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# Foreword

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

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

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

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# 1 Scope

The present document specifies the Radio Resource Control protocol for the radio interface between UE and NG-RAN.

The scope of the present document also includes:

- the radio related information transported in a transparent container between source gNB and target gNB upon inter gNB handover;
- the radio related information transported in a transparent container between a source or target gNB and another system upon inter RAT handover.
- the radio related information transported in a transparent container between a source eNB and target gNB during E-UTRA-NR Dual Connectivity.

The RRC protocol is also used to configure the radio interface between an IAB-node and its parent node [2].

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# 2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 38.300: "NR; Overall description; Stage 2".
- [3] 3GPP TS 38.321: "NR; Medium Access Control (MAC); Protocol specification".
- [4] 3GPP TS 38.322: "NR; Radio Link Control (RLC) protocol specification".
- [5] 3GPP TS 38.323: "NR; Packet Data Convergence Protocol (PDCP) protocol specification".
- [6] ITU-T Recommendation X.680 (08/2015) "Information Technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation" (Same as the ISO/IEC International Standard 8824-1).
- [7] ITU-T Recommendation X.681 (08/2015) "Information Technology – Abstract Syntax Notation One (ASN.1): Information object specification" (Same as the ISO/IEC International Standard 8824-2).
- [8] ITU-T Recommendation X.691 (08/2015) "Information technology – ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)" (Same as the ISO/IEC International Standard 8825-2).
- [9] 3GPP TS 38.215: "NR; Physical layer measurements".
- [10] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA) Radio Resource Control (RRC); Protocol Specification".
- [11] 3GPP TS 33.501: "Security Architecture and Procedures for 5G System".
- [12] 3GPP TS 38.104: "NR; Base Station (BS) radio transmission and reception".

- [13] 3GPP TS 38.213: "NR; Physical layer procedures for control".
- [14] 3GPP TS 38.133: "NR; Requirements for support of radio resource management".
- [15] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".
- [16] 3GPP TS 38.211: "NR; Physical channels and modulation".
- [17] 3GPP TS 38.212: "NR; Multiplexing and channel coding".
- [18] ITU-T Recommendation X.683 (08/2015) "Information Technology – Abstract Syntax Notation One (ASN.1): Parameterization of ASN.1 specifications" (Same as the ISO/IEC International Standard 8824-4).
- [19] 3GPP TS 38.214: "NR; Physical layer procedures for data".
- [20] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in Idle mode and RRC Inactive state".
- [21] 3GPP TS 23.003: "Numbering, addressing and identification".
- [22] 3GPP TS 36.101: "E-UTRA; User Equipment (UE) radio transmission and reception".
- [23] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".
- [24] 3GPP TS 37.324: "Service Data Adaptation Protocol (SDAP) specification".
- [25] 3GPP TS 22.261: "Service requirements for the 5G System".
- [26] 3GPP TS 38.306: "User Equipment (UE) radio access capabilities".
- [27] 3GPP TS 36.304: "E-UTRA; User Equipment (UE) procedures in idle mode".
- [28] ATIS 0700041: "WEA 3.0: Device-Based Geo-Fencing".
- [29] 3GPP TS 23.041: "Technical realization of Cell Broadcast Service (CBS)".
- [30] 3GPP TS 33.401: "3GPP System Architecture Evolution (SAE); Security architecture".
- [31] 3GPP TS 36.211: "E-UTRA; Physical channels and modulation".
- [32] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".
- [33] 3GPP TS 36.104: "E-UTRA; Base Station (BS) radio transmission and reception".
- [34] 3GPP TS 38.101-3 "NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".
- [35] 3GPP TS 38.423: "NG-RAN, Xn application protocol (XnAP)".
- [36] 3GPP TS 38.473: "NG-RAN; F1 application protocol (F1AP)".
- [37] 3GPP TS 36.423: "E-UTRA; X2 application protocol (X2AP)".
- [38] 3GPP TS 24.008: "Mobile radio interface layer 3 specification; Core network protocols; Stage 3".
- [39] 3GPP TS 38.101-2 "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".
- [40] 3GPP TS 36.133: "E-UTRA; Requirements for support of radio resource management".
- [41] 3GPP TS 37.340: "E-UTRA and NR; Multi-connectivity; Stage 2".
- [42] 3GPP TS 38.413: "NG-RAN, NG Application Protocol (NGAP)".
- [43] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

- [44] 3GPP TR 36.816: "Evolved Universal Terrestrial Radio Access (E-UTRA); Study on signalling and procedure for interference avoidance for in-device coexistence".
- [45] 3GPP TS 25.331: "Universal Terrestrial Radio Access (UTRA); Radio Resource Control (RRC); Protocol specification".
- [46] 3GPP TS 25.133: "Requirements for Support of Radio Resource Management (FDD)".
- [47] 3GPP TS 38.340: "Backhaul Adaptation Protocol (BAP) specification".
- [48] 3GPP TS 37.213: "Physical layer procedures for shared spectrum channel access".
- [49] 3GPP TS 37.355: "LTE Positioning Protocol (LPP)".
- [50] IEEE 802.11-2012, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications, IEEE Std.
- [51] Bluetooth Special Interest Group: "Bluetooth Core Specification v5.0", December 2016.
- [52] 3GPP TS 32.422: "Telecommunication management; Subscriber and equipment trace; Trace control and configuration management".
- [53] 3GPP TS 38.314: "NR; layer 2 measurements".
- [54] Void.
- [55] 3GPP TS 23.287: "Architecture enhancements for 5G System (5GS) to support Vehicle-to-Everything (V2X) services".
- [56] 3GPP TS 23.285: "Technical Specification Group Services and System Aspects; Architecture enhancements for V2X services".
- [57] 3GPP TS 24.587: "Technical Specification Group Core Network and Terminals; Vehicle-to-Everything (V2X) services in 5G System (5GS)".
- [58] Military Standard WGS84 Metric MIL-STD-2401 (11 January 1994): "Military Standard Department of Defence World Geodetic System (WGS)".
- [59] 3GPP TS 38.101-4 "NR; User Equipment (UE) radio transmission and reception; Part 4: Performance Requirements".
- [60] 3GPP TS 33.536: "Technical Specification Group Services and System Aspects; Security aspects of 3GPP support for advanced Vehicle-to-Everything (V2X) services".
- [61] 3GPP TS 37.320: "Universal Terrestrial Radio Access (UTRA), Evolved Universal Terrestrial Radio Access (E-UTRA) and New Radio (NR); Radio measurement collection for Minimization of Drive Tests (MDT); Overall description; Stage 2".
- [62] 3GPP TS 36.306: "User Equipment (UE) radio access capabilities".

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## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

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

**BH RLC channel:** The BH RLC channel consisting of an RLC and logical channel of an IAB-node.

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

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



**Dedicated signalling:** Signalling sent on DCCH logical channel between the network and a single UE.

**Dormant BWP:** The dormant BWP is one of downlink BWPs configured by the network via dedicated RRC signalling. In the dormant BWP, the UE stops monitoring PDCCH on/for the SCell, but continues performing CSI measurements, Automatic Gain Control (AGC) and beam management, if configured. For each serving cell other than the SpCell or PUCCH SCell, the network may configure one BWP as a dormant BWP.

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

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

**Global cell identity:** An identity to uniquely identifying an NR cell. It is consisted of *cellIdentity* and *plmn-Identity* of the first *PLMN-Identity* in *plmn-IdentityList* in SIB1.

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

**NPN-only Cell:** A cell that is only available for normal service for NPNs' subscriber. An NPN-capable UE determines that a cell is NPN-only Cell by detecting that the *cellReservedForOtherUse* IE is set to true while the *npn-IdentityInfoList* IE is present in *CellAccessRelatedInfo*.

**NR sidelink communication:** AS functionality enabling at least V2X Communication as defined in TS 23.287 [55], between two or more nearby UEs, using NR technology but not traversing any network node.

**PNI-NPN identity:** an identifier of a PNI-NPN comprising of a PLMN ID and a CAG -ID combination.

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

**Primary SCG Cell:** For dual connectivity operation, the SCG cell in which the UE performs random access when performing the Reconfiguration with Sync procedure.

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

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

**PUSCH-Less SCell:** An SCell configured without PUSCH.

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

**Secondary Cell:** For a UE configured with CA, a cell providing additional radio resources on top of Special Cell.

**Secondary Cell Group:** For a UE configured with dual connectivity, the subset of serving cells comprising of the PSCell and zero or more secondary cells.

**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 cells comprising of the Special Cell(s) and all secondary cells.

**SNPN identity:** an identifier of an SNPN comprising of a PLMN ID and an NID combination.

**Special Cell:** For Dual Connectivity operation the term Special Cell refers to the PCell of the MCG or the PSCell of the SCG, otherwise the term Special Cell refers to the PCell.

**Split SRB:** In MR-DC, an SRB that supports transmission via MCG and SCG as well as duplication of RRC PDUs as defined in TS 37.340 [41].

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

**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 5.3.8.3.

**V2X sidelink communication:** AS functionality enabling V2X Communication as defined in TS 23.285 [56], 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] 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].

5GC	5G Core Network
ACK	Acknowledgement
AM	Acknowledged Mode
ARQ	Automatic Repeat Request
AS	Access Stratum
ASN.1	Abstract Syntax Notation One
BAP	Backhaul Adaptation Protocol
BCD	Binary Coded Decimal
BH	Backhaul
BLER	Block Error Rate
BWP	Bandwidth Part
CA	Carrier Aggregation
CAG	Closed Access Group
CAG-ID	Closed Access Group Identifier
CAPC	Channel Access Priority Class
CBR	Channel Busy Ratio
CCCH	Common Control Channel
CG	Cell Group
CHO	Conditional Handover
CLI	Cross Link Interference
CMAS	Commercial Mobile Alert Service
CP	Control Plane
CPC	Conditional PSCell Change
C-RNTI	Cell RNTI
CSI	Channel State Information
DAPS	Dual Active Protocol Stack
DC	Dual Connectivity
DCCH	Dedicated Control Channel
DCI	Downlink Control Information
DCP	DCI with CRC scrambled by PS-RNTI
DFN	Direct Frame Number
DL	Downlink
DL-PRS	Downlink Positioning Reference Signal
DL-SCH	Downlink Shared Channel
DM-RS	Demodulation Reference Signal
DRB	(user) Data Radio Bearer
DRX	Discontinuous Reception
DTCH	Dedicated Traffic Channel
EN-DC	E-UTRA NR Dual Connectivity with E-UTRA connected to EPC
EPC	Evolved Packet Core
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
GSM	Global System for Mobile Communications
HARQ	Hybrid Automatic Repeat Request
HRNN	Human Readable Network Name
IAB	Integrated Access and Backhaul
IAB-DU	IAB-node DU

IAB-MT	IAB Mobile Termination
IDC	In-Device Coexistence
IE	Information element
IMSI	International Mobile Subscriber Identity
kB	Kilobyte (1000 bytes)
L1	Layer 1
L2	Layer 2
L3	Layer 3
LBT	Listen Before Talk
MAC	Medium Access Control
MCG	Master Cell Group
MDT	Minimization of Drive Tests
MIB	Master Information Block
MPE	Maximum Permissible Exposure
MR-DC	Multi-Radio Dual Connectivity
N/A	Not Applicable
NE-DC	NR E-UTRA Dual Connectivity
(NG)EN-DC	E-UTRA NR Dual Connectivity (covering E-UTRA connected to EPC or 5GC)
NGEN-DC	E-UTRA NR Dual Connectivity with E-UTRA connected to 5GC
NID	Network Identifier
NPN	Non-Public Network
NR-DC	NR-NR Dual Connectivity
NR/5GC	NR connected to 5GC
PCell	Primary Cell
PDCP	Packet Data Convergence Protocol
PDU	Protocol Data Unit
PLMN	Public Land Mobile Network
PNI-NPN	Public Network Integrated Non-Public Network
posSIB	Positioning SIB
PRS	Positioning Reference Signal
PSCell	Primary SCG Cell
PWS	Public Warning System
QoS	Quality of Service
RAN	Radio Access Network
RAT	Radio Access Technology
RLC	Radio Link Control
RMTC	RSSI Measurement Timing Configuration
RNA	RAN-based Notification Area
RNTI	Radio Network Temporary Identifier
ROHC	Robust Header Compression
RPLMN	Registered Public Land Mobile Network
RRC	Radio Resource Control
RS	Reference Signal
SBAS	Satellite Based Augmentation System
SCell	Secondary Cell
SCG	Secondary Cell Group
SCS	Subcarrier Spacing
SFN	System Frame Number
SFTD	SFN and Frame Timing Difference
SI	System Information
SIB	System Information Block
SL	Sidelink
SLSS	Sidelink Synchronisation Signal
SNPN	Stand-alone Non-Public Network
SpCell	Special Cell
SRB	Signalling Radio Bearer
SRS	Sounding Reference Signal
SSB	Synchronization Signal Block
TAG	Timing Advance Group
TDD	Time Division Duplex
TM	Transparent Mode
UE	User Equipment

UL	Uplink
UM	Unacknowledged Mode
UP	User Plane

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

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## 4 General

### 4.1 Introduction

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 messages in ASN.1 and description;
- 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 generic error handling;
- clause 11 specifies the RRC messages transferred across network nodes;
- clause 12 specifies the UE capability related constraints and performance requirements.

### 4.2 Architecture

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

A UE is either in RRC\_CONNECTED state or in RRC\_INACTIVE state when an RRC connection has been established. 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 based on network configuration;
  - The UE:
    - Monitors Short Messages transmitted with P-RNTI over DCI (see clause 6.5);
    - Monitors a Paging channel for CN paging using 5G-S-TMSI;
    - Performs neighbouring cell measurements and cell (re-)selection;
    - Acquires system information and can send SI request (if configured).
    - Performs logging of available measurements together with location and time for logged measurement configured UEs.
- **RRC\_INACTIVE:**

- A UE specific DRX may be configured by upper layers or by RRC layer;
- UE controlled mobility based on network configuration;
- The UE stores the UE Inactive AS context;
- A RAN-based notification area is configured by RRC layer;

The UE:

- Monitors Short Messages transmitted with P-RNTI over DCI (see clause 6.5);
  - Monitors a Paging channel for CN paging using 5G-S-TMSI and RAN paging using fullI-RNTI;
  - Performs neighbouring cell measurements and cell (re-)selection;
  - Performs RAN-based notification area updates periodically and when moving outside the configured RAN-based notification area;
  - Acquires system information and can send SI request (if configured).
  - Performs logging of available measurements together with location and time for logged measurement configured UEs.
- **RRC\_CONNECTED:**
- The UE stores the AS context;
  - 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 SpCell, for increased bandwidth;
  - For UEs supporting DC, use of one SCG, aggregated with the MCG, for increased bandwidth;
  - Network controlled mobility within NR and to/from E-UTRA;
  - The UE:
    - Monitors Short Messages transmitted with P-RNTI over DCI (see clause 6.5), if configured;
    - Monitors control channels associated with the shared data channel to determine if data is scheduled for it;
    - Provides channel quality and feedback information;
    - Performs neighbouring cell measurements and measurement reporting;
    - Acquires system information;
    - Performs immediate MDT measurement together with available location reporting.

Figure 4.2.1-1 illustrates an overview of UE RRC state machine and state transitions in NR. A UE has only one RRC state in NR at one time.

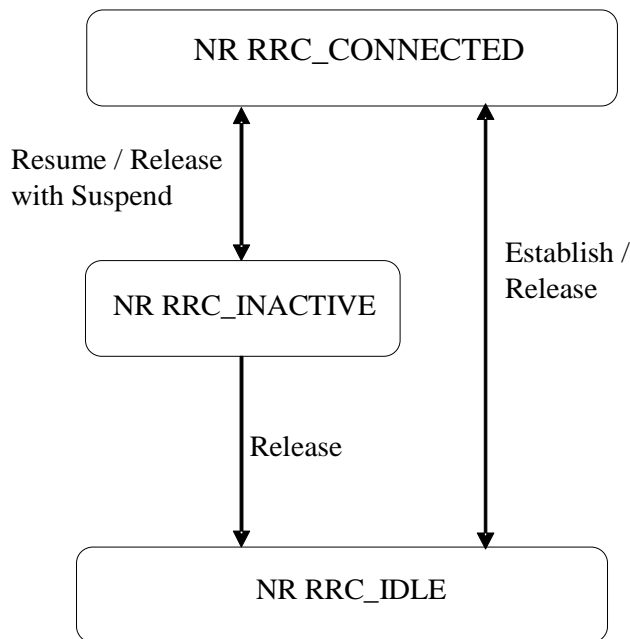


Figure 4.2.1-1: UE state machine and state transitions in NR

Figure 4.2.1-2 illustrates an overview of UE state machine and state transitions in NR as well as the mobility procedures supported between NR/5GC E-UTRA/EPC and E-UTRA/5GC.

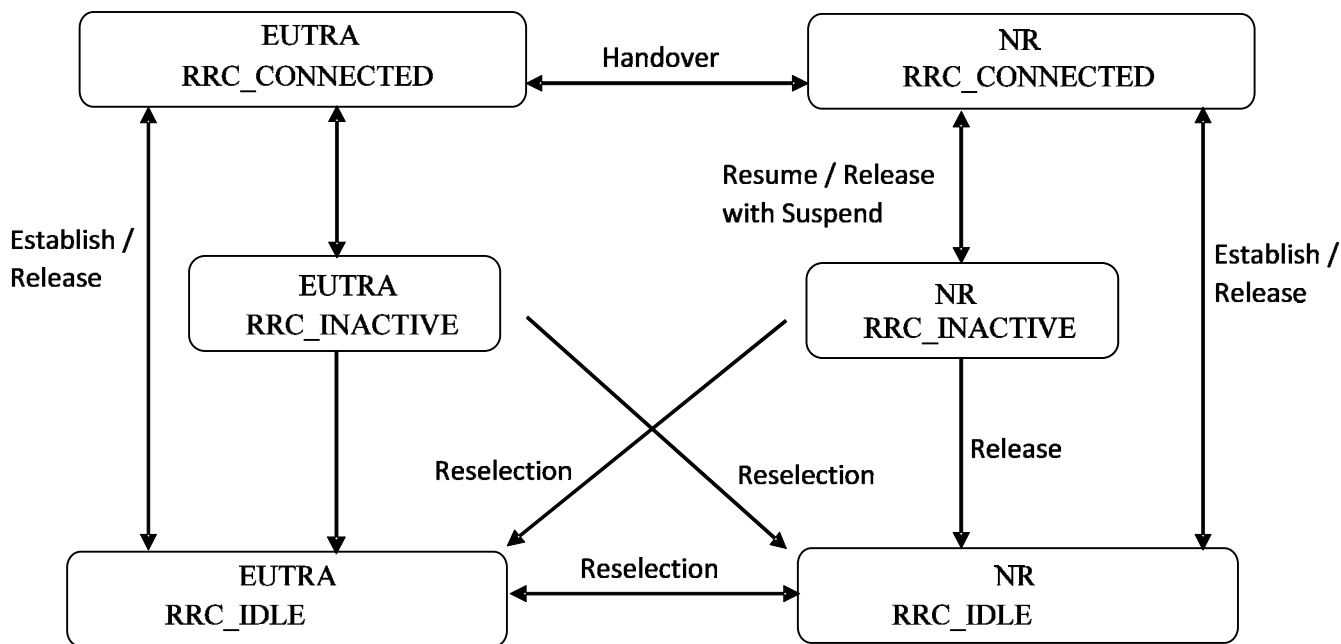


Figure 4.2.1-2: UE state machine and state transitions between NR/5GC, E-UTRA/EPC and E-UTRA/5GC

### 4.2.2 Signalling radio bearers

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

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

- SRB1 is for RRC messages (which may include a piggybacked NAS message) as well as for NAS messages prior to the establishment of SRB2, all using DCCH logical channel;
- SRB2 is for NAS messages and for RRC messages which include logged measurement information, all using DCCH logical channel. SRB2 has a lower priority than SRB1 and may be configured by the network after AS security activation;
- SRB3 is for specific RRC messages when UE is in (NG)EN-DC or NR-DC, all using DCCH logical channel.

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

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

Once AS security is activated, all RRC messages on SRB1, SRB2 and SRB3, including those containing NAS messages, are integrity protected and ciphered by PDCP. NAS independently applies integrity protection and ciphering to the NAS messages, see TS 24.501 [23].

Split SRB is supported for all the MR-DC options in both SRB1 and SRB2 (split SRB is not supported for SRB0 and SRB3).

For operation with shared spectrum channel access, SRB0, SRB1 and SRB3 are assigned with the highest priority Channel Access Priority Class (CAPC), (i.e. CAPC = 1) while CAPC for SRB2 is configurable.

## 4.3 Services

### 4.3.1 Services provided to upper layers

The RRC protocol offers the following services to upper layers:

- Broadcast of common control information;
- Notification of UEs in RRC\_IDLE, e.g. about a mobile terminating call;
- Notification of UEs about ETWS and/or CMAS;
- Transfer of dedicated signalling;
- Broadcast of positioning assistance data.

### 4.3.2 Services expected from lower layers

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

- Integrity protection, ciphering and loss-less in-sequence delivery of information without duplication;

## 4.4 Functions

The RRC protocol includes the following main functions:

- Broadcast of system information:
  - Including NAS common information;
  - Information applicable for UEs in RRC\_IDLE and RRC\_INACTIVE (e.g. cell (re-)selection parameters, neighbouring cell information) and information (also) applicable for UEs in RRC\_CONNECTED (e.g. common channel configuration information);
  - Including ETWS notification, CMAS notification;

- Including positioning assistance data.
- RRC connection control:
  - Paging;
  - Establishment/modification/suspension/resumption/release of RRC connection, including e.g. assignment/modification of UE identity (C-RNTI, fullI-RNTI, etc.), establishment/modification/suspension/resumption/release of SRBs (except for SRB0);
  - Access barring;
  - Initial AS security activation, i.e. initial configuration of AS integrity protection (SRBs, DRBs) and AS ciphering (SRBs, DRBs);
  - RRC connection mobility including e.g. intra-frequency and inter-frequency handover, associated AS security handling, i.e. key/algorithm change, specification of RRC context information transferred between network nodes;
  - Establishment/modification/suspension/resumption/release of RBs carrying user data (DRBs);
  - Radio configuration control including e.g. assignment/modification of ARQ configuration, HARQ configuration, DRX configuration;
  - In case of DC, cell management including e.g. change of PSCell, addition/modification/release of SCG cell(s);
  - In case of CA, cell management including e.g. addition/modification/release of SCell(s);
  - QoS control including assignment/ modification of semi-persistent scheduling (SPS) configuration and configured grant configuration for DL and UL respectively, assignment/ modification of parameters for UL rate control in the UE, i.e. allocation of a priority and a prioritised bit rate (PBR) for each RB.
  - Recovery from radio link failure.
- Inter-RAT mobility including e.g. AS security activation, transfer of RRC context information;
- Measurement configuration and reporting:
  - Establishment/modification/release of measurement configuration (e.g. intra-frequency, inter-frequency and inter- RAT measurements);
  - Setup and release of measurement gaps;
  - Measurement reporting.
- Configuration of BAP entity and BH RLC channels for the support of IAB-node.
- Other functions including e.g. generic protocol error handling, transfer of dedicated NAS information, transfer of UE radio access capability information.
- Support of self-configuration and self-optimisation.
- Support of measurement logging and reporting for network performance optimisation, as specified in TS 37.320 [61].

