTE1: Only the timers marked with "NOTE1" are applicable to NB-IoT.  NOTE2: The behaviour as specified in 7.3.2 applies. | | | |

|  |
| --- |
| Next change |

# 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, 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,

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,

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, 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} 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 SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *HandoverPreparationInformation* field descriptions |
| --- |
| ***as-Config***  The radio resource configuration. Applicable in case of intra-E-UTRA handover. 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 intra-5GC handover from NR. |
| ***sourceRB-ConfigIntra5GC***  NR radio bearer config used at intra5GC handover, 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 | Included | May be included | May be included | May be included | May be included |
| NR | Included | Excluded | Excluded | May be included | May be included |

| 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 from GERAN to E-UTRA, otherwise the field is not present. |
| *HO4* | The field is mandatory present in case of handover within E-UTRA/5GC and optional present in case of handover from NR to E-UTRA/5GC; 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, -- Need ON

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.

Direction: eNB to/from EPC

*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.

Direction: eNB to/ from EPC

*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/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 SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *UERadioPagingInformation* field descriptions |
| --- |
| ***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. |
| ***supportedBandListEUTRAForPaging***  Indicates the UE supported frequency bands which is derived by the eNB from *UE-EUTRA-Capability*. |

## 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-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

}

-- 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. |
| ***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 pattern configuration 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

powerPrefIndication-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

}

-- ASN1STOP

| *AS-Context* field descriptions |
| --- |
| ***idc-Indication***  Including information used for handling the IDC problems. |
| ***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. |

| 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. |

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.

Direction: eNB to/from EPC

*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 SEQUENCE {} OPTIONAL

}

-- ASN1STOP

| *UEPagingCoverageInformation-NB* field descriptions |
| --- |
| ***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. |

#### – *UERadioAccessCapabilityInformation-NB*

This message is used to transfer UE NB-IoT Radio Access capability information, covering both upload to and download from the EPC.

Direction: eNB to/ from EPC

*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.

Direction: eNB to/ from EPC

*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;

|  |
| --- |
| Next change |

## 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) | *RRCConnectionReconfiguration* | *RRCConnectionReconfigurationComplete* | 15 |  |
| 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-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 | *RRCEarlyDataComplete* or *RRCConnectionRelease* for UP-EDT |  | NA |  |
| Paging | *Paging* |  | NA |  |
| **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. |
| 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 |
| 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 |  |
| Delay Budget Report |  | *DelayBudgetReport* | 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 | *RRCEarlyDataComplete-NB* or *RRCConnectionRelease-NB* for UP-EDT |  | 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 |  |

|  |
| --- |
| Next change |

## A.6 Protection of RRC messages (informative)

The following list provides information which messages can be sent (unprotected) prior to security activation and which messages can be sent unprotected after security activation. Those messages indicated "-" in "P" column should never be sent unprotected by eNB or UE. Further requirements are defined in the procedural text.

P…Messages that can be sent (unprotected) prior to security activation

A - I…Messages that can be sent without integrity protection after security activation