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## 5 Procedures

### 5.1 General

#### 5.1.1 Introduction

This clause covers the general requirements.



## 5.1.2 General requirements

The UE shall:

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

NOTE: Network may initiate a subsequent procedure prior to receiving the UE's response of a previously initiated procedure.

- 1> within a clause execute the steps according to the order specified in the procedural description;
- 1> consider the term 'radio bearer' (RB) to cover SRBs and DRBs unless explicitly stated otherwise;
- 1> set the *rrc-TransactionIdentifier* in the response message, if included, to the same value as included in the message received from the network that triggered the response message;
- 1> upon receiving a choice value set to *setup*:
  - 2> apply the corresponding received configuration and start using the associated resources, unless explicitly specified otherwise;
- 1> upon receiving a choice value set to *release*:
  - 2> clear the corresponding configuration and stop using the associated resources;
- 1> in case the size of a list is extended, upon receiving an extension field comprising the entries in addition to the ones carried by the original field (regardless of whether the network signals more entries in total); apply the following generic behaviour unless explicitly stated otherwise:
  - 2> create a combined list by concatenating the additional entries included in the extension field to the original field while maintaining the order among both the original and the additional entries;
  - 2> for the combined list, created according to the previous, apply the same behaviour as defined for the original field.

## 5.1.3 Requirements for UE in MR-DC

In this specification, the UE considers itself to be in:

- EN-DC, if and only if it is configured with *nr-SecondaryCellGroupConfig* according to TS 36.331[10], and it is connected to EPC,
- NGEN-DC, if and only if it is configured with *nr-SecondaryCellGroupConfig* according to TS 36.331[10], and it is connected to 5GC,
- NE-DC, if and only if it is configured with *mrdc-SecondaryCellGroup* set to *eutra-SCG*,
- NR-DC, if and only if it is configured with *mrdc-SecondaryCellGroup* set to *nr-SCG*,
- MR-DC, if and only if it is in (NG)EN-DC, NE-DC or NR-DC.

NOTE: This use of these terms deviates from the definition in TS 37.340 [41] and other specifications. In TS 37.340, these terms include also the case where the UE is configured with E-UTRA or NR MCG only (i.e. no NR or E-UTRA SCG) but with one or more bearers terminated in a secondary node (i.e. using NR PDCP).

The UE in (NG)EN-DC only executes a sub-clause of clause 5 in this specification when the subclause:

- is referred to from a subclause under execution, either in this specification or in TS 36.331 [10]; or
- applies to a message received on SRB3 (if SRB3 is established); or
- applies to field(s), IE(s), UE variable(s) or timer(s) in this specification that the UE is configured with.

When executing a subclause of clause 5 in this specification, the UE follows the requirements in clause 5.1.2 and in all subclauses of this specification applicable to the messages (including processing time requirements), fields, IEs, timers and UE variables indicated in the subclause under execution.

## 5.2 System information

### 5.2.1 Introduction

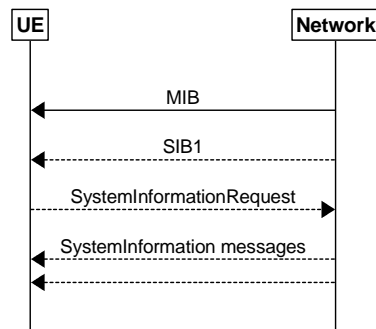
System Information (SI) is divided into the *MIB* and a number of SIBs and posSIBs where:

- the *MIB* is always transmitted on the BCH with a periodicity of 80 ms and repetitions made within 80 ms (TS 38.212 [17], clause 7.1) and it includes parameters that are needed to acquire *SIB1* from the cell. The first transmission of the *MIB* is scheduled in subframes as defined in TS 38.213 [13], clause 4.1 and repetitions are scheduled according to the period of SSB;
- the *SIB1* is transmitted on the DL-SCH with a periodicity of 160 ms and variable transmission repetition periodicity within 160 ms as specified in TS 38.213 [13], clause 13. The default transmission repetition periodicity of *SIB1* is 20 ms but the actual transmission repetition periodicity is up to network implementation. For SSB and CORESET multiplexing pattern 1, *SIB1* repetition transmission period is 20 ms. For SSB and CORESET multiplexing pattern 2/3, *SIB1* transmission repetition period is the same as the SSB period (TS 38.213 [13], clause 13). *SIB1* includes information regarding the availability and scheduling (e.g. mapping of SIBs to SI message, periodicity, SI-window size) of other SIBs with an indication whether one or more SIBs are only provided on-demand and, in that case, the configuration needed by the UE to perform the SI request. *SIB1* is cell-specific SIB;
- SIBs other than *SIB1* and posSIBs are carried in *SystemInformation* (SI) messages, which are transmitted on the DL-SCH. Only SIBs or posSIBs having the same periodicity can be mapped to the same SI message. SIBs and posSIBs are mapped to the different SI messages. Each SI message is transmitted within periodically occurring time domain windows (referred to as SI-windows with same length for all SI messages). Each SI message is associated with an SI-window and the SI-windows of different SI messages do not overlap. That is, within one SI-window only the corresponding SI message is transmitted. An SI message may be transmitted a number of times within the SI-window. Any SIB or posSIB except *SIB1* can be configured to be cell specific or area specific, using an indication in *SIB1*. The cell specific SIB is applicable only within a cell that provides the SIB while the area specific SIB is applicable within an area referred to as SI area, which consists of one or several cells and is identified by *systemInformationAreaID*;
- The mapping of SIBs to SI messages is configured in *schedulingInfoList*, while the mapping of posSIBs to SI messages is configured in *pos-SchedulingInfoList*;
- For a UE in RRC\_CONNECTED, the network can provide system information through dedicated signalling using the *RRCReconfiguration* message, e.g. if the UE has an active BWP with no common search space configured to monitor system information, paging, or upon request from the UE.
- For PSCell and SCells, the network provides the required SI by dedicated signalling, i.e. within an *RRCReconfiguration* message. Nevertheless, the UE shall acquire *MIB* of the PSCell to get SFN timing of the SCG (which may be different from MCG). Upon change of relevant SI for SCell, the network releases and adds the concerned SCell. For PSCell, the required SI can only be changed with Reconfiguration with Sync.

NOTE: The physical layer imposes a limit to the maximum size a SIB can take. The maximum *SIB1* or *SI message* size is 2976 bits.

## 5.2.2 System information acquisition

### 5.2.2.1 General UE requirements



**Figure 5.2.2.1-1: System information acquisition**

The UE applies the SI acquisition procedure to acquire the AS, NAS- and positioning assistance data information. The procedure applies to UEs in RRC\_IDLE, in RRC\_INACTIVE and in RRC\_CONNECTED.

The UE in RRC\_IDLE and RRC\_INACTIVE shall ensure having a valid version of (at least) the *MIB*, *SIB1* through *SIB4*, *SIB5* (if the UE supports E-UTRA), *SIB11* (if the UE is configured for idle/inactive measurements), *SIB12* (if UE is capable of NR sidelink communication and is configured by upper layers to receive or transmit NR sidelink communication), and *SIB13*, *SIB14* (if UE is capable of V2X sidelink communication and is configured by upper layers to receive or transmit V2X sidelink communication).

### 5.2.2.2 SIB validity and need to (re)-acquire SIB

#### 5.2.2.2.1 SIB validity

The UE shall apply the SI acquisition procedure as defined in clause 5.2.2.3 upon cell selection (e.g. upon power on), cell-reselection, return from out of coverage, after reconfiguration with sync completion, after entering the network from another RAT, upon receiving an indication that the system information has changed, upon receiving a PWS notification, upon receiving request (e.g., a positioning request) from upper layers; and whenever the UE does not have a valid version of a stored SIB or posSIB or a valid version of a requested SIB.

When the UE acquires a *MIB* or a *SIB1* or an SI message in a serving cell as described in clause 5.2.2.3, and if the UE stores the acquired SIB, then the UE shall store the associated *areaScope*, if present, the first *PLMN-Identity* in the *PLMN-IdentityInfoList* for non-NPN-only cells or the first NPN identity (SNPN identity in case of SNPN, or PNI-NPN identity in case of PNI-NPN) in the *NPN-IdentityInfoList* for NPN-only cells, the *cellIdentity*, the *systemInformationAreaID*, if present, and the *valueTag*, if present, as indicated in the *si-SchedulingInfo* for the SIB. The UE may use a valid stored version of the SI except *MIB*, *SIB1*, *SIB6*, *SIB7* or *SIB8* e.g. after cell re-selection, upon return from out of coverage or after the reception of SI change indication. The value tag for posSIB is optionally provided in LPP signalling [49].

NOTE: The storage and management of the stored SIBs in addition to the SIBs valid for the current serving cell is left to UE implementation.

The UE shall:

- 1> delete any stored version of a SIB after 3 hours from the moment it was successfully confirmed as valid;
- 1> for each stored version of a SIB:
  - 2> if the *areaScope* is associated and its value for the stored version of the SIB is the same as the value received in the *si-SchedulingInfo* for that SIB from the serving cell:
  - 3> if the UE is NPN capable and the cell is an NPN-only cell and the first NPN identity included in the *NPN-IdentityInfoList*, the *systemInformationAreaID* and the *valueTag* that are included in the *si-SchedulingInfo*

for the SIB received from the serving cell are identical to the NPN identity, the *systemInformationAreaID* and the *valueTag* associated with the stored version of that SIB:

- 4> consider the stored SIB as valid for the cell;
- 3> else if the first *PLMN-Identity* included in the *PLMN-IdentityInfoList*, the *systemInformationAreaID* and the *valueTag* that are included in the *si-SchedulingInfo* for the SIB received from the serving cell are identical to the *PLMN-Identity*, the *systemInformationAreaID* and the *valueTag* associated with the stored version of that SIB:
  - 4> consider the stored SIB as valid for the cell;
- 2> if the *areaScope* is not present for the stored version of the SIB and the *areaScope* value is not included in the *si-SchedulingInfo* for that SIB from the serving cell:
  - 3> if the UE is NPN capable and the cell is an NPN-only cell and the first NPN identity in the *NPN-IdentityInfoList*, the *cellIdentity* and *valueTag* that are included in the *si-SchedulingInfo* for the SIB received from the serving cell are identical to the NPN identity, the *cellIdentity* and the *valueTag* associated with the stored version of that SIB:
    - 4> consider the stored SIB as valid for the cell;
  - 3> else if the first *PLMN-Identity* in the *PLMN-IdentityInfoList*, the *cellIdentity* and *valueTag* that are included in the *si-SchedulingInfo* for the SIB received from the serving cell are identical to the *PLMN-Identity*, the *cellIdentity* and the *valueTag* associated with the stored version of that SIB:
    - 4> consider the stored SIB as valid for the cell;

#### 5.2.2.2.2 SI change indication and PWS notification

A modification period is used, i.e. updated SI message (other than SI message for ETWS, CMAS and positioning assistance data) is broadcasted in the modification period following the one where SI change indication is transmitted. The modification period boundaries are defined by SFN values for which  $\text{SFN mod } m = 0$ , where  $m$  is the number of radio frames comprising the modification period. The modification period is configured by system information. The UE receives indications about SI modifications and/or PWS notifications using Short Message transmitted with P-RNTI over DCI (see clause 6.5). Repetitions of SI change indication may occur within preceding modification period. SI change indication is not applicable for SI messages containing posSIBs.

UEs in RRC\_IDLE or in RRC\_INACTIVE shall monitor for SI change indication in its own paging occasion every DRX cycle. UEs in RRC\_CONNECTED shall monitor for SI change indication in any paging occasion at least once per modification period if the UE is provided with common search space on the active BWP to monitor paging, as specified in TS 38.213 [13], clause 13.

ETWS or CMAS capable UEs in RRC\_IDLE or in RRC\_INACTIVE shall monitor for indications about PWS notification in its own paging occasion every DRX cycle. ETWS or CMAS capable UEs in RRC\_CONNECTED shall monitor for indication about PWS notification in any paging occasion at least once every *defaultPagingCycle* if the UE is provided with common search space on the active BWP to monitor paging.

For Short Message reception in a paging occasion, the UE monitors the PDCCH monitoring occasion(s) for paging as specified in TS 38.304 [20] and TS 38.213 [13].

If the UE receives a Short Message, the UE shall:

- 1> if the UE is ETWS capable or CMAS capable, the *etwsAndCmasIndication* bit of Short Message is set, and the UE is provided with *searchSpaceOtherSystemInformation* on the active BWP or the initial BWP:
  - 2> immediately re-acquire the *SIB1*;
  - 2> if the UE is ETWS capable and *si-SchedulingInfo* includes scheduling information for *SIB6*:
    - 3> acquire *SIB6*, as specified in sub-clause 5.2.2.3.2, immediately;
  - 2> if the UE is ETWS capable and *si-SchedulingInfo* includes scheduling information for *SIB7*:
    - 3> acquire *SIB7*, as specified in sub-clause 5.2.2.3.2, immediately;

2> if the UE is CMAS capable and *si-SchedulingInfo* includes scheduling information for *SIB8*:

3> acquire *SIB8*, as specified in sub-clause 5.2.2.3.2, immediately;

NOTE: In case *SIB6*, *SIB7*, or *SIB8* overlap with a measurement gap it is left to UE implementation how to immediately acquire *SIB6*, *SIB7*, or *SIB8*.

1> if the *systemInfoModification* bit of Short Message is set:

2> apply the SI acquisition procedure as defined in sub-clause 5.2.2.3 from the start of the next modification period.

### 5.2.2.3 Acquisition of System Information

#### 5.2.2.3.1 Acquisition of *MIB* and *SIB1*

The UE shall:

1> apply the specified BCCH configuration defined in 9.1.1.1;

1> if the UE is in RRC\_IDLE or in RRC\_INACTIVE; or

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

2> acquire the *MIB*, which is scheduled as specified in TS 38.213 [13];

2> if the UE is unable to acquire the *MIB*;

3> perform the actions as specified in clause 5.2.2.5;

2> else:

3> perform the actions specified in clause 5.2.2.4.1.

1> if the UE is in RRC\_CONNECTED with an active BWP with common search space configured by *searchSpaceSIB1* and *pagingSearchSpace* and has received an indication about change of system information; or

1> if the UE is in RRC\_CONNECTED with an active BWP with common search space configured by *searchSpaceSIB1* and *pagingSearchSpace* and the UE has not stored a valid version of a SIB, in accordance with sub-clause 5.2.2.2.1, of one or several required SIB(s), in accordance with sub-clause 5.2.2.1, and, UE has not acquired SIB1 in current modification period or if requested by upper layers; or

1> if the UE is in RRC\_IDLE or in RRC\_INACTIVE; or

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

2> if *ssb-SubcarrierOffset* indicates *SIB1* is transmitted in the cell (TS 38.213 [13]) and if *SIB1* acquisition is required for the UE:

3> acquire the *SIB1*, which is scheduled as specified in TS 38.213 [13];

3> if the UE is unable to acquire the *SIB1*:

4> perform the actions as specified in clause 5.2.2.5;

3> else:

4> upon acquiring *SIB1*, perform the actions specified in clause 5.2.2.4.2.

2> else if *SIB1* acquisition is required for the UE and *ssb-SubcarrierOffset* indicates that *SIB1* is not scheduled in the cell:

3> perform the actions as specified in clause 5.2.2.5.

NOTE: The UE in RRC\_CONNECTED is only required to acquire broadcasted *SIB1* if the UE can acquire it without disrupting unicast data reception, i.e. the broadcast and unicast beams are quasi co-located.

### 5.2.2.3.2 Acquisition of an SI message

For SI message acquisition PDCCH monitoring occasion(s) are determined according to *searchSpaceOtherSystemInformation*. If *searchSpaceOtherSystemInformation* is set to zero, PDCCH monitoring occasions for SI message reception in SI-window are same as PDCCH monitoring occasions for *SIB1* where the mapping between PDCCH monitoring occasions and SSBs is specified in TS 38.213[13]. If *searchSpaceOtherSystemInformation* is not set to zero, PDCCH monitoring occasions for SI message are determined based on search space indicated by *searchSpaceOtherSystemInformation*. PDCCH monitoring occasions for SI message which are not overlapping with UL symbols (determined according to *tdd-UL-DL-ConfigurationCommon*) are sequentially numbered from one in the SI window. The  $[x \times N + K]^{\text{th}}$  PDCCH monitoring occasion (s) for SI message in SI-window corresponds to the  $K^{\text{th}}$  transmitted SSB, where  $x = 0, 1, \dots, X-1$ ,  $K = 1, 2, \dots, N$ ,  $N$  is the number of actual transmitted SSBs determined according to *ssb-PositionsInBurst* in *SIB1* and  $X$  is equal to  $\text{CEIL}(\text{number of PDCCH monitoring occasions in SI-window}/N)$ . The actual transmitted SSBs are sequentially numbered from one in ascending order of their SSB indexes. The UE assumes that, in the SI window, PDCCH for an SI message is transmitted in at least one PDCCH monitoring occasion corresponding to each transmitted SSB and thus the selection of SSB for the reception SI messages is up to UE implementation.

When acquiring an SI message, the UE shall:

- 1> determine the start of the SI-window for the concerned SI message as follows:
  - 2> if the concerned SI message is configured in the *schedulingInfoList*:
    - 3> for the concerned SI message, determine the number  $n$  which corresponds to the order of entry in the list of SI messages configured by *schedulingInfoList* in *si-SchedulingInfo* in *SIB1*;
    - 3> determine the integer value  $x = (n - 1) \times w$ , where  $w$  is the *si-WindowLength*;
    - 3> the SI-window starts at the slot  $\#a$ , where  $a = x \bmod N$ , in the radio frame for which  $\text{SFN} \bmod T = \text{FLOOR}(x/N)$ , where  $T$  is the *si-Periodicity* of the concerned SI message and  $N$  is the number of slots in a radio frame as specified in TS 38.213 [13];
  - 2> else if the concerned SI message is configured in the *pos-SchedulingInfoList* and *offsetToSI-Used* is not configured:
    - 3> create a concatenated list of SI messages by appending the *pos-SchedulingInfoList* in *posSI-SchedulingInfo* in *SIB1* to *schedulingInfoList* in *si-SchedulingInfo* in *SIB1*
    - 3> for the concerned SI message, determine the number  $n$  which corresponds to the order of entry in the concatenated list;
    - 3> determine the integer value  $x = (n - 1) \times w$ , where  $w$  is the *si-WindowLength*;
    - 3> the SI-window starts at the slot  $\#a$ , where  $a = x \bmod N$ , in the radio frame for which  $\text{SFN} \bmod T = \text{FLOOR}(x/N)$ , where  $T$  is the *posSI-Periodicity* of the concerned SI message and  $N$  is the number of slots in a radio frame as specified in TS 38.213 [13];
  - 2> else if the concerned SI message is configured by the *pos-SchedulingInfoList* and *offsetToSI-Used* is configured:
    - 3> determine the number  $m$  which corresponds to the number of SI messages with an associated *si-Periodicity* of 8 radio frames (80 ms), configured by *schedulingInfoList* in *SIB1*;
    - 3> for the concerned SI message, determine the number  $n$  which corresponds to the order of entry in the list of SI messages configured by *pos-SchedulingInfoList* in *SIB1*;
    - 3> determine the integer value  $x = m \times w + (n - 1) \times w$ , where  $w$  is the *si-WindowLength*
    - 3> the SI-window starts at the slot  $\#a$ , where  $a = x \bmod N$ , in the radio frame for which  $\text{SFN} \bmod T = \text{FLOOR}(x/N)$ , where  $T$  is the *posSI-Periodicity* of the concerned SI message and  $N$  is the number of slots in a radio frame as specified in TS 38.213 [13];
- 1> receive the PDCCH containing the scheduling RNTI, i.e. SI-RNTI in the PDCCH monitoring occasion(s) for SI message acquisition, from the start of the SI-window and continue until the end of the SI-window whose absolute length in time is given by *si-WindowLength*, or until the SI message was received;

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

NOTE 1: The UE is only required to acquire broadcasted SI message if the UE can acquire it without disrupting unicast data reception, i.e. the broadcast and unicast beams are quasi co-located.

NOTE 2: The UE is not required to monitor PDCCH monitoring occasion(s) corresponding to each transmitted SSB in SI-window.

NOTE 3: If the concerned SI message was not received in the current modification period, handling of SI message acquisition is left to UE implementation.

NOTE 4: A UE in RRC\_CONNECTED may stop the PDCCH monitoring during the SI window for the concerned SI message when the requested SIB(s) are acquired.

1> perform the actions for the acquired SI message as specified in sub-clause 5.2.2.4.

### 5.2.2.3.3 Request for on demand system information

The UE shall:

- 1> if *SIB1* includes *si-SchedulingInfo* containing *si-RequestConfigSUL* and criteria to select supplementary uplink as defined in TS 38.321[13], clause 5.1.1 is met:
  - 2> trigger the lower layer to initiate the Random Access procedure on supplementary uplink in accordance with [3] using the PRACH preamble(s) and PRACH resource(s) in *si-RequestConfigSUL* corresponding to the SI message(s) that the UE requires to operate within the cell, and for which *si-BroadcastStatus* is set to *notBroadcasting*;
  - 2> if acknowledgement for SI request is received from lower layers:
    - 3> acquire the requested SI message(s) as defined in sub-clause 5.2.2.3.2, immediately;
- 1> else if *SIB1* includes *si-SchedulingInfo* containing *si-RequestConfig* and criteria to select normal uplink as defined in TS 38.321[13], clause 5.1.1 is met:
  - 2> trigger the lower layer to initiate the random access procedure on normal uplink in accordance with TS 38.321 [3] using the PRACH preamble(s) and PRACH resource(s) in *si-RequestConfig* corresponding to the SI message(s) that the UE requires to operate within the cell, and for which *si-BroadcastStatus* is set to *notBroadcasting*;
  - 2> if acknowledgement for SI request is received from lower layers:
    - 3> acquire the requested SI message(s) as defined in sub-clause 5.2.2.3.2, immediately;
- 1> else:
  - 2> apply the default L1 parameter values as specified in corresponding physical layer specifications except for the parameters for which values are provided in *SIB1*;
  - 2> apply the default MAC Cell Group configuration as specified in 9.2.2;
  - 2> apply the *timeAlignmentTimerCommon* included in *SIB1*;
  - 2> apply the CCCH configuration as specified in 9.1.1.2;
  - 2> initiate transmission of the *RRCSystemInfoRequest* message in accordance with 5.2.2.3.4;
  - 2> if acknowledgement for *RRCSystemInfoRequest* message is received from lower layers:
    - 3> acquire the requested SI message(s) as defined in sub-clause 5.2.2.3.2, immediately;
- 1> if cell reselection occurs while waiting for the acknowledgment for SI request from lower layers:
  - 2> reset MAC;
  - 2> if SI request is based on *RRCSystemInfoRequest* message:

3> release RLC entity for SRB0.

NOTE: After RACH failure for SI request it is up to UE implementation when to retry the SI request.

#### 5.2.2.3.3a Request for on demand positioning system information

The UE shall:

- 1> if *SIB1* includes *posSI-SchedulingInfo* containing *posSI-RequestConfigSUL* and criteria to select supplementary uplink as defined in TS 38.321[13], clause 5.1.1 is met:
  - 2> trigger the lower layer to initiate the Random Access procedure on supplementary uplink in accordance with [3] using the PRACH preamble(s) and PRACH resource(s) in *posSI-RequestConfigSUL* corresponding to the SI message(s) that the UE requires to operate within the cell, and for which *posSI-BroadcastStatus* is set to *notBroadcasting*;
  - 2> if acknowledgement for SI request is received from lower layers:
    - 3> acquire the requested SI message(s) as defined in sub-clause 5.2.2.3.2, immediately;
- 1> else if *SIB1* includes *posSI-SchedulingInfo* containing *posSI-RequestConfig* and criteria to select normal uplink as defined in TS 38.321[13], clause 5.1.1 is met:
  - 2> trigger the lower layer to initiate the random access procedure on normal uplink in accordance with TS 38.321 [3] using the PRACH preamble(s) and PRACH resource(s) in *posSI-RequestConfig* corresponding to the SI message(s) that the UE upper layers require for positioning operations , and for which *posSI-BroadcastStatus* is set to *notBroadcasting*;
  - 2> if acknowledgement for SI request is received from lower layers:
    - 3> acquire the requested SI message(s) as defined in sub-clause 5.2.2.3.2, immediately;
- 1> else:
  - 2> apply the default L1 parameter values as specified in corresponding physical layer specifications except for the parameters for which values are provided in *SIB1*;
  - 2> apply the default MAC Cell Group configuration as specified in 9.2.2;
  - 2> apply the *timeAlignmentTimerCommon* included in *SIB1*;
  - 2> apply the CCCH configuration as specified in 9.1.1.2;
  - 2> initiate transmission of the *RRCSystemInfoRequest* message with *rrcPosSystemInfoRequest* in accordance with 5.2.2.3.4;
  - 2> if acknowledgement for *RRCSystemInfoRequest* message with *rrcPosSystemInfoRequest* is received from lower layers:
    - 3> acquire the requested SI message(s) as defined in sub-clause 5.2.2.3.2, immediately;
- 1> if cell reselection occurs while waiting for the acknowledgment for SI request from lower layers:
  - 2> reset MAC;
  - 2> if SI request is based on *RRCSystemInfoRequest* message with *rrcPosSystemInfoRequest*:
    - 3> release RLC entity for SRB0.

NOTE: After RACH failure for SI request it is up to UE implementation when to retry the SI request.

#### 5.2.2.3.4 Actions related to transmission of *RRCSystemInfoRequest* message

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

- 1> if the procedure is triggered to request the required SI message(s) other than positioning:



- 2> set the *requested-SI-List* to indicate the SI message(s) that the UE requires to operate within the cell, and for which *si-BroadcastStatus* is set to *notBroadcasting*;
- 1> else if the procedure is triggered to request the required SI message(s) for positioning:
  - 2> set the *requestedPosSI-List* to indicate the SI message(s) that the UE upper layers require for positioning operations, and for which *posSI-BroadcastStatus* is set to *notBroadcasting*.

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

#### 5.2.2.3.5 Acquisition of SIB(s) or posSIB(s) in RRC\_CONNECTED

The UE shall:

- 1> if the UE is in RRC\_CONNECTED with an active BWP not configured with common search space with the field *searchSpaceOtherSystemInformation* and the UE has not stored a valid version of a SIB, in accordance with sub-clause 5.2.2.2.1, of one or several required SIB(s), in accordance with sub-clause 5.2.2.1 or if requested by upper layers:
  - 2> for the SI message(s) that, according to the *si-SchedulingInfo* or *posSI-SchedulingInfo* in the stored SIB1, contain at least one required SIB or requested posSIB:
    - 3> if *onDemandSIB-Request* is configured and timer T350 is not running:
      - 4> initiate transmission of the *DedicatedSIBRequest* message in accordance with 5.2.2.3.6;
      - 4> start timer T350 with the timer value set to the *onDemandSIB-RequestProhibitTimer*;
  - 1> else if the UE is in RRC\_CONNECTED with an active BWP configured with common search space with the field *searchSpaceOtherSystemInformation* and the UE has not stored a valid version of a SIB, in accordance with sub-clause 5.2.2.2.1, of one or several required SIB(s), in accordance with sub-clause 5.2.2.1 or if requested by upper layers:
    - 2> for the SI message(s) that, according to the *si-SchedulingInfo* in the stored SIB1, contain at least one required SIB and for which *si-BroadcastStatus* is set to *broadcasting*:
      - 3> acquire the SI message(s) as defined in sub-clause 5.2.2.3.2;
    - 2> for the SI message(s) that, according to the *si-SchedulingInfo* in the stored SIB1, contain at least one required SIB and for which *si-BroadcastStatus* is set to *notBroadcasting*:
      - 3> if *onDemandSIB-Request* is configured and timer T350 is not running:
        - 4> initiate transmission of the *DedicatedSIBRequest* message in accordance with 5.2.2.3.6;
        - 4> start timer T350 with the timer value set to the *onDemandSIB-RequestProhibitTimer*;
        - 4> acquire the requested SI message(s) corresponding to the requested SIB(s) as defined in sub-clause 5.2.2.3.2.
    - 2> for the SI message(s) that, according to the *posSI-SchedulingInfo* in the stored SIB1, contain at least one requested posSIB and for which *posSI-BroadcastStatus* is set to *broadcasting*:
      - 3> acquire the SI message(s) as defined in sub-clause 5.2.2.3.2;
    - 2> for the SI message(s) that, according to the *posSI-SchedulingInfo* in the stored SIB1, contain at least one requested posSIB and for which *posSI-BroadcastStatus* is set to *notBroadcasting*:
      - 3> if *onDemandSIB-Request* is configured and timer T350 is not running:
        - 4> initiate transmission of the *DedicatedSIBRequest* message in accordance with 5.2.2.3.6;
        - 4> start timer T350 with the timer value set to the *onDemandSIB-RequestProhibitTimer*;
        - 4> acquire the requested SI message(s) corresponding to the requested posSIB(s) as defined in sub-clause 5.2.2.3.2.

NOTE: UE may include on demand request for SIB and/or posSIB(s) in the same *DedicatedSIBRequest* message.

#### 5.2.2.3.6 Actions related to transmission of *DedicatedSIBRequest* message

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

- 1> if the procedure is triggered to request the required SIB(s):
  - 2> include *requestedSIB-List* in the *onDemandSIB-RequestList* to indicate the requested SIB(s);
- 1> if the procedure is triggered to request the required posSIB(s):
  - 2> include *requestedPosSIB-List* in the *onDemandSIB-RequestList* to indicate the requested posSIB(s).

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

#### 5.2.2.4 Actions upon receipt of System Information

##### 5.2.2.4.1 Actions upon reception of the *MIB*

Upon receiving the *MIB* the UE shall:

- 1> store the acquired *MIB*;
- 1> if the UE is in RRC\_IDLE or in RRC\_INACTIVE, or if the UE is in RRC\_CONNECTED while *T311* is running:
  - 2> if the *cellBarred* in the acquired *MIB* is set to *barred*:
    - 3> consider the cell as barred in accordance with TS 38.304 [20];
    - 3> if *intraFreqReselection* is set to *notAllowed*; and
    - 3> if the cell operates in licensed spectrum or the cell belongs to a PLMN which is indicated as being equivalent to the registered PLMN or the cell belongs to the registered SNPN of the UE:
      - 4> consider cell re-selection to other cells on the same frequency as the barred cell as not allowed, as specified in TS 38.304 [20].
  - 3> else:
    - 4> consider cell re-selection to other cells on the same frequency as the barred cell as allowed, as specified in TS 38.304 [20].
- 2> else:
  - 3> apply the received *systemFrameNumber*, *pdccch-ConfigSIB1*, *subCarrierSpacingCommon*, *ssb-SubcarrierOffset* and *dmrs-TypeA-Position*.

##### 5.2.2.4.2 Actions upon reception of the *SIB1*

Upon receiving the *SIB1* the UE shall:

- 1> store the acquired *SIB1*;
- 1> if the *cellAccessRelatedInfo* 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 *PLMN-IdentityInfo* containing the selected PLMN;
- 1> if the *cellAccessRelatedInfo* contains an entry of *npn-IdentityInfoList* with the NPN identity of the selected PLMN or SNPN:
  - 2> in the remainder of the procedures use *npn-IdentityList*, *trackingAreaCode*, and *cellIdentity* for the cell as received in the corresponding entry of *npn-IdentityInfoList* containing the selected PLMN or SNPN;

- 1> if in RRC\_CONNECTED while T311 is not running:
  - 2> disregard the *frequencyBandList*, if received, while in RRC\_CONNECTED;
  - 2> forward the *cellIdentity* to upper layers;
  - 2> forward the *trackingAreaCode* to upper layers;
  - 2> forward the received *posSIB-MappingInfo* to upper layers, if included;
  - 2> apply the configuration included in the *servingCellConfigCommon*;
  - 2> if the UE has a stored valid version of a SIB or posSIB, in accordance with sub-clause 5.2.2.2.1, that the UE requires to operate within the cell in accordance with sub-clause 5.2.2.1:
    - 3> use the stored version of the required SIB or posSIB;
  - 2> else:
    - 3> acquire the required SIB or posSIB requested by upper layer as defined in sub-clause 5.2.2.3.5;

NOTE: Void.

- 1> else:
  - 2> if the UE supports one or more of the frequency bands indicated in the *frequencyBandList* for downlink for TDD, or one or more of the frequency bands indicated in the *frequencyBandList* for uplink for FDD, and they are not downlink only bands, and
  - 2> if the UE supports at least one *additionalSpectrumEmission* in the *NR-NS-PmaxList* for a supported band in the downlink for TDD, or a supported band in uplink for FDD, and
  - 2> if the UE supports an uplink channel bandwidth with a maximum transmission bandwidth configuration (see TS 38.101-1 [15] and TS 38.101-2 [39]) which
    - is smaller than or equal to the *carrierBandwidth* (indicated in *uplinkConfigCommon* for the SCS of the initial uplink BWP), and which
    - is wider than or equal to the bandwidth of the initial uplink BWP, and
  - 2> if the UE supports a downlink channel bandwidth with a maximum transmission bandwidth configuration (see TS 38.101-1 [15] and TS 38.101-2 [39]) which
    - is smaller than or equal to the *carrierBandwidth* (indicated in *downlinkConfigCommon* for the SCS of the initial downlink BWP), and which
    - is wider than or equal to the bandwidth of the initial downlink BWP:
  - 3> if *trackingAreaCode* is not provided for the selected PLMN nor the registered PLMN nor PLMN of the equivalent PLMN list:
    - 4> consider the cell as barred in accordance with TS 38.304 [20];
    - 4> if *intraFreqReselection* is set to notAllowed:
      - 5> consider cell re-selection to other cells on the same frequency as the barred cell as not allowed, as specified in TS 38.304 [20];
    - 4> else:
      - 5> consider cell re-selection to other cells on the same frequency as the barred cell as allowed, as specified in TS 38.304 [20];
  - 3> else if UE is IAB-MT and if *iab-Support* is not provided for the selected PLMN nor the registered PLMN nor PLMN of the equivalent PLMN list nor the selected SNPN nor the registered SNPN:
    - 4> consider the cell as barred for IAB-MT in accordance with TS 38.304 [20];
  - 3> else:
    - 4> apply a supported uplink channel bandwidth with a maximum transmission bandwidth which

- is contained within the *carrierBandwidth* indicated in *uplinkConfigCommon* for the SCS of the initial uplink BWP, and which
  - is wider than or equal to the bandwidth of the initial BWP for the uplink;
- 4> apply a supported downlink channel bandwidth with a maximum transmission bandwidth which
- is contained within the *carrierBandwidth* indicated in *downlinkConfigCommon* for the SCS of the initial downlink BWP, and which
  - is wider than or equal to the bandwidth of the initial BWP for the downlink;
- 4> select the first frequency band in the *frequencyBandList*, for FDD from *frequencyBandList* for uplink, or for TDD from *frequencyBandList* for downlink, which the UE supports and for which the UE supports at least one of the *additionalSpectrumEmission* values in *nr-NS-PmaxList*, if present;
- 4> forward the *cellIdentity* to upper layers;
- 4> forward the *trackingAreaCode* to upper layers;
- 4> forward the received *posSIB-MappingInfo* to upper layers, if included;
- 4> forward the PLMN identity or SNPN identity or PNI-NPN identity to upper layers;
- 4> if in RRC\_INACTIVE and the forwarded information does not trigger message transmission by upper layers:
- 5> if the serving cell does not belong to the configured *ran-NotificationAreaInfo*:
    - 6> initiate an RNA update as specified in 5.3.13.8;
- 4> forward the *ims-EmergencySupport* to upper layers, if present;
- 4> forward the *eCallOverIMS-Support* to upper layers, if present;
- 4> forward the *uac-AccessCategory1-SelectionAssistanceInfo* to upper layers, if present;
- 4> apply the configuration included in the *servingCellConfigCommon*;
- 4> apply the specified PCCH configuration defined in 9.1.1.3;
- 4> if the UE has a stored valid version of a SIB, in accordance with sub-clause 5.2.2.2.1, that the UE requires to operate within the cell in accordance with sub-clause 5.2.2.1:
- 5> use the stored version of the required SIB;
- 4> if the UE has not stored a valid version of a SIB, in accordance with sub-clause 5.2.2.2.1, of one or several required SIB(s), in accordance with sub-clause 5.2.2.1:
- 5> for the SI message(s) that, according to the *si-SchedulingInfo*, contain at least one required SIB and for which *si-BroadcastStatus* is set to *broadcasting*:
    - 6> acquire the SI message(s) as defined in sub-clause 5.2.2.3.2;
  - 5> for the SI message(s) that, according to the *si-SchedulingInfo*, contain at least one required SIB and for which *si-BroadcastStatus* is set to *notBroadcasting*:
    - 6> trigger a request to acquire the SI message(s) as defined in sub-clause 5.2.2.3.3;
- 4> if the UE has received request from upper layers:
- 5> for the SI message(s) that, according to the *posSI-SchedulingInfo*, contain at least one requested posSIB and for which *posSI-BroadcastStatus* is set to *broadcasting*:
    - 6> acquire the SI message(s) as defined in sub-clause 5.2.2.3.2;
  - 5> for the SI message(s) that, according to the *posSI-SchedulingInfo*, contain at least one requested posSIB for which *posSI-BroadcastStatus* is set to *notBroadcasting*:

- 6> trigger a request to acquire the SI message(s) as defined in sub-clause 5.2.2.3.3a;
  - 4> apply the first listed *additionalSpectrumEmission* which it supports among the values included in *NR-NS-PmaxList* within *frequencyBandList* in *uplinkConfigCommon* for FDD or in *downlinkConfigCommon* for TDD;
  - 4> if the *additionalPmax* is present in the same entry of the selected *additionalSpectrumEmission* within *NR-NS-PmaxList*:
    - 5> apply the *additionalPmax* for UL;
  - 4> else:
    - 5> apply the *p-Max* in *uplinkConfigCommon* for UL;
  - 4> if *supplementaryUplink* is present in *servingCellConfigCommon*; and
  - 4> if the UE supports one or more of the frequency bands indicated in the *frequencyBandList* of *supplementaryUplink*; and
  - 4> if the UE supports at least one *additionalSpectrumEmission* in the *NR-NS-PmaxList* for a supported *supplementaryUplink* band; and
  - 4> if the UE supports an uplink channel bandwidth with a maximum transmission bandwidth configuration (see TS 38.101-1 [15] and TS 38.101-2 [39]) which
    - is smaller than or equal to the *carrierBandwidth* (indicated in *supplementaryUplink* for the SCS of the initial uplink BWP), and which
    - is wider than or equal to the bandwidth of the initial uplink BWP of the SUL;
  - 5> consider *supplementaryUplink* as configured in the serving cell;
  - 5> select the first frequency band in the *frequencyBandList* of *supplementaryUplink* which the UE supports and for which the UE supports at least one of the *additionalSpectrumEmission* values in *nr-NS-PmaxList*, if present;
  - 5> apply a supported *supplementaryUplink* channel bandwidth with a maximum transmission bandwidth which
    - is contained within the *carrierBandwidth* (indicated in *supplementaryUplink* for the SCS of the initial uplink BWP), and which
    - is wider than or equal to the bandwidth of the initial BWP of the SUL;
  - 5> apply the first listed *additionalSpectrumEmission* which it supports among the values included in *NR-NS-PmaxList* within *frequencyBandList* for the *supplementaryUplink*;
  - 5> if the *additionalPmax* is present in the same entry of the selected *additionalSpectrumEmission* within *NR-NS-PmaxList* for the *supplementaryUplink*:
    - 6> apply the *additionalPmax* in *supplementaryUplink* for SUL;
  - 5> else:
    - 6> apply the *p-Max* in *supplementaryUplink* for SUL;
- 2> else:
- 3> consider the cell as barred in accordance with TS 38.304 [20]; and
  - 3> perform barring as if *intraFreqReselection* is set to *notAllowed*;

#### 5.2.2.4.3 Actions upon reception of *SIB2*

Upon receiving *SIB2*, the UE shall:

- 1> if in RRC\_IDLE or in RRC\_INACTIVE or in RRC\_CONNECTED while T311 is running:
  - 2> if, for the entry in *frequencyBandList* with the same index as the frequency band selected in clause 5.2.2.4.2, the UE supports at least one *additionalSpectrumEmission* in the *NR-NS-PmaxList* within the *frequencyBandList*:
    - 3> apply the first listed *additionalSpectrumEmission* which it supports among the values included in *NR-NS-PmaxList* within *frequencyBandList*;
    - 3> if the *additionalPmax* is present in the same entry of the selected *additionalSpectrumEmission* within *NR-NS-PmaxList*:
      - 4> apply the *additionalPmax*;
    - 3> else:
      - 4> apply the *p-Max*;
    - 3> if the UE selects a frequency band (from the procedure in clause 5.2.2.4.2) for the supplementary uplink:
      - 4> if, for the entry in *frequencyBandListSUL* with the same index as the frequency band selected in clause 5.2.2.4.2, the UE supports at least one *additionalSpectrumEmission* in the *NR-NS-PmaxList* within the *frequencyBandListSUL*:
        - 5> apply the first listed *additionalSpectrumEmission* which it supports among the values included in *NR-NS-PmaxList* within *frequencyBandListSUL*;
        - 5> if the *additionalPmax* is present in the same entry of the selected *additionalSpectrumEmission* within *NR-NS-PmaxList*:
          - 6> apply the *additionalPmax*;
        - 5> else:
          - 6> apply the *p-Max*;
      - 4> else:
        - 5> apply the *p-Max*.
  - 2> else:
    - 3> apply the *p-Max*;

#### 5.2.2.4.4 Actions upon reception of *SIB3*

No UE requirements related to the contents of this *SIB3* apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/ or within the corresponding field descriptions.

#### 5.2.2.4.5 Actions upon reception of *SIB4*

Upon receiving *SIB4* the UE shall:

- 1> if in RRC\_IDLE, or in RRC\_INACTIVE or in RRC\_CONNECTED while T311 is running:
  - 2> for each entry in the *interFreqCarrierFreqList*:
    - 3> select the first frequency band in the *frequencyBandList*, and *frequencyBandListSUL*, if present, which the UE supports and for which the UE supports at least one of the *additionalSpectrumEmission* values in *NR-NS-PmaxList*, if present:
    - 3> if, the frequency band selected by the UE in *frequencyBandList* to represent a non-serving NR carrier frequency is not a downlink only band:
      - 4> if, for the selected frequency band, the UE supports at least one *additionalSpectrumEmission* in the *NR-NS-PmaxList* within the *frequencyBandList*:

- 5> apply the first listed *additionalSpectrumEmission* which it supports among the values included in *NR-NS-PmaxList* within *frequencyBandList*;
- 5> if the *additionalPmax* is present in the same entry of the selected *additionalSpectrumEmission* within *NR-NS-PmaxList*:
  - 6> apply the *additionalPmax*;
- 5> else:
  - 6> apply the *p-Max*;
- 5> if *frequencyBandListSUL* is present in *SIB4* and, for the frequency band selected in *frequencyBandListSUL*, the UE supports at least one *additionalSpectrumEmission* in the *NR-NS-PmaxList* within *FrequencyBandListSUL*:
  - 6> apply the first listed *additionalSpectrumEmission* which it supports among the values included in *NR-NS-PmaxList* within *frequencyBandListSUL*;
  - 6> if the *additionalPmax* is present in the same entry of the selected *additionalSpectrumEmission* within *NR-NS-PmaxList*:
    - 7> apply the *additionalPmax*;
  - 6> else:
    - 7> apply the *p-Max*;
- 5> else:
  - 6> apply the *p-Max*;
- 4> else:
  - 5> apply the *p-Max*;
- 1> if in *RRC\_IDLE* or *RRC\_INACTIVE*, and T331 is running:
  - 2> perform the actions as specified in 5.7.8.1a;

#### 5.2.2.4.6 Actions upon reception of *SIB5*

No UE requirements related to the contents of this *SIB5* apply other than those specified elsewhere e.g. within procedures using the concerned system information, and/ or within the corresponding field descriptions.