A - C…Messages that can be sent unciphered after security activation

NA… Message can never be sent after security activation

| Message | P | | A-I | A-C | Comment |
| --- | --- | --- | --- | --- | --- |
| CSFBParametersRequestCDMA2000 | **+** | | **-** | **-** |  |
| CSFBParametersResponseCDMA2000 | + | | - | - |  |
| CounterCheck | - | | - | - |  |
| CounterCheckResponse | - | | - | - |  |
| DelayBudgetReport | - | | - | - |  |
| DLInformationTransfer | + | | - | - |  |
| FailureInformation | - | | - | - |  |
| HandoverFromEUTRAPreparationRequest (CDMA2000) | - | | - | - |  |
| InDeviceCoexIndication | - | | - | - |  |
| InterFreqRSTDMeasurementIndication | - | | - | - |  |
| LoggedMeasurementsConfiguration | | - | - | - |  |
| MasterInformationBlock | + | | + | + |  |
| MasterInformationBlock-MBMS | + | | + | + |  |
| MBMSCountingRequest | + | | + | + |  |
| MBMSCountingResponse | - | | - | - |  |
| MBMSInterestIndication | + | | - | - |  |
| MBSFNAreaConfiguration | + | | + | + |  |
| MeasReportAppLayer | - | | - | - |  |
| MeasurementReport | - | | - | - | Measurement configuration may be sent prior to security activation. But: In order to protect privacy of UEs, MEASUREMENT REPORT is only sent from the UE after successful security activation. |
| MobilityFromEUTRACommand | - | | - | - |  |
| Paging | + | | + | + |  |
| ProximityIndication | - | | - | - |  |
| PURConfigurationRequest | - | | - | - |  |
| RNReconfiguration | - | | - | - |  |
| RNReconfigurationComplete | - | | - | - |  |
| RRCConnectionReconfiguration | + | | - | - | The message shall not be sent unprotected before security activation if it is used to perform handover or to establish SRB2, SRB4 and DRBs |
| RRCConnectionReconfigurationComplete | + | | - | - | Unprotected, if sent as response to RRCConnectionReconfiguration which was sent before security activation |
| RRCConnectionReestablishment | - | | + | + | This message is not protected by PDCP operation. |
| RRCConnectionReestablishmentComplete | - | | - | - |  |
| RRCConnectionReestablishmentReject | - | | + | + | One reason to send this may be that the security context has been lost, therefore sent as unprotected. |
| RRCConnectionReestablishmentRequest | - | | - | + | This message is not protected by PDCP operation. However, a short MAC-I is included. |
| RRCConnectionReject | + | | + | + | Except for UP-EDT, A-I and A-C are NA. |
| RRCConnectionRelease | + | | - | - | Justification for P: If the RRC connection only for signalling not requiring DRBs or ciphered messages, or the signalling connection has to be released prematurely, this message is sent as unprotected.  For UP-EDT, the message is only sent after successful security activation.  *RRCConnectionRelease* message sent before security activation cannot include *rrc-InactiveConfig, redirectedCarrierInfo, idleModeMobilityControlInfo* information fields when UE is connected to 5GC. |
| RRCConnectionRequest | + | | NA | NA |  |
| RRCConnectionResume | - | | - | + | When this message is transmitted, security is activated but suspended. Integrity verification is done after the message received by RRC.  For UP-EDT, the message is only sent after successful security activation.  For RRC\_INACTIVE state, the message is protected with both integrity and ciphering. |
| RRCConnectionResumeRequest | - | | - | + | This message is not protected by PDCP operation. However, a short MAC-I is included. |
| RRCConnectionResumeComplete | - | | - | - |  |
| RRCConnectionSetup | + | | NA | NA |  |
| RRCConnectionSetupComplete | + | | NA | NA |  |
| RRCEarlyDataRequest | + | | NA | NA |  |
| RRCEarlyDataComplete | + | | NA | NA |  |
| SCGFailureInformation | - | | - | - |  |
| SCGFailureInformationNR | - | | - | - |  |
| SCPTMConfiguration | + | | + | + |  |
| SecurityModeCommand | + | | NA | NA | Integrity protection applied, but no ciphering (integrity verification done after the message received by RRC) |
| SecurityModeComplete | - | | NA | NA | Integrity protection applied, but no ciphering. Ciphering is applied after completing the procedure. |
| SecurityModeFailure | + | | NA | NA | Neither integrity protection nor ciphering applied. |
| SidelinkUEInformation | + | | - | - |  |
| SystemInformation | + | | + | + |  |
| SystemInformationBlockType1 | + | | + | + |  |
| SystemInformationBlockType1-MBMS | + | | + | + |  |
| UEAssistanceInformation | - | | - | - |  |
| UECapabilityEnquiry | + | | - | - |  |
| UECapabilityInformation | + | | - | - |  |
| UEInformationRequest | - | | - | - |  |
| UEInformationResponse | - | | - | - | In order to protect privacy of UEs, UEInformationResponse is only sent from the UE after successful security activation. |
| ULHandoverPreparationTransfer (CDMA2000) | - | | - | - | This message should follow HandoverFromEUTRAPreparationRequest |
| ULInformationTransfer | + | | - | - |  |
| ULInformationTransferMRDC | - | | - | - |  |
| WLANConnectionStatusReport | - | | - | - |  |