#### 5.2.2.4.7 Actions upon reception of *SIB6*

Upon receiving the *SIB6* the UE shall:

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

#### 5.2.2.4.8 Actions upon reception of *SIB7*

Upon receiving the *SIB7* the UE shall:

- 1> if there is no current value for *messageIdentifier* and *serialNumber* for *SIB7*; or
- 1> if either the received value of *messageIdentifier* or of *serialNumber*, or of both *messageIdentifier* and *serialNumber* are different from the current values of *messageIdentifier* and *serialNumber* for *SIB7*:
  - 2> use the received values of *messageIdentifier* and *serialNumber* for *SIB7* as the current values of *messageIdentifier* and *serialNumber* for *SIB7*;
  - 2> discard any previously buffered *warningMessageSegment*;
- 2> if all segments of a warning message have been received:

- 3> assemble the warning message from the received *warningMessageSegment(s)*;
- 3> forward the received warning message, *messageIdentifier*, *serialNumber* and *dataCodingScheme* to upper layers;
- 3> stop reception of *SIB7*;
- 3> discard the current values of *messageIdentifier* and *serialNumber* for *SIB7*;
- 2> else:
  - 3> store the received *warningMessageSegment*;
  - 3> continue reception of *SIB7*;
- 1> else if all segments of a warning message have been received:
  - 2> assemble the warning message from the received *warningMessageSegment(s)*;
  - 2> forward the received complete warning message, *messageIdentifier*, *serialNumber* and *dataCodingScheme* to upper layers;
  - 2> stop reception of *SIB7*;
  - 2> discard the current values of *messageIdentifier* and *serialNumber* for *SIB7*;
- 1> else:
  - 2> store the received *warningMessageSegment*;
  - 2> continue reception of *SIB7*;

The UE should discard any stored *warningMessageSegment* and the current value of *messageIdentifier* and *serialNumber* for *SIB7* if the complete warning message has not been assembled within a period of 3 hours.

#### 5.2.2.4.9 Actions upon reception of *SIB8*

Upon receiving the *SIB8* the UE shall:

- 1> if the *SIB8* contains a complete warning message and the complete geographical area coordinates (if any):
  - 2> forward the received warning message, *messageIdentifier*, *serialNumber*, *dataCodingScheme* and the geographical area coordinates (if any) to upper layers;
  - 2> continue reception of *SIB8*;
- 1> else:
  - 2> if the received values of *messageIdentifier* and *serialNumber* are the same (each value is the same) as a pair for which a warning message and the geographical area coordinates (if any) are currently being assembled:
    - 3> store the received *warningMessageSegment*;
    - 3> store the received *warningAreaCoordinatesSegment* (if any);
  - 3> if all segments of a warning message and geographical area coordinates (if any) have been received:
    - 4> assemble the warning message from the received *warningMessageSegment*;
    - 4> assemble the geographical area coordinates from the received *warningAreaCoordinatesSegment* (if any);
    - 4> forward the received warning message, *messageIdentifier*, *serialNumber*, *dataCodingScheme* and geographical area coordinates (if any) to upper layers;
    - 4> stop assembling a warning message and geographical area coordinates (if any) for this *messageIdentifier* and *serialNumber* and delete all stored information held for it;



- 3> continue reception of *SIB8*;
- 2> else if the received values of *messageIdentifier* and/or *serialNumber* are not the same as any of the pairs for which a warning message is currently being assembled:
  - 3> start assembling a warning message for this *messageIdentifier* and *serialNumber* pair;
  - 3> start assembling the geographical area coordinates (if any) for this *messageIdentifier* and *serialNumber* pair;
  - 3> store the received *warningMessageSegment*;
  - 3> store the received *warningAreaCoordinatesSegment* (if any);
  - 3> continue reception of *SIB8*;

The UE should discard *warningMessageSegment* and *warningAreaCoordinatesSegment* (if any) and the associated values of *messageIdentifier* and *serialNumber* for *SIB8* if the complete warning message and the geographical area coordinates (if any) have not been assembled within a period of 3 hours.

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

#### 5.2.2.4.10 Actions upon reception of *SIB9*

Upon receiving *SIB9* with *referenceTimeInfo*, the UE may perform the related actions as specified in subclause 5.7.1.3.

#### 5.2.2.4.11 Actions upon reception of *SIB10*

Upon receiving *SIB10*, the UE shall:

- 1> Forward the *HRNN-list* entries with the corresponding PNI-NPN and SNPN identities to upper layers;

#### 5.2.2.4.12 Actions upon reception of *SIB11*

Upon receiving *SIB11*, the UE shall:

- 1> if in *RRC\_IDLE* or *RRC\_INACTIVE*, and *T331* is running:
  - 2> perform the actions as specified in 5.7.8.1a;

#### 5.2.2.4.13 Actions upon reception of *SIB12*

Upon receiving *SIB12*, the UE shall:

- 1> if the UE has stored at least one segment of *SIB12* and the value tag of *SIB12* has changed since a previous segment was stored:
  - 2> discard all stored segments;
- 1> store the segment;
- 1> if all segments have been received:
  - 2> assemble *SIB12-IEs* from the received segments;
  - 2> if *sl-FreqInfoList* is included in *sl-ConfigCommonNR*:
    - 3> if configured to receive NR sidelink communication:
      - 4> use the resource pool(s) indicated by *sl-RxPool* for NR sidelink communication reception, as specified in 5.8.7;
    - 3> if configured to transmit NR sidelink communication:

- 4> use the resource pool(s) indicated by *sl-TxPoolSelectedNormal*, or *sl-TxPoolExceptional* for NR sidelink communication transmission, as specified in 5.8.8;
- 4> perform CBR measurement on the transmission resource pool(s) indicated by *sl-TxPoolSelectedNormal* and *sl-TxPoolExceptional* for NR sidelink communication transmission, as specified in 5.5.3.1;
- 34> use the synchronization configuration parameters for NR sidelink communication on frequencies included in *sl-FreqInfoList*, as specified in 5.8.5;
- 2> if *sl-RadioBearerConfigList* or *sl-RLC-BearerConfigList* is included in *sl-ConfigCommonNR*:
  - 3> perform sidelink DRB reconfiguration as specified in 5.8.9.1a;
- 2> if *sl-MeasConfigCommon* is included in *sl-ConfigCommonNR*:
  - 3> store the NR sidelink measurement configuration.

The UE should discard any stored segments for *SIB12* if the complete *SIB12* has not been assembled within a period of 3 hours. The UE shall discard any stored segments for *SIB12* upon cell (re-) selection.

#### 5.2.2.4.14 Actions upon reception of *SIB13*

Upon receiving *SIB13*, the UE shall perform the actions upon reception of *SystemInformationBlockType21* as specified in 5.2.2.28 in TS 36.331 [10].

#### 5.2.2.4.15 Actions upon reception of *SIB14*

Upon receiving *SIB14*, the UE shall perform the actions upon reception of *SystemInformationBlockType26* as specified in 5.2.2.33 in TS 36.331 [10].

#### 5.2.2.4.16 Actions upon reception of *SIBpos*

No UE requirements related to the contents of the *SIBpos* apply other than those specified elsewhere e.g. within TS 37.355 [49], and/or within the corresponding field descriptions.

### 5.2.2.5 Essential system information missing

The UE shall:

- 1> if in *RRC\_IDLE* or in *RRC\_INACTIVE* or in *RRC\_CONNECTED* while T311 is running:
  - 2> if the UE is unable to acquire the *MIB*:
    - 3> consider the cell as barred in accordance with TS 38.304 [20]; and
    - 3> perform barring as if *intraFreqReselection* is set to allowed;
  - 2> else if the UE is unable to acquire the *SIB1*:
    - 3> consider the cell as barred in accordance with TS 38.304 [20].
    - 3> if the cell operates in licensed spectrum and *intraFreqReselection* in *MIB* is set to *notAllowed*:
      - 4> consider cell re-selection to other cells on the same frequency as the barred cell as not allowed, as specified in TS 38.304 [20].
  - 3> else:
    - 4> consider cell re-selection to other cells on the same frequency as the barred cell as allowed, as specified in TS 38.304 [20].

## 5.3 Connection control

### 5.3.1 Introduction

#### 5.3.1.1 RRC connection control

RRC connection establishment involves the establishment of SRB1. The network completes RRC connection establishment prior to completing the establishment of the NG connection, i.e. prior to receiving the UE context information from the 5GC. Consequently, AS security is not activated during the initial phase of the RRC connection. During this initial phase of the RRC connection, the network may configure the UE to perform measurement reporting, but the UE only sends the corresponding measurement reports after successful AS security activation. However, the UE only accepts a re-configuration with sync message when AS security has been activated.

Upon receiving the UE context from the 5GC, the RAN activates AS security (both ciphering and integrity protection) using the initial AS security activation procedure. The RRC messages to activate AS 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 AS 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 AS security activation procedure, the network may initiate the establishment of SRB2 and DRBs, i.e. the network may do this prior to receiving the confirmation of the initial AS security activation from the UE. In any case, the network will apply both ciphering and integrity protection for the RRC reconfiguration messages used to establish SRB2 and DRBs. The network should release the RRC connection if the initial AS security activation and/ or the radio bearer establishment fails. A configuration with SRB2 without DRB or with DRB without SRB2 is not supported (i.e., SRB2 and at least one DRB must be configured in the same RRC Reconfiguration message, and it is not allowed to release all the DRBs without releasing the RRC Connection). For IAB-MT, a configuration with SRB2 without DRB is supported.

The release of the RRC connection normally is initiated by the network. The procedure may be used to re-direct the UE to an NR frequency or an E-UTRA carrier frequency.

The suspension of the RRC connection is initiated by the network. When the RRC connection is suspended, the UE stores the UE Inactive AS context and any configuration received from the network, and transits to RRC\_INACTIVE state. The RRC message to suspend the RRC connection is integrity protected and ciphered.

The resumption of a suspended RRC connection is initiated by upper layers when the UE needs to transit from RRC\_INACTIVE state to RRC\_CONNECTED state or by RRC layer to perform a RNA update or by RAN paging from NG-RAN. 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 AS security and re-establishes SRB(s) and DRB(s).

In response to a request to resume the RRC connection, the network may resume the suspended RRC connection and send UE to RRC\_CONNECTED, or reject the request to resume and send UE to RRC\_INACTIVE (with a wait timer), 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 (in this case the network sends an RRC setup message).

**NOTE:** In case the UE receives the configurations for NR sidelink communication via the E-UTRA, the configurations for NR sidelink communication in *SIB12* and *sl-ConfigDedicatedNR* within *RRCReconfiguration* used in subclause 5.3 are provided by the configurations in *SystemInformationBlockType28* and *sl-ConfigDedicatedNR* within *RRCConnectionReconfiguration* as specified in TS 36.331[10], respectively.

#### 5.3.1.2 AS Security

AS security comprises of the integrity protection and ciphering of RRC signalling (SRBs) and user data (DRBs).

RRC handles the configuration of the AS security parameters which are part of the AS configuration: the integrity protection algorithm, the ciphering algorithm, if integrity protection and/or ciphering is enabled for a DRB and two parameters, namely the *keySetChangeIndicator* and the *nextHopChainingCount*, which are used by the UE to determine the AS security keys upon reconfiguration with sync (with key change), connection re-establishment and/or connection resume.

The integrity protection algorithm is common for SRB1, SRB2, SRB3 (if configured) and DRBs configured with integrity protection, with the same *keyToUse* value. The ciphering algorithm is common for SRB1, SRB2, SRB3 (if configured) and DRBs configured with the same *keyToUse* value. For MR-DC, integrity protection is not enabled for DRBs terminated in eNB. Neither integrity protection nor ciphering applies for SRB0.

NOTE 0: All DRBs related to the same PDU session have the same enable/disable setting for ciphering and the same enable/disable setting for integrity protection, as specified in TS 33.501 [11].

RRC integrity protection and ciphering are always activated together, i.e. in one message/procedure. RRC integrity protection and ciphering for SRBs are never de-activated. However, it is possible to switch to a 'NULL' ciphering algorithm (*nea0*).

The 'NULL' integrity protection algorithm (*nia0*) is used only for SRBs and for the UE in limited service mode, see TS 33.501 [11] and when used for SRBs, integrity protection is disabled for DRBs. 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 protection check has failed and indicate the integrity protection verification check failure to RRC.

The AS applies four different security keys: one for the integrity protection of RRC signalling ( $K_{\text{RRCint}}$ ), one for the ciphering of RRC signalling ( $K_{\text{RRCenc}}$ ), one for integrity protection of user data ( $K_{\text{UPint}}$ ) and one for the ciphering of user data ( $K_{\text{UPenc}}$ ). All four AS keys are derived from the  $K_{\text{gNB}}$  key. The  $K_{\text{gNB}}$  key is based on the  $K_{\text{AMF}}$  key (as specified in TS 33.501 [11]), which is handled by upper layers.

The integrity protection and ciphering algorithms can only be changed with reconfiguration with sync. The AS keys ( $K_{\text{gNB}}$ ,  $K_{\text{RRCint}}$ ,  $K_{\text{RRCenc}}$ ,  $K_{\text{UPint}}$  and  $K_{\text{UPenc}}$ ) change upon reconfiguration with sync (if *masterKeyUpdate* is included), and upon connection re-establishment and connection resume.

For each radio bearer an independent counter (*COUNT*, as specified in TS 38.323 [5]) is maintained for each direction. For each radio bearer, the *COUNT* is used as input for ciphering and integrity protection.

It is not allowed to use the same *COUNT* value more than once for a given security key. As specified in TS 33.501 subclause 6.9.4.1 [11], the network is responsible for avoiding reuse of the *COUNT* with the same RB identity and with the same key, e.g. due to the transfer of large volumes of data, release and establishment of new RBs, and multiple termination point changes for RLC-UM bearers and multiple termination point changes for RLC-AM bearer with SN terminated PDCP re-establishment (*COUNT* reset) due to SN only full configuration whilst the key stream inputs (i.e. bearer ID, security key) at MN have not been updated. In order to avoid such re-use, the network may e.g. use different RB identities for RB establishments, change the AS security key, or an RRC\_CONNECTED to RRC\_IDLE/RRC\_INACTIVE and then to RRC\_CONNECTED transition.

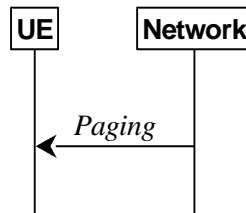
In order to limit the signalling overhead, individual messages/ packets include a short sequence number (PDCP SN, as specified in TS 38.323 [5]). In addition, an overflow counter mechanism is used: the hyper frame number (*HFN*, as specified in TS 38.323 [5]). The HFN needs to be synchronized between the UE and the network.

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.

For a UE provided with an *sk-counter*, *keyToUse* indicates whether the UE uses the master key ( $K_{\text{gNB}}$ ) or the secondary key ( $S\text{-}K_{\text{gNB}}$  or  $S\text{-}K_{\text{gNB}}$ ) for a particular DRB. The secondary key is derived from the master key and *sk-Counter*, as defined in TS 33.501[11]. Whenever there is a need to refresh the secondary key, e.g. upon change of MN with  $K_{\text{gNB}}$  change or to avoid *COUNT* reuse, the security key update is used (see 5.3.5.7). When the UE is in NR-DC, the network may provide a UE configured with an SCG with an *sk-Counter* even when no DRB is setup using the secondary key ( $S\text{-}K_{\text{gNB}}$ ) in order to allow the configuration of SRB3. The network can also provide the UE with an *sk-Counter*, even if no SCG is configured, when using SN terminated MCG bearers.

## 5.3.2 Paging

### 5.3.2.1 General



**Figure 5.3.2.1-1: Paging**

The purpose of this procedure is:

- to transmit paging information to a UE in RRC\_IDLE or RRC\_INACTIVE.

### 5.3.2.2 Initiation

The network initiates the paging procedure by transmitting the *Paging* message at the UE's paging occasion as specified in TS 38.304 [20]. The network may address multiple UEs within a *Paging* message by including one *PagingRecord* for each UE.

### 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 the UE identity allocated by upper layers:
    - 3> forward the *ue-Identity* and *accessType* (if present) 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 UE's stored *fullI-RNTI*:
    - 3> if the UE is configured by upper layers with Access Identity 1:
      - 4> initiate the RRC connection resumption procedure according to 5.3.13 with *resumeCause* set to *mps-PriorityAccess*;
    - 3> else if the UE is configured by upper layers with Access Identity 2:
      - 4> initiate the RRC connection resumption procedure according to 5.3.13 with *resumeCause* set to *mcs-PriorityAccess*;
    - 3> else if the UE is configured by upper layers with one or more Access Identities equal to 11-15:
      - 4> initiate the RRC connection resumption procedure according to 5.3.13 with *resumeCause* set to *highPriorityAccess*;
    - 3> else:
      - 4> initiate the RRC connection resumption procedure according to 5.3.13 with *resumeCause* set to *mt-Access*;
  - 2> else if the *ue-Identity* included in the *PagingRecord* matches the UE identity allocated by upper layers:
    - 3> forward the *ue-Identity* to upper layers and *accessType* (if present) to the upper layers;
    - 3> perform the actions upon going to RRC\_IDLE as specified in 5.3.11 with release cause 'other'.

### 5.3.3 RRC connection establishment

#### 5.3.3.1 General

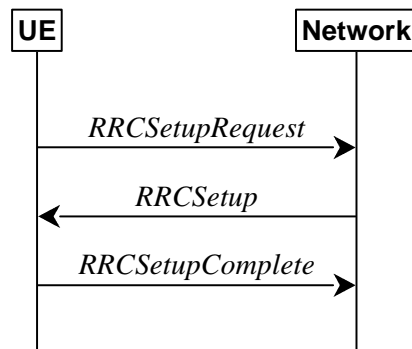


Figure 5.3.3.1-1: RRC connection establishment, successful

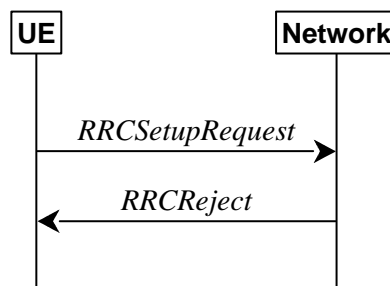


Figure 5.3.3.1-2: RRC connection establishment, network reject

The purpose of this procedure is to establish an RRC connection. RRC connection establishment involves SRB1 establishment. The procedure is also used to transfer the initial NAS dedicated information/ message from the UE to the network.

The network applies the procedure e.g.as follows:

- When establishing an RRC connection;
- When UE is resuming or re-establishing an RRC connection, and the network is not able to retrieve or verify the UE context. In this case, UE receives *RRCSetup* and responds with *RRCSetupComplete*.

#### 5.3.3.1a Conditions for establishing RRC Connection for sidelink communication

For NR sidelink communication, an RRC connection establishment is initiated only in the following cases:

- 1> if configured by upper layers to transmit NR sidelink communication and related data is available for transmission;
- 2> if the frequency on which the UE is configured to transmit NR sidelink communication is included in *sl-FreqInfoList* within *SIB12* provided by the cell on which the UE camps; and if the valid version of *SIB12* does not include *sl-TxPoolSelectedNormal* for the concerned frequency;

For V2X sidelink communication, an RRC connection is initiated only when the conditions specified for V2X sidelink communication in subclause 5.3.3.1a of TS 36.331 [10] are met.

NOTE: Upper layers initiate an RRC connection. The interaction with NAS is left to UE implementation.

### 5.3.3.2 Initiation

The UE initiates the procedure when upper layers request establishment of an RRC connection while the UE is in RRC\_IDLE and it has acquired essential system information as described in 5.2.2.1, or for sidelink communication as specified in sub-clause 5.3.3.1a.

The UE shall ensure having valid and up to date essential system information as specified in clause 5.2.2.2 before initiating this procedure.

Upon initiation of the procedure, 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 5.3.14 using the Access Category and Access Identities provided by upper layers;
  - 3> if the access attempt is barred, the procedure ends;
- 1> apply the default L1 parameter values as specified in corresponding physical layer specifications except for the parameters for which values are provided in *SIB1*;
- 1> apply the default MAC Cell Group 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 *SIB1*;
- 1> start timer T300;
- 1> initiate transmission of the *RRCSetupRequest* message in accordance with 5.3.3.3;

### 5.3.3.3 Actions related to transmission of *RRCSetupRequest* message

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

- 1> set the *ue-Identity* as follows:
  - 2> if upper layers provide a 5G-S-TMSI:
    - 3> set the *ue-Identity* to *ng-5G-S-TMSI-Part1*;
  - 2> else:
    - 3> draw a 39-bit random value in the range  $0..2^{39}-1$  and set the *ue-Identity* to this value;

NOTE 1: Upper layers provide the 5G-S-TMSI if the UE is registered in the TA of the current cell.

- 1> set the *establishmentCause* in accordance with the information received from upper layers;

The UE shall submit the *RRCSetupRequest* 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 5.3.3.6.

### 5.3.3.4 Reception of the *RRCSetup* by the UE

The UE shall perform the following actions upon reception of the *RRCSetup*:

- 1> if the *RRCSetup* is received in response to an *RRCReestablishmentRequest*; or
- 1> if the *RRCSetup* is received in response to an *RRCResumeRequest* or *RRCResumeRequest1*:
  - 2> discard any stored UE Inactive AS context and *suspendConfig*;

- 2> discard any current AS security context including the  $K_{RRCEnc}$  key, the  $K_{RRCint}$  key, the  $K_{UPint}$  key and the  $K_{UPenc}$  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;
- 2> release the RRC configuration except for the default L1 parameter values, default MAC Cell Group configuration and CCCH configuration;
- 2> indicate to upper layers fallback of the RRC connection;
- 2> stop timer T380, if running;
- 1> perform the cell group configuration procedure in accordance with the received *masterCellGroup* and as specified in 5.3.5.5;
- 1> perform the radio bearer configuration procedure in accordance with the received *radioBearerConfig* and as specified in 5.3.5.6;
- 1> if stored, discard the cell reselection priority information provided by the *cellReselectionPriorities* or inherited from another RAT;
- 1> stop timer T300, T301 or T319 if running;
- 1> if T390 is running:
  - 2> stop timer T390 for all access categories;
  - 2> perform the actions as specified in 5.3.14.4;
- 1> if T302 is running:
  - 2> stop timer T302;
  - 2> perform the actions as specified in 5.3.14.4;
- 1> stop timer T320, if running;
- 1> if the *RRCSetup* is received in response to an *RRCResumeRequest*, *RRCResumeRequest1* or *RRCSetupRequest*:
  - 2> if T331 is running:
    - 3> stop timer T331;
    - 3> perform the actions as specified in 5.7.8.3;
  - 2> enter RRC\_CONNECTED;
  - 2> stop the cell re-selection procedure;
- 1> consider the current cell to be the PCell;
- 1> set the content of *RRCSetupComplete* message as follows:
  - 2> if upper layers provide a 5G-S-TMSI:
    - 3> if the *RRCSetup* is received in response to an *RRCSetupRequest*:
      - 4> set the *ng-5G-S-TMSI-Value* to *ng-5G-S-TMSI-Part2*;
    - 3> else:
      - 4> set the *ng-5G-S-TMSI-Value* to *ng-5G-S-TMSI*;
  - 2> set the *selectedPLMN-Identity* to the PLMN or SNPN selected by upper layers (TS 24.501 [23]) from the PLMN(s) included in the *plmn-IdentityList* or the PLMN(s) or SNPN(s) included in the *nnpn-IdentityInfoList* in *SIB1*;



- 2> if upper layers provide the 'Registered AMF':
  - 3> include and set the *registeredAMF* as follows:
    - 4> if the PLMN identity of the 'Registered AMF' is different from the PLMN selected by the upper layers:
      - 5> include the *plmnIdentity* in the *registeredAMF* and set it to the value of the PLMN identity in the 'Registered AMF' received from upper layers;
    - 4> set the *amf-Identifier* to the value received from upper layers;
  - 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 [21]):
  - 3> include the *s-NSSAI-List* and set the content to the values provided by the upper layers;
- 2> set the *dedicatedNAS-Message* to include the information received from upper layers;
- 2> if connecting as an IAB-node:
  - 3> include the *iab-NodeIndication*;
- 2> if the SIB1 contains *idleModeMeasurementsNR* and the UE has NR idle/inactive measurement information concerning cells other than the PCell available in *VarMeasIdleReport*; or
- 2> if the SIB1 contains *idleModeMeasurementsEUTRA* and the UE has E-UTRA idle/inactive measurement information available in *VarMeasIdleReport*:
  - 3> include the *idleMeasAvailable*;
- 2> if the UE has logged measurements available for NR and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:
  - 3> include the *logMeasAvailable* in the *RRCSetupComplete* message;
- 2> if the UE has Bluetooth logged measurements available and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:
  - 3> include the *logMeasAvailableBT* in the *RRCSetupComplete* message;
- 2> if the UE has WLAN logged measurements available and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:
  - 3> include the *logMeasAvailableWLAN* in the *RRCSetupComplete* message;
- 2> if the UE has connection establishment failure or connection resume failure information available in *VarConnEstFailReport* and if the RPLMN is equal to *plmn-Identity* stored in *VarConnEstFailReport*:
  - 3> include *connEstFailInfoAvailable* in the *RRCSetupComplete* message;
- 2> if the UE has radio link failure or handover failure information available in *VarRLF-Report* and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report*:
  - 3> if *reconnectCellId* in *VarRLF-Report* is not set:
    - 4> set *timeUntilReconnection* in *VarRLF-Report* to the time that elapsed since the last radio link or handover failure;
    - 4> set *nrReconnectCellId* in *reconnectCellId* in *VarRLF-Report* to the global cell identity and the tracking area code of the PCell;
  - 3> include *rlf-InfoAvailable* in the *RRCSetupComplete* message;
- 2> if the UE supports RLF report for inter-RAT MRO NR as defined in TS 36.306 [62], and if the UE has radio link failure or handover failure information available in *VarRLF-Report* of TS 36.331 [10]:

- 3> if *reconnectCellId* in *VarRLF-Report* of TS 36.331[10] is not set:
  - 4> set *timeUntilReconnection* in *VarRLF-Report* of TS 36.331[10] to the time that elapsed since the last radio link or handover failure in LTE;
  - 4> set *nrReconnectCellId* in *reconnectCellId* in *VarRLF-Report* of TS 36.331[10] to the global cell identity and the tracking area code of the PCell;
- 3> if the UE is capable of cross-RAT RLF reporting and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report* of TS 36.331 [10]
  - 4> include *rlf-InfoAvailable* in the *RRCSetupComplete* message;
- 2> if the UE supports storage of mobility history information and the UE has mobility history information available in *VarMobilityHistoryReport*:
  - 3> include the *mobilityHistoryAvail* in the *RRCSetupComplete* message;
- 2> if the *RRCSetup* is received in response to an *RRCResumeRequest*, *RRCResumeRequest1* or *RRCSetupRequest*:
  - 3> if *speedStateReselectionPars* is configured in the *SIB2*:
    - 4> include the *mobilityState* in the *RRCSetupComplete* message and set it to the mobility state (as specified in TS 38.304 [20]) of the UE just prior to entering RRC\_CONNECTED state;
- 1> submit the *RRCSetupComplete* message to lower layers for transmission, upon which the procedure ends.

### 5.3.3.5 Reception of the *RRCReject* by the UE

The UE shall:

- 1> perform the actions as specified in 5.3.15;

### 5.3.3.6 Cell re-selection or cell selection while T390, T300 or T302 is running (UE in RRC\_IDLE)

The UE shall:

- 1> if cell reselection occurs while T300 or T302 is running:
  - 2> perform the actions upon going to RRC\_IDLE as specified in 5.3.11 with release cause 'RRC connection failure';
- 1> else if cell selection or reselection occurs while T390 is running:
  - 2> stop T390 for all access categories;
  - 2> perform the actions as specified in 5.3.14.4.

### 5.3.3.7 T300 expiry

The UE shall:

- 1> if timer T300 expires:
  - 2> reset MAC, release the MAC configuration and re-establish RLC for all RBs that are established;
- 2> if the T300 has expired a consecutive *connEstFailCount* times on the same cell for which *connEstFailureControl* is included in *SIB1*:
  - 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 38.304 [20] and TS 36.304 [27];

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> if the UE has connection establishment failure information or connection resume failure information available in *VarConnEstFailReport* and if the RPLMN is not equal to plmn-identity stored in *VarConnEstFailReport*; or
- 2> if the cell identity of current cell is not equal to the cell identity stored in *measResultFailedCell* in *VarConnEstFailReport*:
  - 3> reset the *numberOfConnFail* to 0;
- 2> clear the content included in *VarConnEstFailReport* except for the *numberOfConnFail*, if any;
- 2> store the following connection establishment failure information in the *VarConnEstFailReport* by setting its fields as follows:
  - 3> set the *plmn-Identity* to the PLMN selected by upper layers (see TS 24.501 [23]) from the PLMN(s) included in the *plmn-IdentityList* in *SIB1*;
  - 3> set the *measResultFailedCell* to include the global cell identity, tracking area code, the cell level and SS/PBCH block level RSRP, and RSRQ, and SS/PBCH block indexes, of the failed cell based on the available SSB measurements collected up to the moment the UE detected connection establishment failure;
  - 3> if available, set the *measResultNeighCells*, in order of decreasing ranking-criterion as used for cell reselection, 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 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 38.133 [14].

- 3> if available, set the *locationInfo* as follows:
  - 4> if available, set the *commonLocationInfo* to include the detailed location information;
  - 4> if available, set the *bt-LocationInfo* to include the Bluetooth measurement results, in order of decreasing RSSI for Bluetooth beacons;
  - 4> if available, set the *wlan-LocationInfo* to include the WLAN measurement results, in order of decreasing RSSI for WLAN APs;
  - 4> if available, set the *sensor-LocationInfo* to include the sensor measurement results as follows:
    - 5> if available, include the *sensor-MeasurementInformation*;
    - 5> if available, include the *sensor-MotionInformation*;
- 3> set *perRAInfoList* to indicate random access failure information as specified in 5.7.10.5;
- 3> if the *numberOfConnFail* is smaller than 8:
  - 4> increment the *numberOfConnFail* by 1;
- 2> inform upper layers about the failure to establish the RRC connection, upon which the procedure ends;

The UE may discard the connection establishment failure or connection resume failure information, i.e. release the UE variable *VarConnEstFailReport*, 48 hours after the last connection establishment failure is detected.

### 5.3.3.8 Abortion of RRC connection establishment

If upper layers abort the RRC connection establishment procedure, due to a NAS procedure being aborted as specified in TS 24.501 [23], while the UE has not yet entered RRC\_CONNECTED, the UE shall:

- 1> stop timer T300, if running;
- 1> reset MAC, release the MAC configuration and re-establish RLC for all RBs that are established;

## 5.3.4 Initial AS security activation

### 5.3.4.1 General

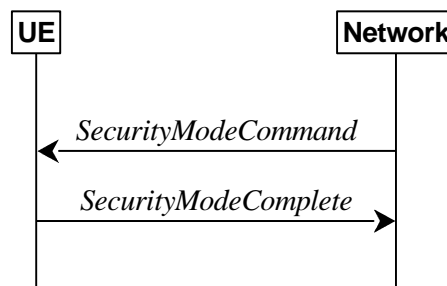


Figure 5.3.4.1-1: Security mode command, successful

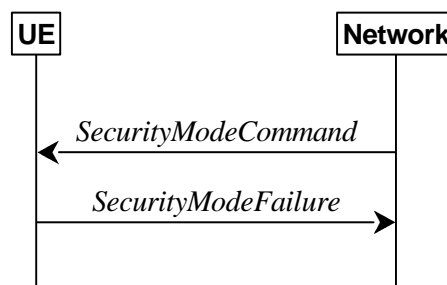


Figure 5.3.4.1-2: Security mode command, failure

The purpose of this procedure is to activate AS security upon RRC connection establishment.

### 5.3.4.2 Initiation

The network initiates the security mode command procedure to a UE in RRC\_CONNECTED. Moreover, the network applies the procedure as follows:

- when only SRB1 is established, i.e. prior to establishment of SRB2 and/ or DRBs.

### 5.3.4.3 Reception of the *SecurityModeCommand* by the UE

The UE shall:

- 1> derive the  $K_{gNB}$  key, as specified in TS 33.501 [11];
- 1> derive the  $K_{RRCint}$  key associated with the *integrityProtAlgorithm* indicated in the *SecurityModeCommand* message, as specified in TS 33.501 [11];
- 1> request lower layers to verify the integrity protection of the *SecurityModeCommand* message, using the algorithm indicated by the *integrityProtAlgorithm* as included in the *SecurityModeCommand* message and the  $K_{RRCint}$  key;
- 1> if the *SecurityModeCommand* message passes the integrity protection check:

- 2> derive the  $K_{RRCEnc}$  key and the  $K_{UPenc}$  key associated with the *cipheringAlgorithm* indicated in the *SecurityModeCommand* message, as specified in TS 33.501 [11];
  - 2> derive the  $K_{UPint}$  key associated with the *integrityProtAlgorithm* indicated in the *SecurityModeCommand* message, as specified in TS 33.501 [11];
  - 2> configure lower layers to apply SRB integrity protection using the indicated algorithm and the  $K_{RRCint}$  key immediately, i.e. integrity protection shall be applied to all subsequent messages received and sent by the UE, including the *SecurityModeComplete* message;
  - 2> configure lower layers to apply SRB ciphering using the indicated algorithm, the  $K_{RRCEnc}$  key after completing the procedure, i.e. ciphering shall be applied to all subsequent messages received and sent by the UE, except for the *SecurityModeComplete* message which is sent unciphered;
  - 2> consider AS security to be activated;
  - 2> submit the *SecurityModeComplete* message to lower layers for transmission, upon which the procedure ends;
- 1> else:
- 2> continue using the configuration used prior to the reception of the *SecurityModeCommand* message, i.e. neither apply integrity protection nor ciphering.
  - 2> submit the *SecurityModeFailure* message to lower layers for transmission, upon which the procedure ends.

## 5.3.5 RRC reconfiguration

### 5.3.5.1 General

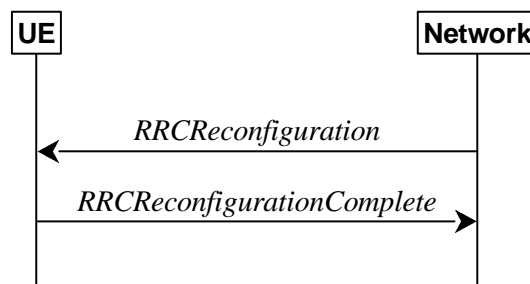


Figure 5.3.5.1-1: RRC reconfiguration, successful

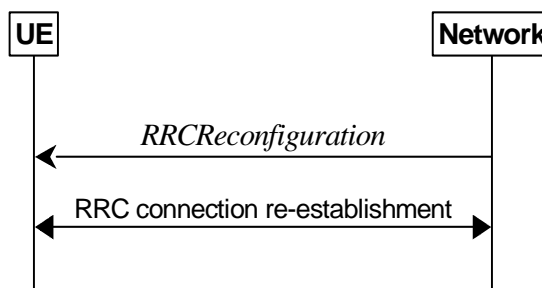


Figure 5.3.5.1-2: RRC reconfiguration, failure

The purpose of this procedure is to modify an RRC connection, e.g. to establish/modify/release RBs, to perform reconfiguration with sync, to setup/modify/release measurements, to add/modify/release SCells and cell groups, to add/modify/release conditional handover configuration, to add/modify/release conditional PSCell change configuration. As part of the procedure, NAS dedicated information may be transferred from the Network to the UE.

RRC reconfiguration to perform reconfiguration with sync includes, but is not limited to, the following cases:

- reconfiguration with sync and security key refresh, involving RA to the PCell/PSCell, MAC reset, refresh of security and re-establishment of RLC and PDCP triggered by explicit L2 indicators;

- reconfiguration with sync but without security key refresh, involving RA to the PCell/PSCell, MAC reset and RLC re-establishment and PDCP data recovery (for AM DRB) triggered by explicit L2 indicators.
- reconfiguration with sync for DAPS and security key refresh, involving RA to the target PCell, establishment of target MAC, and
  - for non-DAPS bearer: refresh of security and re-establishment of RLC and PDCP triggered by explicit L2 indicators;
  - for DAPS bearer: establishment of RLC for the target PCell, refresh of security and reconfiguration of PDCP to add the ciphering function, the integrity protection function and ROHC function of the target PCell;
  - for SRB: refresh of security and establishment of RLC and PDCP for the target PCell;
- reconfiguration with sync for DAPS but without security key refresh, involving RA to the target PCell, establishment of target MAC, and:
  - for non-DAPS bearer: RLC re-establishment and PDCP data recovery (for AM DRB) triggered by explicit L2 indicators.
  - for DAPS bearer: establishment of RLC for target PCell, reconfiguration of PDCP to add the ciphering function, the integrity protection function and ROHC function of the target PCell;
  - for SRB: establishment of RLC and PDCP for the target PCell.

In (NG)EN-DC and NR-DC, SRB3 can be used for measurement configuration and reporting, for UE assistance (re-)configuration and reporting for power savings, to (re-)configure MAC, RLC, physical layer and RLF timers and constants of the SCG configuration, and to reconfigure PDCP for DRBs associated with the S-K<sub>eNB</sub> or SRB3, and to reconfigure SDAP for DRBs associated with S-K<sub>eNB</sub> in NGEN-DC and NR-DC, and to add/modify/release conditional PSCell change configuration, provided that the (re-)configuration does not require any MN involvement. In (NG)EN-DC and NR-DC, only *measConfig*, *radioBearerConfig*, *conditionalReconfiguration*, *otherConfig* and/or *secondaryCellGroup* are included in *RRCReconfiguration* received via SRB3.

### 5.3.5.2 Initiation

The Network may initiate the RRC reconfiguration procedure to a UE in RRC\_CONNECTED. The Network applies the procedure as follows:

- the establishment of RBs (other than SRB1, that is established during RRC connection establishment) is performed only when AS security has been activated;
- the addition of Secondary Cell Group and SCells is performed only when AS security has been activated;
- the *reconfigurationWithSync* is included in *secondaryCellGroup* only when at least one RLC bearer is setup in SCG;
- the *reconfigurationWithSync* is included in *masterCellGroup* only when AS security has been activated, and SRB2 with at least one DRB or, for IAB, SRB2, are setup and not suspended;
- the *conditionalReconfiguration* for CPC is included only when at least one RLC bearer is setup in SCG;
- the *conditionalReconfiguration* for CHO is included only when AS security has been activated, and SRB2 with at least one DRB or, for IAB, SRB2, are setup and not suspended.

### 5.3.5.3 Reception of an *RRCReconfiguration* by the UE

The UE shall perform the following actions upon reception of the *RRCReconfiguration*, or upon execution of the conditional reconfiguration (CHO or CPC):

- 1> if the *RRCReconfiguration* is applied due to a conditional reconfiguration execution upon cell selection while timer T311 is running, as defined in 5.3.7.3:
  - 2> remove all the entries within *VarConditionalReconfig*, if any;
- 1> if the *RRCReconfiguration* includes the *daps-SourceRelease*:

- 2> release source SpCell configuration;
- 2> reset the source MAC and release the source MAC configuration;
- 2> for each DAPS bearer:
  - 3> release the RLC entity or entities as specified in TS 38.322 [4], clause 5.1.3, and the associated logical channel for the source SpCell;
  - 3> reconfigure the PDCP entity to release DAPS as specified in TS 38.323 [5];
- 2> for each SRB:
  - 3> release the PDCP entity for the source SpCell;
  - 3> release the RLC entity as specified in TS 38.322 [4], clause 5.1.3, and the associated logical channel for the source SpCell;
- 2> release the physical channel configuration for the source SpCell;
- 2> discard the keys used in the source SpCell (the  $K_{gNB}$  key, the  $K_{RRCCenc}$  key, the  $K_{RRCint}$  key, the  $K_{UPint}$  key and the  $K_{UPenc}$  key), if any;
- 1> if the *RRCReconfiguration* is received via other RAT (i.e., inter-RAT handover to NR):
  - 2> if the *RRCReconfiguration* does not include the *fullConfig* and the UE is connected to 5GC (i.e., delta signalling during intra 5GC handover):
    - 3> re-use the source RAT SDAP and PDCP configurations if available (i.e., current SDAP/PDCP configurations for all RBs from source E-UTRA RAT prior to the reception of the inter-RAT HO *RRCReconfiguration* message);
- 1> else:
  - 2> if the *RRCReconfiguration* includes the *fullConfig*:
    - 3> perform the full configuration procedure as specified in 5.3.5.11;
- 1> if the *RRCReconfiguration* includes the *masterCellGroup*:
  - 2> perform the cell group configuration for the received *masterCellGroup* according to 5.3.5.5;
- 1> if the *RRCReconfiguration* includes the *masterKeyUpdate*:
  - 2> perform AS security key update procedure as specified in 5.3.5.7;
- 1> if the *RRCReconfiguration* includes the *sk-Counter*:
  - 2> perform security key update procedure as specified in 5.3.5.7;
- 1> if the *RRCReconfiguration* includes the *secondaryCellGroup*:
  - 2> perform the cell group configuration for the SCG according to 5.3.5.5;
- 1> if the *RRCReconfiguration* includes the *mrdc-SecondaryCellGroupConfig*:
  - 2> if the *mrdc-SecondaryCellGroupConfig* is set to *setup*:
    - 3> if the *mrdc-SecondaryCellGroupConfig* includes *mrdc-ReleaseAndAdd*:
      - 4> perform MR-DC release as specified in clause 5.3.5.10;
    - 3> if the received *mrdc-SecondaryCellGroup* is set to *nr-SCG*:
      - 4> perform the RRC reconfiguration according to 5.3.5.3 for the *RRCReconfiguration* message included in *nr-SCG*;
    - 3> if the received *mrdc-SecondaryCellGroup* is set to *eutra-SCG*:

- 4> perform the RRC connection reconfiguration as specified in TS 36.331 [10], clause 5.3.5.3 for the *RRCConnectionReconfiguration* message included in *eutra-SCG*;
  - 2> else (*mrdc-SecondaryCellGroupConfig* is set to *release*):
    - 3> perform MR-DC release as specified in clause 5.3.5.10;
  - 1> if the *RRCReconfiguration* message includes the *radioBearerConfig*:
    - 2> perform the radio bearer configuration according to 5.3.5.6;
  - 1> if the *RRCReconfiguration* message includes the *radioBearerConfig2*:
    - 2> perform the radio bearer configuration according to 5.3.5.6;
  - 1> if the *RRCReconfiguration* message includes the *measConfig*:
    - 2> perform the measurement configuration procedure as specified in 5.5.2;
  - 1> if the *RRCReconfiguration* message includes the *dedicatedNAS-MessageList*:
    - 2> forward each element of the *dedicatedNAS-MessageList* to upper layers in the same order as listed;
  - 1> if the *RRCReconfiguration* message includes the *dedicatedSIB1-Delivery*:
    - 2> perform the action upon reception of *SIB1* as specified in 5.2.2.4.2;
- NOTE 0: If this *RRCReconfiguration* is associated to the MCG and includes *reconfigurationWithSync* in *spCellConfig* and *dedicatedSIB1-Delivery*, the UE initiates (if needed) the request to acquire required SIBs, according to clause 5.2.2.3.5, only after the random access procedure towards the target SpCell is completed.
- 1> if the *RRCReconfiguration* message includes the *dedicatedSystemInformationDelivery*:
    - 2> perform the action upon reception of System Information as specified in 5.2.2.4;
  - 1> if the *RRCReconfiguration* message includes the *dedicatedPosSysInfoDelivery*:
    - 2> perform the action upon reception of the contained posSIB(s), as specified in sub-clause 5.2.2.4.16;
  - 1> if the *RRCReconfiguration* message includes the *otherConfig*:
    - 2> perform the other configuration procedure as specified in 5.3.5.9;
  - 1> if the *RRCReconfiguration* message includes the *bap-Config*:
    - 2> perform the BAP configuration procedure as specified in 5.3.5.12;
  - 1> if the *RRCReconfiguration* message includes the *iab-IP-AddressConfigurationList*:
    - 2> if *iab-IP-AddressToReleaseList* is included:
      - 3> for each *IAB-IP-AddressIndex* received in the *iab-IP-AddressToReleaseList*
        - 4> perform release of IP address as specified in 5.3.5.12a.1.1;
    - 2> if *iab-IP-AddressToAddModList* is included:
      - 3> for each *IAB-IP-AddressIndex* received in the *iab-IP-AddressToAddModList*
        - 4> perform IAB IP address addition/update as specified in 5.3.5.12a.1.2;
  - 1> if the *RRCReconfiguration* message includes the *conditionalReconfiguration*:
    - 2> perform conditional reconfiguration as specified in 5.3.5.13;
  - 1> if the *RRCReconfiguration* message includes the *needForGapsConfigNR*:
    - 2> if *needForGapsConfigNR* is set to *setup*:



- 3> consider itself to be configured to provide the measurement gap requirement information of NR target bands;
  - 2> else:
    - 3> consider itself not to be configured to provide the measurement gap requirement information of NR target bands;
  - 1> if the *RRCReconfiguration* message includes the *sl-ConfigDedicatedNR*:
    - 2> perform the sidelink dedicated configuration procedure as specified in 5.3.5.14;
- NOTE 0a: If the *sl-ConfigDedicatedNR* was received embedded within an E-UTRA *RRCConnectionReconfiguration* message, the UE does not build an NR *RRCReconfigurationComplete* message for the received *sl-ConfigDedicatedNR*.
- 1> if the *RRCReconfiguration* message includes the *sl-ConfigDedicatedEUTRA-Info*:
    - 2> perform related procedures for V2X sidelink communication in accordance with TS 36.331 [10], clause 5.3.10 and clause 5.5.2;
  - 1> set the content of the *RRCReconfigurationComplete* message as follows:
    - 2> if the *RRCReconfiguration* includes the *masterCellGroup* containing the *reportUplinkTxDirectCurrent*:
      - 3> include the *uplinkTxDirectCurrentList* for each MCG serving cell with UL;
      - 3> include *uplinkDirectCurrentBWP-SUL* for each MCG serving cell configured with SUL carrier, if any, within the *uplinkTxDirectCurrentList*;
    - 2> if the *RRCReconfiguration* includes the *secondaryCellGroup* containing the *reportUplinkTxDirectCurrent*:
      - 3> include the *uplinkTxDirectCurrentList* for each SCG serving cell with UL;
      - 3> include *uplinkDirectCurrentBWP-SUL* for each SCG serving cell configured with SUL carrier, if any, within the *uplinkTxDirectCurrentList*;
    - 2> if the *RRCReconfiguration* message includes the *mrdc-SecondaryCellGroupConfig* with *mrdc-SecondaryCellGroup* set to *eutra-SCG*:
      - 3> include in the *eutra-SCG-Response* the E-UTRA *RRCConnectionReconfigurationComplete* message in accordance with TS 36.331 [10] clause 5.3.5.3;
    - 2> if the *RRCReconfiguration* message includes the *mrdc-SecondaryCellGroupConfig* with *mrdc-SecondaryCellGroup* set to *nr-SCG*:
      - 3> include in the *nr-SCG-Response* the *RRCReconfigurationComplete* message;
    - 2> if the *RRCReconfiguration* message was included in an *RRCResume* message:
      - 3> include the *RRCReconfigurationComplete* message in the *nr-SCG-Response* within the *scg-Response* in the *RRCResumeComplete* message;
    - 2> if the *RRCReconfiguration* message was included in E-UTRA *RRCConnectionResume* message:
      - 3> include the *RRCReconfigurationComplete* message in the E-UTRA MCG RRC message *RRCConnectionResumeComplete* in accordance with TS 36.331 [10], clause 5.3.3.4a;
    - 2> if the UE has logged measurements available for NR and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:
      - 3> include the *logMeasAvailable* in the *RRCReconfigurationComplete* message;
    - 2> if the UE has Bluetooth logged measurements available and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:
      - 3> include the *logMeasAvailableBT* in the *RRCReconfigurationComplete* message;

- 2> if the UE has WLAN logged measurements available and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:
  - 3> include the *logMeasAvailableWLAN* in the *RRCReconfigurationComplete* message;
- 2> if the UE has connection establishment failure or connection resume failure information available in *VarConnEstFailReport* and if the RPLMN is equal to *plmn-Identity* stored in *VarConnEstFailReport*:
  - 3> include *connEstFailInfoAvailable* in the *RRCReconfigurationComplete* message;
- 2> if the *RRCReconfiguration* message was received in response to the *MCGFailureInformation* message:
  - 3> clear the information included in *VarRLF-Report*, if any;
- 2> if the UE has radio link failure or handover failure information available in *VarRLF-Report* and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report*; or
- 2> if the UE has radio link failure or handover failure information available in *VarRLF-Report* of TS 36.331 [10] and if the UE is capable of cross-RAT RLF reporting and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report* of TS 36.331 [10]:
  - 3> include *rlf-InfoAvailable* in the *RRCReconfigurationComplete* message;
- 2> if the *RRCReconfiguration* message was received via SRB1, but not within *mrdc-SecondaryCellGroup* or E-UTRA *RRCCConnectionReconfiguration*:
  - 3> if the UE is configured to provide the measurement gap requirement information of NR target bands:
    - 4> if the *RRCReconfiguration* message includes the *needForGapsConfigNR*; or
    - 4> if the *NeedForGapsInfoNR* information is changed compared to last time the UE reported this information:
      - 5> include the *NeedForGapsInfoNR* and set the contents as follows:
        - 6> include *intraFreq-needForGap* and set the gap requirement information of intra-frequency measurement for each NR serving cell;
        - 6> if *requestedTargetBandFilterNR* is configured, for each supported NR band that is also included in *requestedTargetBandFilterNR*, include an entry in *interFreq-needForGap* and set the gap requirement information for that band; otherwise, include an entry in *interFreq-needForGap* and set the corresponding gap requirement information for each supported NR band;
- 1> if the UE is configured with E-UTRA *nr-SecondaryCellGroupConfig* (UE in (NG)EN-DC):
  - 2> if the *RRCReconfiguration* message was received via E-UTRA SRB1 as specified in TS 36.331 [10]; or
  - 2> if the *RRCReconfiguration* message was received via E-UTRA RRC message *RRCCConnectionReconfiguration* within *MobilityFromNRCommand*;
    - 3> if the *RRCReconfiguration* is applied due to a conditional reconfiguration execution:
      - 4> submit the *RRCReconfigurationComplete* message via the E-UTRA MCG embedded in E-UTRA RRC message *ULInformationTransferMRDC* as specified in TS 36.331 [10], clause 5.6.2a.
    - 3> else:
      - 4> submit the *RRCReconfigurationComplete* via E-UTRA embedded in E-UTRA RRC message *RRCCConnectionReconfigurationComplete* as specified in TS 36.331 [10], clause 5.3.5.3/5.3.5.4/5.4.2.3;
    - 3> if *reconfigurationWithSync* was included in *spCellConfig* of an SCG:
      - 4> initiate the Random Access procedure on the SpCell, as specified in TS 38.321 [3];
    - 3> else:

- 4> the procedure ends;
- 2> if the *RRCReconfiguration* message was received within *nr-SecondaryCellGroupConfig* in *RRCConnectionReconfiguration* message received via SRB3 within *DLInformationTransferMRDC*:
  - 3> submit the *RRCReconfigurationComplete* via E-UTRA embedded in E-UTRA RRC message *RRCConnectionReconfigurationComplete* as specified in TS 36.331 [10], clause 5.3.5.3/5.3.5.4;
  - 3> if *reconfigurationWithSync* was included in *spCellConfig* of an SCG:
    - 4> initiate the Random Access procedure on the SpCell, as specified in TS 38.321 [3];
  - 3> else:
    - 4> the procedure ends;

NOTE 1: The order the UE sends the *RRCConnectionReconfigurationComplete* message and performs the Random Access procedure towards the SCG is left to UE implementation.

- 2> else (*RRCReconfiguration* was received via SRB3) but not within *DLInformationTransferMRDC*:
  - 3> submit the *RRCReconfigurationComplete* message via SRB3 to lower layers for transmission using the new configuration;

NOTE 2: In (NG)EN-DC and NR-DC, in the case *RRCReconfiguration* is received via SRB1 or within *DLInformationTransferMRDC* via SRB3, the random access is triggered by RRC layer itself as there is not necessarily other UL transmission. In the case *RRCReconfiguration* is received via SRB3 but not within *DLInformationTransferMRDC*, the random access is triggered by the MAC layer due to arrival of *RRCReconfigurationComplete*.

- 1> else if the *RRCReconfiguration* message was received via SRB1 within the *nr-SCG* within *mrdc-SecondaryCellGroup* (UE in NR-DC, *mrdc-SecondaryCellGroup* was received in *RRCReconfiguration* via SRB1):
  - 2> if the *RRCReconfiguration* is applied due to a conditional reconfiguration execution:
    - 3> submit the *RRCReconfigurationComplete* message via the NR MCG embedded in NR RRC message *ULInformationTransferMRDC* as specified in clause 5.7.2a.3.
  - 2> if *reconfigurationWithSync* was included in *spCellConfig* in *nr-SCG*:
    - 3> initiate the Random Access procedure on the PSCell, as specified in TS 38.321 [3];
  - 2> else
    - 3> the procedure ends;

NOTE 2a: The order in which the UE sends the *RRCReconfigurationComplete* message and performs the Random Access procedure towards the SCG is left to UE implementation.

- 1> else if the *RRCReconfiguration* message was received via SRB3 (UE in NR-DC):
  - 2> if the *RRCReconfiguration* message was received within *DLInformationTransferMRDC*:
    - 3> if the *RRCReconfiguration* message was received within the *nr-SCG* within *mrdc-SecondaryCellGroup* (NR SCG RRC Reconfiguration):
      - 4> if *reconfigurationWithSync* was included in *spCellConfig* in *nr-SCG*:
        - 5> initiate the Random Access procedure on the PSCell, as specified in TS 38.321 [3];
      - 4> else:
        - 5> the procedure ends;
    - 3> else:

- 4> submit the *RRCReconfigurationComplete* message via SRB1 to lower layers for transmission using the new configuration;
- 2> else:
  - 3> submit the *RRCReconfigurationComplete* message via SRB3 to lower layers for transmission using the new configuration;
- 1> else (*RRCReconfiguration* was received via SRB1):
  - 2> submit the *RRCReconfigurationComplete* message via SRB1 to lower layers for transmission using the new configuration;
  - 2> if this is the first *RRCReconfiguration* message after successful completion of the RRC re-establishment procedure:
    - 3> resume SRB2 and DRBs that are suspended;
- 1> if *reconfigurationWithSync* was included in *spCellConfig* of an MCG or SCG, and when MAC of an NR cell group successfully completes a Random Access procedure triggered above:
  - 2> stop timer T304 for that cell group;
  - 2> stop timer T310 for source SpCell if running;
  - 2> apply the parts of the CSI reporting configuration, the scheduling request configuration and the sounding RS configuration that do not require the UE to know the SFN of the respective target SpCell, if any;
  - 2> apply the parts of the measurement and the radio resource configuration that require the UE to know the SFN of the respective target SpCell (e.g. measurement gaps, periodic CQI reporting, scheduling request configuration, sounding RS configuration), if any, upon acquiring the SFN of that target SpCell;
  - 2> for each DRB configured as DAPS bearer, request uplink data switching to the PDCP entity, as specified in TS 38.323 [5];
  - 2> if the *reconfigurationWithSync* was included in *spCellConfig* of an MCG:
    - 3> if T390 is running:
      - 4> stop timer T390 for all access categories;
      - 4> perform the actions as specified in 5.3.14.4.
    - 3> if T350 is running:
      - 4> stop timer T350;
    - 3> if *RRCReconfiguration* does not include *dedicatedSIB1-Delivery* and
    - 3> if the active downlink BWP, which is indicated by the *firstActiveDownlinkBWP-Id* for the target SpCell of the MCG, has a common search space configured by *searchSpaceSIB1*:
      - 4> acquire the *SIB1*, which is scheduled as specified in TS 38.213 [13], of the target SpCell of the MCG;
      - 4> upon acquiring *SIB1*, perform the actions specified in clause 5.2.2.4.2;
  - 2> if the *reconfigurationWithSync* was included in *spCellConfig* of an MCG; or:
  - 2> if the *reconfigurationWithSync* was included in *spCellConfig* of an SCG and the CPC was configured
    - 3> remove all the entries within *VarConditionalReconfig*, if any;
    - 3> for each *measId* of the source SpCell configuration, if the associated *reportConfig* has a *reportType* set to *condTriggerConfig*:
      - 4> for the associated *reportConfigId*:

- 5> remove the entry with the matching *reportConfigId* from the *reportConfigList* within the *VarMeasConfig*;
- 4> if the associated *measObjectId* is only associated to a *reportConfig* with *reportType* set to *condTriggerConfig*:
  - 5> remove the entry with the matching *measObjectId* from the *measObjectList* within the *VarMeasConfig*;
  - 4> remove the entry with the matching *measId* from the *measIdList* within the *VarMeasConfig*;
- 2> if *reconfigurationWithSync* was included in *masterCellGroup* or *secondaryCellGroup*; and
- 2> if the UE transmitted a *UEAssistanceInformation* message for the corresponding cell group during the last 1 second, and the UE is still configured to provide the concerned UE assistance information for the corresponding cell group:
  - 3> initiate transmission of a *UEAssistanceInformation* message for the corresponding cell group in accordance with clause 5.7.4.3 to provide the concerned UE assistance information;
  - 3> start or restart the prohibit timer (if exists) associated with the concerned UE assistance information with the timer value set to the value in corresponding configuration;
- 2> if *SIB12* is provided by the target PCell; and the UE transmitted a *SidelinkUEInformationNR* message indicating a change of NR sidelink communication related parameters relevant in target PCell (i.e. change of *sl-RxInterestedFreqList* or *sl-TxResourceReqList*) during the last 1 second preceding reception of the *RRCReconfiguration* message including *reconfigurationWithSync* in *spCellConfig* of an MCG:
  - 3> initiate transmission of the *SidelinkUEInformationNR* message in accordance with 5.8.3.3;
- 2> the procedure ends.

NOTE 3: The UE is only required to acquire broadcasted *SIB1* if the UE can acquire it without disrupting unicast data reception, i.e. the broadcast and unicast beams are quasi co-located.

NOTE 4: The UE sets the content of *UEAssistanceInformation* according to latest configuration (i.e. the configuration after applying the *RRCReconfiguration* message) and latest UE preference. The UE may include more than the concerned UE assistance information within the *UEAssistanceInformation* according to 5.7.4.2. Therefore, the content of *UEAssistanceInformation* message may not be similar to the original one.

#### 5.3.5.4 Secondary cell group release

The UE shall:

- 1> as a result of SCG release triggered by E-UTRA (i.e. (NG)EN-DC case) or NR (i.e. NR-DC case):
  - 2> reset SCG MAC, if configured;
  - 2> for each RLC bearer that is part of the SCG configuration:
    - 3> perform RLC bearer release procedure as specified in 5.3.5.5.3;
  - 2> release the SCG configuration;
  - 2> if CPC was configured,
    - 3> remove all the entries within *VarConditionalReconfig*, if any;
  - 2> stop timer T310 for the corresponding SpCell, if running;
  - 2> stop timer T312 for the corresponding SpCell, if running;
  - 2> stop timer T304 for the corresponding SpCell, if running.

NOTE: Release of cell group means only release of the lower layer configuration of the cell group but the *RadioBearerConfig* may not be released.

### 5.3.5.5 Cell Group configuration

#### 5.3.5.5.1 General

The network configures the UE with Master Cell Group (MCG), and zero or one Secondary Cell Group (SCG). In (NG)EN-DC, the MCG is configured as specified in TS 36.331 [10], and for NE-DC, the SCG is configured as specified in TS 36.331 [10]. The network provides the configuration parameters for a cell group in the *CellGroupConfig* IE.

The UE performs the following actions based on a received *CellGroupConfig* IE:

- 1> if the *CellGroupConfig* contains the *spCellConfig* with *reconfigurationWithSync*:
  - 2> perform Reconfiguration with sync according to 5.3.5.5.2;
  - 2> resume all suspended radio bearers and resume SCG transmission for all radio bearers, if suspended;
- 1> if the *CellGroupConfig* contains the *rlc-BearerToReleaseList*:
  - 2> perform RLC bearer release as specified in 5.3.5.5.3;
- 1> if the *CellGroupConfig* contains the *rlc-BearerToAddModList*:
  - 2> perform the RLC bearer addition/modification as specified in 5.3.5.5.4;
- 1> if the *CellGroupConfig* contains the *mac-CellGroupConfig*:
  - 2> configure the MAC entity of this cell group as specified in 5.3.5.5.5;
- 1> if the *CellGroupConfig* contains the *sCellToReleaseList*:
  - 2> perform SCell release as specified in 5.3.5.5.8;
- 1> if the *CellGroupConfig* contains the *spCellConfig*:
  - 2> configure the SpCell as specified in 5.3.5.5.7;
- 1> if the *CellGroupConfig* contains the *sCellToAddModList*:
  - 2> perform SCell addition/modification as specified in 5.3.5.5.9;
- 1> if the *CellGroupConfig* contains the *bh-RLC-ChannelToReleaseList*:
  - 2> perform BH RLC channel release as specified in 5.3.5.5.10;
- 1> if the *CellGroupConfig* contains the *bh-RLC-ChannelToAddModList*:
  - 2> perform the BH RLC channel addition/modification as specified in 5.3.5.5.11;

#### 5.3.5.5.2 Reconfiguration with sync

The UE shall perform the following actions to execute a reconfiguration with sync.

- 1> if the AS security is not activated, perform the actions upon going to RRC\_IDLE as specified in 5.3.11 with the release cause 'other' upon which the procedure ends;
- 1> if no DAPS bearer is configured:
  - 2> stop timer T310 for the corresponding SpCell, if running;
- 1> if this procedure is executed for the MCG:
  - 2> if timer T316 is running;

- 3> stop timer T316;
- 3> clear the information included in *VarRLF-Report*, if any;
- 2> resume MCG transmission, if suspended.
- 1> stop timer T312 for the corresponding SpCell, if running;
- 1> start timer T304 for the corresponding SpCell with the timer value set to *t304*, as included in the *reconfigurationWithSync*;
- 1> if the *frequencyInfoDL* is included:
  - 2> consider the target SpCell to be one on the SSB frequency indicated by the *frequencyInfoDL* with a physical cell identity indicated by the *physCellId*;
- 1> else:
  - 2> consider the target SpCell to be one on the SSB frequency of the source SpCell with a physical cell identity indicated by the *physCellId*;
- 1> start synchronising to the DL of the target SpCell;
- 1> apply the specified BCCH configuration defined in 9.1.1.1 for the target SpCell;
- 1> acquire the *MIB* of the target SpCell, which is scheduled as specified in TS 38.213 [13];

NOTE 1: The UE should perform the reconfiguration with sync as soon as possible following the reception of the RRC message triggering the reconfiguration with sync, which could be before confirming successful reception (HARQ and ARQ) of this message.

NOTE 2: The UE may omit reading the *MIB* if the UE already has the required timing information, or the timing information is not needed for random access.

NOTE 2a: A UE with DAPS bearer does not monitor for system information updates in the source PCell.

- 1> If any DAPS bearer is configured:
  - 2> create a MAC entity for the target cell group with the same configuration as the MAC entity for the source cell group;
  - 2> for each DAPS bearer:
    - 3> establish an RLC entity or entities for the target cell group, with the same configurations as for the source cell group;
    - 3> establish the logical channel for the target cell group, with the same configurations as for the source cell group;

NOTE 2b: In order to understand if a DAPS bearer is configured, the UE needs to check the presence of the field *daps-Config* within the *RadioBearerConfig* IE received in *radioBearerConfig* or *radioBearerConfig2*.

- 2> for each SRB:
  - 3> establish an RLC entity for the target cell group, with the same configurations as for the source cell group;
  - 3> establish the logical channel for the target cell group, with the same configurations as for the source cell group;
  - 3> suspend SRBs for the source cell group;

NOTE 3: Void

- 2> apply the value of the *newUE-Identity* as the C-RNTI in the target cell group;
- 2> configure lower layers for the target SpCell in accordance with the received *spCellConfigCommon*;

- 2> configure lower layers for the target SpCell in accordance with any additional fields, not covered in the previous, if included in the received *reconfigurationWithSync*.

1> else:

- 2> reset the MAC entity of this cell group;
- 2> consider the SCell(s) of this cell group, if configured, that are not included in the *SCellToAddModList* in the *RRCReconfiguration* message, to be in deactivated state;
- 2> apply the value of the *newUE-Identity* as the C-RNTI for this cell group;
- 2> configure lower layers in accordance with the received *spCellConfigCommon*;
- 2> configure lower layers in accordance with any additional fields, not covered in the previous, if included in the received *reconfigurationWithSync*.

### 5.3.5.5.3 RLC bearer release

The UE shall:

- 1> for each *logicalChannelIdentity* value included in the *rlc-BearerToReleaseList* that is part of the current UE configuration within the same cell group (LCH release); or
- 1> for each *logicalChannelIdentity* value that is to be released as the result of an SCG release according to 5.3.5.4:
  - 2> release the RLC entity or entities as specified in TS 38.322 [4], clause 5.1.3;
  - 2> release the corresponding logical channel.

### 5.3.5.5.4 RLC bearer addition/modification

For each *RLC-BearerConfig* received in the *rlc-BearerToAddModList* IE the UE shall:

- 1> if the UE's current configuration contains an RLC bearer with the received *logicalChannelIdentity* within the same cell group:
  - 2> if the RLC bearer is associated with an DAPS bearer :
    - 3> reconfigure the RLC entity or entities for the target cell group in accordance with the received *rlc-Config*;
    - 3> reconfigure the logical channel for the target cell group in accordance with the received *mac-LogicalChannelConfig*;
  - 2> else:
    - 3> if *reestablishRLC* is received:
      - 4> re-establish the RLC entity as specified in TS 38.322 [4];
    - 3> reconfigure the RLC entity or entities in accordance with the received *rlc-Config*;
    - 3> reconfigure the logical channel in accordance with the received *mac-LogicalChannelConfig*;

NOTE: The network does not re-associate an already configured logical channel with another radio bearer. Hence *servedRadioBearer* is not present in this case.

- 1> else (a logical channel with the given *logicalChannelIdentity* is not configured within the same cell group, including the case when full configuration option is used):
  - 2> if the *servedRadioBearer* associates the logical channel with an SRB and *rlc-Config* is not included:
    - 3> establish an RLC entity in accordance with the default configuration defined in 9.2 for the corresponding SRB;
  - 2> else:



- 3> establish an RLC entity in accordance with the received *rlc-Config*;
- 2> if the *servedRadioBearer* associates the logical channel with an SRB and if *mac-LogicalChannelConfig* is not included:
  - 3> configure this MAC entity with a logical channel in accordance to the default configuration defined in 9.2 for the corresponding SRB;
- 2> else:
  - 3> configure this MAC entity with a logical channel in accordance to the received *mac-LogicalChannelConfig*;
- 2> associate this logical channel with the PDCP entity identified by *servedRadioBearer*.

#### 5.3.5.5.5 MAC entity configuration

The UE shall:

- 1> if SCG MAC is not part of the current UE configuration (i.e. SCG establishment):
  - 2> create an SCG MAC entity;
- 1> if any DAPS bearer is configured:
  - 2> reconfigure the MAC main configuration for the target cell group in accordance with the received *mac-CellGroupConfig* excluding *tag-ToReleaseList* and *tag-ToAddModList*;
- 1> else:
  - 2> reconfigure the MAC main configuration of the cell group in accordance with the received *mac-CellGroupConfig* excluding *tag-ToReleaseList* and *tag-ToAddModList*;
- 1> if the received *mac-CellGroupConfig* includes the *tag-ToReleaseList*:
  - 2> for each *TAG-Id* value included in the *tag-ToReleaseList* that is part of the current UE configuration:
    - 3> release the TAG indicated by *TAG-Id*;
- 1> if the received *mac-CellGroupConfig* includes the *tag-ToAddModList*:
  - 2> for each *tag-Id* value included in *tag-ToAddModList* that is not part of the current UE configuration (TAG addition):
    - 3> add the TAG, corresponding to the *tag-Id*, in accordance with the received *timeAlignmentTimer*;
  - 2> for each *tag-Id* value included in *tag-ToAddModList* that is part of the current UE configuration (TAG modification):
    - 3> reconfigure the TAG, corresponding to the *tag-Id*, in accordance with the received *timeAlignmentTimer*.

#### 5.3.5.5.6 RLF Timers & Constants configuration

The UE shall:

- 1> if the received *rlf-TimersAndConstants* is set to *release*:
  - 2> if any DAPS bearer is configured:
    - 3> use values for timers T301, T310, T311 and constants N310, N311 for the target cell group, as included in *ue-TimersAndConstants* received in *SIB1*;
  - 2> else:
    - 3> use values for timers T301, T310, T311 and constants N310, N311, as included in *ue-TimersAndConstants* received in *SIB1*;

1> else:

2> if any DAPS bearer is configured:

3> configure the value of timers and constants for the target cell group in accordance with received *rlf-TimersAndConstants*;

2> else:

3> (re-)configure the value of timers and constants in accordance with received *rlf-TimersAndConstants*;

3> stop timer T310 for this cell group, if running;

3> stop timer T312 for this cell group, if running;

3> reset the counters N310 and N311.

### 5.3.5.5.7 SpCell Configuration

The UE shall:

1> if the *SpCellConfig* contains the *rlf-TimersAndConstants*:

2> configure the RLF timers and constants for this cell group as specified in 5.3.5.5.6;

1> else if *rlf-TimersAndConstants* is not configured for this cell group:

2> if any DAPS bearer is configured:

3> use values for timers T301, T310, T311 and constants N310, N311 for the target cell group, as included in *ue-TimersAndConstants* received in *SIB1*;

2> else

3> use values for timers T301, T310, T311 and constants N310, N311, as included in *ue-TimersAndConstants* received in *SIB1*;

1> if the *SpCellConfig* contains *spCellConfigDedicated*:

2> configure the SpCell in accordance with the *spCellConfigDedicated*;

2> consider the bandwidth part indicated in *firstActiveUplinkBWP-Id* if configured to be the active uplink bandwidth part;

2> consider the bandwidth part indicated in *firstActiveDownlinkBWP-Id* if configured to be the active downlink bandwidth part;

2> if any of the reference signal(s) that are used for radio link monitoring are reconfigured by the received *spCellConfigDedicated*:

3> stop timer T310 for the corresponding SpCell, if running;

3> stop timer T312 for the corresponding SpCell, if running;

3> reset the counters N310 and N311.

### 5.3.5.5.8 SCell Release

The UE shall:

1> if the release is triggered by reception of the *sCellToReleaseList*:

2> for each *sCellIndex* value included in the *sCellToReleaseList*:

3> if the current UE configuration includes an SCell with value *sCellIndex*:

4> release the SCell.

### 5.3.5.5.9 SCell Addition/Modification

The UE shall:

- 1> for each *sCellIndex* value included in the *sCellToAddModList* that is not part of the current UE configuration (SCell addition):
  - 2> add the SCell, corresponding to the *sCellIndex*, in accordance with the *sCellConfigCommon* and *sCellConfigDedicated*;
  - 2> if the *sCellState* is included:
    - 3> configure lower layers to consider the SCell to be in activated state;
  - 2> else:
    - 3> configure lower layers to consider the SCell to be in deactivated state;
- 2> for each *measId* included in the *measIdList* within *VarMeasConfig*:
  - 3> if SCells are not applicable for the associated measurement; and
  - 3> if the concerned SCell is included in *cellsTriggeredList* defined within the *VarMeasReportList* for this *measId*:
    - 4> remove the concerned SCell from *cellsTriggeredList* defined within the *VarMeasReportList* for this *measId*;
- 1> for each *sCellIndex* value included in the *sCellToAddModList* that is part of the current UE configuration (SCell modification):
  - 2> modify the SCell configuration in accordance with the *sCellConfigDedicated*;
  - 2> if the *sCellToAddModList* was received in an *RRCReconfiguration* message including *reconfigurationWithSync* embedded in an *RRCResume* message or embedded in an E-UTRA *RRCConnectionResume* message:
    - 3> if the *sCellState* is included:
      - 4> configure lower layers to consider the SCell to be in activated state;
    - 3> else:
      - 4> configure lower layers to consider the SCell to be in deactivated state.

### 5.3.5.5.10 BH RLC channel release

The IAB-node shall:

- 1> for each *BH-RLC-ChannelID* value included in the *bh-RLC-ChannelToReleaseList* that is part of the current IAB-node configuration within the same cell group (LCH release); or
- 1> for each *BH-RLC-ChannelID* value that is to be released as the result of an SCG release according to 5.3.5.4:
  - 2> release the RLC entity or entities as specified in TS 38.322 [4], clause 5.1.3;
  - 2> release the corresponding logical channel.

### 5.3.5.5.11 BH RLC channel addition/modification

For each *BH-RLC-ChannelConfig* received in the *bh-RLC-ChannelToAddModList* IE the IAB-node shall:

- 1> if the current configuration contains a BH RLC Channel with the received *BH-RLC-ChannelID* within the same cell group:
- 2> if *reestablishRLC* is received:

- 3> re-establish the RLC entity as specified in TS 38.322 [4];
- 2> reconfigure the RLC entity or entities in accordance with the received *rlc-Config*;
- 2> reconfigure the logical channel in accordance with the received *mac-LogicalChannelConfig*;
- 1> else (a backhaul logical channel with the given *bh-RLC-ChannelID* was not configured before within the same cell group):
  - 2> establish an RLC entity in accordance with the received *rlc-Config*;
  - 2> configure this MAC entity with a logical channel in accordance to the received *mac-LogicalChannelConfig*.

### 5.3.5.6 Radio Bearer configuration

#### 5.3.5.6.1 General

The UE shall perform the following actions based on a received *RadioBearerConfig* IE:

- 1> if the *RadioBearerConfig* includes the *srb3-ToRelease*:
  - 2> perform the SRB release as specified in 5.3.5.6.2;
- 1> if the *RadioBearerConfig* includes the *srb-ToAddModList* or if any DAPS bearer is configured:
  - 2> perform the SRB addition or reconfiguration as specified in 5.3.5.6.3;
- 1> if the *RadioBearerConfig* includes the *drb-ToReleaseList*:
  - 2> perform DRB release as specified in 5.3.5.6.4;
- 1> if the *RadioBearerConfig* includes the *drb-ToAddModList*:
  - 2> perform DRB addition or reconfiguration as specified in 5.3.5.6.5.
- 1> release all SDAP entities, if any, that have no associated DRB as specified in TS 37.324 [24] clause 5.1.2, and indicate the release of the user plane resources for PDU Sessions associated with the released SDAP entities to upper layers.

#### 5.3.5.6.2 SRB release

The UE shall:

- 1> release the PDCP entity and the *srb-Identity* of the SRB3.

#### 5.3.5.6.3 SRB addition/modification

The UE shall:

- 1> If any DAPS bearer is configured for each SRB:
  - 2> establish a PDCP entity for the target cell group as specified in TS 38.323 [5], with the same configuration as the PDCP entity for the source cell group;
  - 2> if the *masterKeyUpdate* is received:
    - 3> configure the PDCP entity with the security algorithms according to *securityConfig* and apply the keys (KRRRCenc and KRRCint) associated with the master key (K<sub>gNB</sub>);
  - 2> else:
    - 3> configure the PDCP entity for the target cell group with state variables continuation as specified in TS 38.323 [5], the state variables and security configuration as the PDCP entity for the source cell group;

- 1> for each *srb-Identity* value included in the *srb-ToAddModList* that is not part of the current UE configuration (SRB establishment or reconfiguration from E-UTRA PDCP to NR PDCP):
  - 2> establish a PDCP entity;
  - 2> if AS security has been activated:
    - 3> if target RAT of handover is E-UTRA/5GC; or
    - 3> if the UE is connected to E-UTRA/5GC:
      - 4> if the UE is capable of E-UTRA/5GC, but not capable of NGEN-DC:
        - 5> configure the PDCP entity with the security algorithms and keys ( $K_{RRCEnc}$  and  $K_{RRCint}$ ) configured/derived as specified in TS 36.331 [10];
      - 4> else (i.e., UE capable of NGEN-DC):
        - 5> configure the PDCP entity with the security algorithms according to *securityConfig* and apply the keys ( $K_{RRCEnc}$  and  $K_{RRCint}$ ) associated with the master key ( $K_{eNB}$ ) or secondary key ( $S-K_{gNB}$ ) as indicated in *keyToUse*, if applicable;
    - 3> else (i.e., UE connected to NR or UE in EN-DC):
      - 4> configure the PDCP entity with the security algorithms according to *securityConfig* and apply the keys ( $K_{RRCEnc}$  and  $K_{RRCint}$ ) associated with the master key ( $K_{eNB}/K_{gNB}$ ) or secondary key ( $S-K_{gNB}$ ) as indicated in *keyToUse*, if applicable;
  - 2> if the current UE configuration as configured by E-UTRA in TS 36.331 [10] includes an SRB identified with the same *srb-Identity* value:
    - 3> associate the E-UTRA RLC entity and DCCH of this SRB with the NR PDCP entity;
    - 3> release the E-UTRA PDCP entity of this SRB;
  - 2> if the *pdcp-Config* is included:
    - 3> configure the PDCP entity in accordance with the received *pdcp-Config*;
  - 2> else:
    - 3> configure the PDCP entity in accordance with the default configuration defined in 9.2.1 for the corresponding SRB;
- 1> if any DAPS bearer is configured, for each *srb-Identity* value included in the *srb-ToAddModList* that is part of the current UE configuration:
  - 2> if the *pdcp-Config* is included:
    - 3> reconfigure the PDCP entity for the target cell group in accordance with the received *pdcp-Config*;
- 1> else, for each *srb-Identity* value included in the *srb-ToAddModList* that is part of the current UE configuration:
  - 2> if the *reestablishPDCP* is set:
    - 3> if target RAT of handover is E-UTRA/5GC; or
    - 3> if the UE is connected to E-UTRA/5GC:
      - 4> if the UE is capable of E-UTRA/5GC, but not capable of NGEN-DC:
        - 5> configure the PDCP entity to apply the integrity protection algorithm and  $K_{RRCint}$  key configured/derived as specified in TS 36.331 [10], i.e. the integrity protection configuration shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;

- 5> configure the PDCP entity to apply the ciphering algorithm and  $K_{RRCCenc}$  key configured/derived as specified in TS 36.331 [10], i.e. the ciphering configuration shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;
- 4> else (i.e., a UE capable of NGEN-DC):
  - 5> configure the PDCP entity to apply the integrity protection algorithm and  $K_{RRCCint}$  key associated with the master key ( $K_{eNB}$ ) or secondary key ( $S-K_{gNB}$ ), as indicated in *keyToUse*, i.e. the integrity protection configuration shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;
  - 5> configure the PDCP entity to apply the ciphering algorithm and  $K_{RRCCenc}$  key associated with the master key ( $K_{eNB}$ ) or secondary key ( $S-K_{gNB}$ ) as indicated in *keyToUse*, i.e. the ciphering configuration shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;
- 3> else (i.e., UE connected to NR or UE in EN-DC):
  - 4> configure the PDCP entity to apply the integrity protection algorithm and  $K_{RRCCint}$  key associated with the master key ( $K_{eNB}/K_{gNB}$ ) or secondary key ( $S-K_{gNB}$ ), as indicated in *keyToUse*, i.e. the integrity protection configuration shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;
  - 4> configure the PDCP entity to apply the ciphering algorithm and  $K_{RRCCenc}$  key associated with the master key ( $K_{eNB}/K_{gNB}$ ) or secondary key ( $S-K_{gNB}$ ) as indicated in *keyToUse*, i.e. the ciphering configuration shall be applied to all subsequent messages received and sent by the UE, including the message used to indicate the successful completion of the procedure;
- 3> re-establish the PDCP entity of this SRB as specified in TS 38.323 [5];
- 2> else, if the *discardOnPDCP* is set:
  - 3> trigger the PDCP entity to perform SDU discard as specified in TS 38.323 [5];
- 2> if the *pdcp-Config* is included:
  - 3> reconfigure the PDCP entity in accordance with the received *pdcp-Config*.

#### 5.3.5.6.4 DRB release

The UE shall:

- 1> for each *drb-Identity* value included in the *drb-ToReleaseList* that is part of the current UE configuration; or
- 1> for each *drb-Identity* value that is to be released as the result of full configuration according to 5.3.5.11:
  - 2> release the PDCP entity and the *drb-Identity*;
  - 2> if SDAP entity associated with this DRB is configured:
    - 3> indicate the release of the DRB to SDAP entity associated with this DRB (TS 37.324 [24], clause 5.3.3);
  - 2> if the DRB is associated with an *eps-BearerIdentity*:
    - 3> if a new bearer is not added either with NR or E-UTRA with same *eps-BearerIdentity*:
      - 4> indicate the release of the DRB and the *eps-BearerIdentity* of the released DRB to upper layers.

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: Whether or not the RLC and MAC entities associated with this PDCP entity are reset or released is determined by the *CellGroupConfig*.

## 5.3.5.6.5 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> establish a PDCP entity and configure it in accordance with the received *pdcip-Config*;
  - 2> if the PDCP entity of this DRB is not configured with *cipheringDisabled*:
    - 3> if target RAT of handover is E-UTRA/5GC; or
    - 3> if the UE is connected to E-UTRA/5GC:
      - 4> if the UE is capable of E-UTRA/5GC but not capable of NGEN-DC:
        - 5> configure the PDCP entity with the ciphering algorithm and  $K_{UPenc}$  key configured/derived as specified in TS 36.331 [10];
      - 4> else (i.e., a UE capable of NGEN-DC):
        - 5> configure the PDCP entity with the ciphering algorithms according to *securityConfig* and apply the key ( $K_{UPenc}$ ) associated with the master key ( $K_{eNB}$ ) or secondary key ( $S-K_{gNB}$ ) as indicated in *keyToUse*, if applicable;
    - 3> else (i.e., UE connected to NR or UE connected to E-UTRA/EPC):
      - 4> configure the PDCP entity with the ciphering algorithms according to *securityConfig* and apply the  $K_{UPenc}$  key associated with the master key ( $K_{eNB}/K_{gNB}$ ) or the secondary key ( $S-K_{gNB}/S-K_{eNB}$ ) as indicated in *keyToUse*;
  - 2> if the PDCP entity of this DRB is configured with *integrityProtection*:
    - 3> configure the PDCP entity with the integrity protection algorithms according to *securityConfig* and apply the  $K_{UPint}$  key associated with the master ( $K_{gNB}$ ) or the secondary key ( $S-K_{gNB}$ ) as indicated in *keyToUse*;
  - 2> if an *sdap-Config* is included:
    - 3> if an SDAP entity with the received *pdu-Session* does not exist:
      - 4> establish an SDAP entity as specified in TS 37.324 [24] clause 5.1.1;
      - 4> if an SDAP entity with the received *pdu-Session* did not exist prior to receiving this reconfiguration:
        - 5> indicate the establishment of the user plane resources for the *pdu-Session* to upper layers;
    - 3> configure the SDAP entity in accordance with the received *sdap-Config* as specified in TS 37.324 [24] and associate the DRB with the SDAP entity;
  - 2> if the DRB is associated with an *eps-BearerIdentity*:
    - 3> if the DRB was configured with the same *eps-BearerIdentity* either by NR or E-UTRA prior to receiving this reconfiguration:
      - 4> associate the established DRB with the corresponding *eps-BearerIdentity*;
    - 3> else:
      - 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 and configured as DAPS bearer:

- 2> reconfigure the PDCP entity to configure DAPS with the ciphering function, integrity protection function and ROHC function of the target cell group as specified in TS 38.323 [5] and configure it in accordance with the received *pdcp-Config*;
- 2> if the *masterKeyUpdate* is received:
  - 3> if the ciphering function of the target cell group PDCP entity is not configured with *cipheringDisabled*:
    - 4> configure the ciphering function of the target cell group PDCP entity with the ciphering algorithm according to *securityConfig* and apply the  $K_{UPenc}$  key associated with the master key ( $K_{gNB}$ ), as indicated in *keyToUse*, i.e. the ciphering configuration shall be applied to all subsequent PDCP PDUs received from the target cell group and sent to the target cell group by the UE;
  - 3> if the integrity protection function of the target cell group PDCP entity is configured with *integrityProtection*:
    - 4> configure the integrity protection function of the target cell group PDCP entity with the integrity protection algorithms according to *securityConfig* and apply the  $K_{UPint}$  key associated with the master key ( $K_{gNB}$ ) as indicated in *keyToUse*;
- 2> else:
  - 3> configure the ciphering function and the integrity protection function of the target cell group PDCP entity with the same security configuration as the PDCP entity for the source cell group;
- 2> if the *sdap-Config* is included and when indication of successful completion of random access towards target cell is received from lower layers as specified in [3]:
  - 3> reconfigure the SDAP entity in accordance with the received *sdap-Config* as specified in TS 37.324 [24];
  - 3> for each QFI value added in *mappedQoS-FlowsToAdd*, if the QFI value is previously configured, the QFI value is released from the old DRB;
- 1> for each *drb-Identity* value included in the *drb-ToAddModList* that is part of the current UE configuration and not configured as DAPS bearer:
  - 2> if the *reestablishPDCP* is set:
    - 3> if target RAT of handover is E-UTRA/5GC; or
    - 3> if the UE is connected to E-UTRA/5GC:
      - 4> if the UE is capable of E-UTRA/5GC but not capable of NGEN-DC:
        - 5> if the PDCP entity of this DRB is not configured with *cipheringDisabled*:
          - 6> configure the PDCP entity with the ciphering algorithm and  $K_{UPenc}$  key configured/derived as specified in TS 36.331 [10], clause 5.4.2.3, i.e. the ciphering configuration shall be applied to all subsequent PDCP PDUs received and sent by the UE;
      - 4> else (i.e., a UE capable of NGEN-DC):
        - 5> if the PDCP entity of this DRB is not configured with *cipheringDisabled*:
          - 6> configure the PDCP entity with the ciphering algorithm and  $K_{UPenc}$  key associated with the master key ( $K_{eNB}$ ) or the secondary key ( $S-K_{gNB}$ ), as indicated in *keyToUse*, i.e. the ciphering configuration shall be applied to all subsequent PDCP PDUs received and sent by the UE;
    - 3> else (i.e., UE connected to NR or UE in EN-DC):
      - 4> if the PDCP entity of this DRB is not configured with *cipheringDisabled*:
        - 5> configure the PDCP entity with the ciphering algorithm and  $K_{UPenc}$  key associated with the master key ( $K_{eNB}/K_{gNB}$ ) or the secondary key ( $S-K_{gNB}/S-K_{eNB}$ ), as indicated in *keyToUse*, i.e. the ciphering configuration shall be applied to all subsequent PDCP PDUs received and sent by the UE;



- 4> if the PDCP entity of this DRB is configured with *integrityProtection*:
  - 5> configure the PDCP entity with the integrity protection algorithms according to *securityConfig* and apply the  $K_{UPint}$  key associated with the master key ( $K_{gNB}$ ) or the secondary key ( $S-K_{gNB}$ ) as indicated in *keyToUse*;
- 3> if *drb-ContinueROHC* is included in *pdcp-Config*:
  - 4> indicate to lower layer that *drb-ContinueROHC* is configured;
- 3> if *drb-ContinueEHC-DL* is included in *pdcp-Config*:
  - 4> indicate to lower layer that *drb-ContinueEHC-DL* is configured;
- 3> if *drb-ContinueEHC-UL* is included in *pdcp-Config*:
  - 4> indicate to lower layer that *drb-ContinueEHC-UL* is configured;
- 3> re-establish the PDCP entity of this DRB as specified in TS 38.323 [5], clause 5.1.2;
- 2> else, if the *recoverPDCP* is set:
  - 3> trigger the PDCP entity of this DRB to perform data recovery as specified in TS 38.323 [5];
- 2> if the *pdcp-Config* is included:
  - 3> reconfigure the PDCP entity in accordance with the received *pdcp-Config*.
- 2> if the *sdap-Config* is included:
  - 3> reconfigure the SDAP entity in accordance with the received *sdap-Config* as specified in TS37.324 [24];
  - 3> for each QFI value added in *mappedQoS-FlowsToAdd*, if the QFI value is previously configured, the QFI value is released from the old DRB;

NOTE 1: Void.

NOTE 2: When determining whether a *drb-Identity* value is part of the current UE configuration, the UE does not distinguish which *RadioBearerConfig* and *DRB-ToAddModList* that DRB was originally configured in. To re-associate a DRB with a different key ( $K_{eNB}$  to  $S-K_{gNB}$ ,  $K_{gNB}$  to  $S-K_{eNB}$ ,  $K_{gNB}$  to  $S-K_{gNB}$ , or vice versa), the network provides the *drb-Identity* value in the (target) *drb-ToAddModList* and sets the *reestablishPDCP* flag. The network does not list the *drb-Identity* in the (source) *drb-ToReleaseList*.

NOTE 3: When setting the *reestablishPDCP* flag for a radio bearer, the network ensures that the RLC receiver entities do not deliver old PDCP PDUs to the re-established PDCP entity. It does that e.g. by triggering a reconfiguration with sync of the cell group hosting the old RLC entity or by releasing the old RLC entity.

NOTE 4: In this specification, UE configuration refers to the parameters configured by NR RRC unless otherwise stated.

NOTE 5: Ciphering and integrity protection can be enabled or disabled for a DRB. The enabling/disabling of ciphering or integrity protection can be changed only by releasing and adding the DRB.

### 5.3.5.7 AS Security key update

The UE shall:

- 1> if UE is connected to E-UTRA/EPC or E-UTRA/5GC:
  - 2> upon reception of *sk-Counter* as specified in TS 36.331 [10]:
    - 3> update the  $S-K_{gNB}$  key based on the  $K_{eNB}$  key and using the received *sk-Counter* value, as specified in TS 33.401 [30] for EN-DC, or TS 33.501 [11] for NGEN-DC;
    - 3> derive the  $K_{RRCenc}$  and  $K_{UPenc}$  keys as specified in TS 33.401 [30] for EN-DC, or TS 33.501 [11] for NGEN-DC;

- 3> derive the  $K_{RRCint}$  and  $K_{UPint}$  keys as specified in TS 33.401 [30] for EN-DC or TS 33.501 [11] for NGEN-DC.
- 1> else if this procedure was initiated due to reception of the *masterKeyUpdate*:
- 2> if the *nas-Container* is included in the received *masterKeyUpdate*:
- 3> forward the *nas-Container* to the upper layers;
- 2> if the *keySetChangeIndicator* is set to *true*:
- 3> derive or update the  $K_{gNB}$  key based on the  $K_{AMF}$  key, as specified in TS 33.501 [11];
- 2> else:
- 3> derive or update the  $K_{gNB}$  key based on the current  $K_{gNB}$  key or the  $NH$ , using the *nextHopChainingCount* value indicated in the received *masterKeyUpdate*, as specified in TS 33.501 [11];
- 2> store the *nextHopChainingCount* value;
- 2> derive the keys associated with the  $K_{gNB}$  key as follows:
- 3> if the *securityAlgorithmConfig* is included in *SecurityConfig*:
- 4> derive the  $K_{RRCenc}$  and  $K_{UPenc}$  keys associated with the *cipheringAlgorithm* indicated in the *securityAlgorithmConfig*, as specified in TS 33.501 [11];
- 4> derive the  $K_{RRCint}$  and  $K_{UPint}$  keys associated with the *integrityProtAlgorithm* indicated in the *securityAlgorithmConfig*, as specified in TS 33.501 [11];
- 3> else:
- 4> derive the  $K_{RRCenc}$  and  $K_{UPenc}$  keys associated with the current *cipheringAlgorithm*, as specified in TS 33.501 [11];
- 4> derive the  $K_{RRCint}$  and  $K_{UPint}$  keys associated with the current *integrityProtAlgorithm*, as specified in TS 33.501 [11].

NOTE 1: Ciphering and integrity protection are optional to configure for the DRBs.

- 1> else if this procedure was initiated due to reception of the *sk-Counter* (UE is in NE-DC, or NR-DC, or is configured with SN terminated bearer(s)):
- 2> derive or update the secondary key (S- $K_{gNB}$  or S-KeNB) based on the  $K_{gNB}$  key and using the received *sk-Counter* value, as specified in TS 33.501 [11];
- 2> derive the  $K_{RRCenc}$  key and the  $K_{UPenc}$  key as specified in TS 33.501 [11] using the ciphering algorithms indicated in the *RadioBearerConfig* associated with the secondary key (S- $K_{gNB}$  or S-KeNB) as indicated by *keyToUse*;
- 2> derive the  $K_{RRCint}$  key and the  $K_{UPint}$  key as specified in TS 33.501 [11] using the integrity protection algorithms indicated in the *RadioBearerConfig* associated with the secondary key (S- $K_{gNB}$  or S-KeNB) as indicated by *keyToUse*;

NOTE 2: If the UE has no radio bearer configured with *keyToUse* set to *secondary* and receives the *sk-Counter* without any *RadioBearerConfig* with *keyToUse* set to *secondary*, the UE does not consider it as an invalid reconfiguration.

### 5.3.5.8 Reconfiguration failure

#### 5.3.5.8.1 Void

#### 5.3.5.8.2 Inability to comply with *RRCReconfiguration*

The UE shall:

- 1> if the UE is in (NG)EN-DC:
  - 2> if the UE is unable to comply with (part of) the configuration included in the *RRCReconfiguration* message received over SRB3;
    - 3> continue using the configuration used prior to the reception of *RRCReconfiguration* message;
    - 3> if MCG transmission is not suspended:
      - 4> initiate the SCG failure information procedure as specified in subclause 5.7.3 to report SCG reconfiguration error, upon which the connection reconfiguration procedure ends;
    - 3> else:
      - 4> initiate the connection re-establishment procedure as specified in TS 36.331 [10], clause 5.3.7, upon which the connection reconfiguration procedure ends;
  - 2> else, if the UE is unable to comply with (part of) the configuration included in the *RRCReconfiguration* message received over SRB1;
    - 3> continue using the configuration used prior to the reception of *RRCReconfiguration* message;
    - 3> initiate the connection re-establishment procedure as specified in TS 36.331 [10], clause 5.3.7, upon which the connection reconfiguration procedure ends.
- 1> else if *RRCReconfiguration* is received via NR (i.e., NR standalone, NE-DC, or NR-DC):
  - 2> if the UE is unable to comply with (part of) the configuration included in the *RRCReconfiguration* message received over SRB3;

NOTE 0: This case does not apply in NE-DC.

- 3> continue using the configuration used prior to the reception of *RRCReconfiguration* message;
- 3> if MCG transmission is not suspended:
  - 4> initiate the SCG failure information procedure as specified in subclause 5.7.3 to report SCG reconfiguration error, upon which the connection reconfiguration procedure ends;
- 3> else:
  - 4> initiate the connection re-establishment procedure as specified in clause 5.3.7, upon which the connection reconfiguration procedure ends;
- 2> else if the UE is unable to comply with (part of) the configuration included in the *RRCReconfiguration* message received over the SRB1 or if the upper layers indicate that the *nas-Container* is invalid:

NOTE 0a: The compliance also covers the SCG configuration carried within octet strings e.g. field *mrdc-SecondaryCellGroupConfig*. I.e. the failure behaviour defined also applies in case the UE cannot comply with the embedded SCG configuration or with the combination of (parts of) the MCG and SCG configurations.

NOTE 0b: The compliance also covers the E-UTRA sidelink configuration carried within an octet string, e.g. field *sl-ConfigDedicatedEUTRA*. I.e. the failure behaviour defined also applies in case the UE cannot comply with the embedded E-UTRA sidelink configuration.

- 3> continue using the configuration used prior to the reception of *RRCReconfiguration* message;
- 3> if AS security has not been activated:
  - 4> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'other'
- 3> else if AS security has been activated but SRB2 and at least one DRB or, for IAB, SRB2, have not been setup:
  - 4> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'RRC connection failure';

3> else:

4> initiate the connection re-establishment procedure as specified in 5.3.7, upon which the reconfiguration procedure ends;

1> else if *RRCReconfiguration* is received via other RAT (Handover to NR failure):

2> if the UE is unable to comply with any part of the configuration included in the *RRCReconfiguration* message or if the upper layers indicate that the *nas-Container* is invalid:

3> perform the actions defined for this failure case as defined in the specifications applicable for the other RAT.

NOTE 1: The UE may apply above failure handling also in case the *RRCReconfiguration* message causes a protocol error for which the generic error handling as defined in clause 10 specifies that the UE shall ignore the message.

NOTE 2: If the UE is unable to comply with part of the configuration, it does not apply any part of the configuration, i.e. there is no partial success/failure.

NOTE 3: It is up to UE implementation whether the compliance check for an *RRCReconfiguration* received as part of *ConditionalReconfiguration* is performed upon the reception of the message or upon CHO and CPC execution (when the message is required to be applied).

### 5.3.5.8.3 T304 expiry (Reconfiguration with sync Failure)

The UE shall:

1> if T304 of the MCG expires:

2> release dedicated preambles provided in *rach-ConfigDedicated* if configured;

2> release dedicated msgA PUSCH resources provided in *rach-ConfigDedicated* if configured;

2> if any DAPS bearer is configured, and radio link failure is not detected in the source PCell, according to subclause 5.3.10.3:

3> release target PCell configuration;

3> reset MAC for the target PCell and release the MAC configuration for the target PCell;

3> for each DAPS bearer:

4> release the RLC entity or entities as specified in TS 38.322 [4], clause 5.1.3, and the associated logical channel for the target PCell;

4> reconfigure the PDCP entity to release DAPS as specified in TS 38.323 [5];

3> for each SRB:

4> if the *masterKeyUpdate* was not received:

5> configure the PDCP entity for the source PCell with state variables continuation as specified in TS 38.323 [5], the state variables as the PDCP entity for the target PCell;

4> release the PDCP entity for the target PCell;

4> release the RLC entity as specified in TS 38.322 [4], clause 5.1.3, and the associated logical channel for the target PCell;

4> trigger the PDCP entity for the source PCell to perform SDU discard as specified in TS 38.323 [5];

4> re-establish the RLC entity for the source PCell;

3> release the physical channel configuration for the target PCell;

3> revert back to the SDAP configuration used in the source PCell;

- 3> discard the keys used in target PCell (the  $K_{gNB}$  key, the  $K_{RRcenc}$  key, the  $K_{RRcint}$  key, the  $K_{UPint}$  key and the  $K_{UPenc}$  key), if any;
- 3> resume suspended SRBs in the source PCell;
- 3> for each non DAPS bearer:
  - 4> revert back to the UE configuration used for the DRB in the source PCell, includes PDCP, RLC states variables, the security configuration and the data stored in transmission and reception buffers in PDCP and RLC entities ;
- 3> revert back to the UE measurement configuration used in the source PCell;
- 3> initiate the failure information procedure as specified in subclause 5.7.5 to report DAPS handover failure.

2> else:

- 3> revert back to the UE configuration used in the source PCell;
- 3> store the handover failure information in *VarRLF-Report* as described in the subclause 5.3.10.5;
- 3> initiate the connection re-establishment procedure as specified in subclause 5.3.7.

NOTE 1: In the context above, "the UE configuration" includes state variables and parameters of each radio bearer.

1> else if T304 of a secondary cell group expires:

2> if MCG transmission is not suspended:

- 3> release dedicated preambles provided in *rach-ConfigDedicated*, if configured;
- 3> initiate the SCG failure information procedure as specified in subclause 5.7.3 to report SCG reconfiguration with sync failure, upon which the RRC reconfiguration procedure ends;

2> else:

- 3> initiate the connection re-establishment procedure as specified in subclause 5.3.7;

1> else if T304 expires when *RRCReconfiguration* is received via other RAT (HO to NR failure):

2> reset MAC;

2> perform the actions defined for this failure case as defined in the specifications applicable for the other RAT.

NOTE 2: In this clause, the term 'handover failure' has been used to refer to 'reconfiguration with sync failure'.

### 5.3.5.9 Other configuration

The UE shall:

1> if the received *otherConfig* includes the *delayBudgetReportingConfig*:

2> if *delayBudgetReportingConfig* is set to *setup*:

- 3> consider itself to be configured to send delay budget reports in accordance with 5.7.4;

2> else:

- 3> consider itself not to be configured to send delay budget reports and stop timer T342, if running.

1> if the received *otherConfig* includes the *overheatingAssistanceConfig*:

2> if *overheatingAssistanceConfig* is set to *setup*:

- 3> consider itself to be configured to provide overheating assistance information in accordance with 5.7.4;

2> else:

- 3> consider itself not to be configured to provide overheating assistance information and stop timer T345, if running;
- 1> if the received *otherConfig* includes the *idc-AssistanceConfig*:
  - 2> if *idc-AssistanceConfig* is set to *setup*:
    - 3> consider itself to be configured to provide IDC assistance information in accordance with 5.7.4;
  - 2> else:
    - 3> consider itself not to be configured to provide IDC assistance information;
- 1> if the received *otherConfig* includes the *drx-PreferenceConfig*:
  - 2> if *drx-PreferenceConfig* is set to *setup*:
    - 3> consider itself to be configured to provide its preference on DRX parameters for power saving for the cell group in accordance with 5.7.4;
  - 2> else:
    - 3> consider itself not to be configured to provide its preference on DRX parameters for power saving for the cell group and stop timer T346a associated with the cell group, if running;
- 1> if the received *otherConfig* includes the *maxBW-PreferenceConfig*:
  - 2> if *maxBW-PreferenceConfig* is set to *setup*:
    - 3> consider itself to be configured to provide its preference on the maximum aggregated bandwidth for power saving for the cell group in accordance with 5.7.4;
  - 2> else:
    - 3> consider itself not to be configured to provide its preference on the maximum aggregated bandwidth for power saving for the cell group and stop timer T346b associated with the cell group, if running;
- 1> if the received *otherConfig* includes the *maxCC-PreferenceConfig*:
  - 2> if *maxCC-PreferenceConfig* is set to *setup*:
    - 3> consider itself to be configured to provide its preference on the maximum number of secondary component carriers for power saving for the cell group in accordance with 5.7.4;
  - 2> else:
    - 3> consider itself not to be configured to provide its preference on the maximum number of secondary component carriers for power saving for the cell group and stop timer T346c associated with the cell group, if running;
- 1> if the received *otherConfig* includes the *maxMIMO-LayerPreferenceConfig*:
  - 2> if *maxMIMO-LayerPreferenceConfig* is set to *setup*:
    - 3> consider itself to be configured to provide its preference on the maximum number of MIMO layers for power saving for the cell group in accordance with 5.7.4;
  - 2> else:
    - 3> consider itself not to be configured to provide its preference on the maximum number of MIMO layers for power saving for the cell group and stop timer T346d associated with the cell group, if running;
- 1> if the received *otherConfig* includes the *minSchedulingOffsetPreferenceConfig*:
  - 2> if *minSchedulingOffsetPreferenceConfig* is set to *setup*:
    - 3> consider itself to be configured to provide its preference on the minimum scheduling offset for cross-slot scheduling for power saving for the cell group in accordance with 5.7.4;

2> else:

3> consider itself not to be configured to provide its preference on the minimum scheduling offset for cross-slot scheduling for power saving for the cell group and stop timer T346e associated with the cell group, if running;

1> if the received *otherConfig* includes the *releasePreferenceConfig*:

2> if *releasePreferenceConfig* is set to *setup*:

3> consider itself to be configured to provide assistance information to transition out of RRC\_CONNECTED in accordance with 5.7.4;

2> else:

3> consider itself not to be configured to provide assistance information to transition out of RRC\_CONNECTED and stop timer T346f, if running.

1> if the received *otherConfig* includes the *obtainCommonLocation*:

2> include available detailed location information for any subsequent measurement report or any subsequent RLF report, CEF report and SCGFailureInformation;

NOTE 1: The UE is requested to attempt to have valid detailed location information available whenever sending a measurement report for which it is configured to include available detailed location information. The UE may not succeed e.g. because the user manually disabled the GPS hardware, due to no/poor satellite coverage. Further details, e.g. regarding when to activate GNSS, are up to UE implementation.

1> if the received *otherConfig* includes the *BT-NameList*:

2> if *BT-NameList* is set to *setup*, include available Bluetooth measurement results for any subsequent measurement report or any subsequent RLF report, CEF report and SCGFailureInformation;

1> if the received *otherConfig* includes the *WLAN-NameList*:

2> if *WLAN-NameList* is set to *setup*, include available WLAN measurement results for any subsequent measurement report or any subsequent RLF report, CEF report and SCGFailureInformation;

NOTE 2: The UE is requested to attempt to have valid Bluetooth measurements and WLAN measurements whenever sending a measurement report for which it is configured to include these measurements. The UE may not succeed e.g. because the user manually disabled the WLAN or Bluetooth hardware. Further details, e.g. regarding when to activate WLAN or Bluetooth, are up to UE implementation.

1> if the received *otherConfig* includes the *Sensor-NameList*:

2> if *Sensor-NameList* is set to *setup*, include available Sensor measurement results for any subsequent measurement report or any subsequent RLF report, CEF report and SCGFailureInformation;

1> if the received *otherConfig* includes the *sl-AssistanceConfigNR*:

2> if *sl-AssistanceConfigNR* is set to true:

3> consider itself to be configured to provide configured grant assistance information for NR sidelink communication in accordance with 5.7.4;

2> else:

3> consider itself not to be configured to provide configured grant assistance information for NR sidelink communication;

### 5.3.5.10 MR-DC release

The UE shall:

1> as a result of MR-DC release triggered by E-UTRA or NR:

- 2> release SRB3, if established, as specified in 5.3.5.6.2;
- 2> release *measConfig* associated with SCG;
- 2> if the UE is configured with NR SCG:
  - 3> release the SCG configuration as specified in clause 5.3.5.4;
  - 3> release *otherConfig* associated with the SCG;
  - 3> stop timers T346a, T346b, T346c, T346d and T346e associated with the SCG, if running;
- 2> else if the UE is configured with E-UTRA SCG:
  - 3> release the SCG configuration as specified in TS 36.331 [10], clause 5.3.10.19 to release the E-UTRA SCG;

### 5.3.5.11 Full configuration

The UE shall:

- 1> release/ clear all current dedicated radio configurations except for the following:
  - the MCG C-RNTI;
  - the AS security configurations associated with the master key;

NOTE 1: Radio configuration is not just the resource configuration but includes other configurations like *MeasConfig*. In case NR-DC or NE-DC is configured, this also includes the entire NR or E-UTRA SCG configuration which are released according to the MR-DC release procedure as specified in 5.3.5.10. The radio configuration does not include SRB1/SRB2 configurations and DRB configurations as configured by *radioBearerConfig* or *radioBearerConfig2*.

NOTE 1a: For NR sidelink communication, the radio configuration includes the sidelink RRC configuration received from the network, but does not include the sidelink RRC reconfiguration and sidelink UE capability received from other UEs via PC5-RRC. In addition, the UE considers the new NR sidelink configurations as full configuration, in case of state transition and change of system information used for NR sidelink communication.

- 1> if the *spCellConfig* in the *masterCellGroup* includes the *reconfigurationWithSync* (i.e., SpCell change):
  - 2> release/ clear all current common radio configurations;
  - 2> use the default values specified in 9.2.3 for timers T310, T311 and constants N310, N311;
- 1> else (full configuration after re-establishment or during RRC resume):
  - 2> use values for timers T301, T310, T311 and constants N310, N311, as included in *ue-TimersAndConstants* received in *SIB1*;
- 1> apply the default L1 parameter values as specified in corresponding physical layer specifications except for the following:
  - parameters for which values are provided in *SIB1*;
- 1> apply the default MAC Cell Group configuration as specified in 9.2.2;
- 1> for each *srb-Identity* value included in the *srb-ToAddModList* (SRB reconfiguration):
  - 2> apply the default SRB configuration defined in 9.2.1 for the corresponding SRB;

NOTE 2: This is to get the SRBs (SRB1 and SRB2 for reconfiguration with sync and SRB2 for resume and reconfiguration after re-establishment) to a known state from which the reconfiguration message can do further configuration.

- 1> for each *pdu-Session* that is part of the current UE configuration:



- 2> release the SDAP entity (clause 5.1.2 in TS 37.324 [24]);
- 2> release each DRB associated to the *pdu-Session* as specified in 5.3.5.6.4;

NOTE 3: This will retain the *pdu-Session* but remove the DRBs including *drb-identity* of these bearers from the current UE configuration. Setup of the DRBs within the AS is described in clause 5.3.5.6.5 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).

- 1> for each *pdu-Session* that is part of the current UE configuration but not added with same *pdu-Session* in the *drb-ToAddModList*:
  - 2> if the procedure was triggered due to reconfiguration with sync:
    - 3> indicate the release of the user plane resources for the *pdu-Session* to upper layers after successful reconfiguration with sync;
  - 2> else:
    - 3> indicate the release of the user plane resources for the *pdu-Session* to upper layers immediately;

### 5.3.5.12 BAP configuration

The IAB-MT shall:

- 1> if the *bap-Config* is set to *setup*:
  - 2> if no BAP entity is established:
    - 3> establish a BAP entity as specified in TS 38.340 [47];
  - 2> configure the BAP entity to use the *bap-Address* as this node's BAP address;
  - 2> if *defaultUL-BAP-RoutingID* is included:
    - 3> configure the BAP entity to apply the default UL BAP routing ID according to the configuration;
  - 2> if *defaultUL-BH-RLC-Channel* is included
    - 3> configure the BAP entity to apply the default UL BH RLC channel according to the configuration;
  - 2> if *flowControlFeedbackType* is included:
    - 3> configure the BAP entity to apply the flow control feedback according to the configuration;
- 1> if the *bap-config* is set to *release*:
  - 2> release the BAP entity as specified in TS 38.340 [47].

### 5.3.5.12a IAB Other Configuration

#### 5.3.5.12a.1 IP address management

##### 5.3.5.12a.1.1 IP Address Release

The IAB-MT shall:

- 1> if the release is triggered by reception of the *iab-IP-AddressToReleaseList*:
  - 2> for each *iab-IP-AddressIndex* value included in *iab-IP-AddressToReleaseList*:
    - 3> release the corresponding *IAB-IP-AddressConfiguration*.

## 5.3.5.12a.1.2 IP Address Addition/Modification

The IAB-MT shall:

- 1> for each *iab-IP-AddressIndex* value included in the *iab-IP-AddressToAddModList* that is not part of the current IAB-MT configuration:
  - 2> add the IP address indicated in *iab-IP-Address*, corresponding to the *iab-IP-AddressIndex*.
  - 2> if added IP address is *iPv4-Address*:
    - 3> if *iab-IP-Usage* is set to *f1-C* corresponding to the *iab-IP-AddressIndex*:
      - 4> store the received IPv4 address for F1-C traffic together with the IAB-donor-DU BAP address corresponding to the *iab-IP-AddressIndex*.
    - 3> else if *iab-IP-Usage* is set to *f1-U*:
      - 4> store the received IPv4 address for F1-U traffic together with the IAB-donor-DU BAP address corresponding to the *iab-IP-AddressIndex*.
    - 3> else if *iab-IP-Usage* is set to *non-F1*:
      - 4> store the received IPv4 address for non-F1 traffic together with the IAB-donor-DU BAP address corresponding to the *iab-IP-AddressIndex*.
    - 3> else:
      - 4> store the received IPv4 address for all traffic together with the IAB-donor-DU BAP address corresponding to the *iab-IP-AddressIndex*.
  - 2> else if *iPv6-Address* is included:
    - 3> if *iab-IP-Usage* is set to *f1-C*:
      - 4> store the received IPv6 address for F1-C traffic together with the IAB-donor-DU BAP address corresponding to the *iab-IP-AddressIndex*.
    - 3> else if *iab-IP-Usage* is set to *f1-U*:
      - 4> store the received IPv6 address for F1-U traffic together with the IAB-donor-DU BAP address corresponding to the *iab-IP-AddressIndex*.
    - 3> else if *iab-IP-Usage* is set to *non-F1*:
      - 4> store the received IPv6 address for non-F1 traffic together with the IAB-donor-DU BAP address corresponding to the *iab-IP-AddressIndex*.
    - 3> else:
      - 4> store the received IPv6 address for all traffic together with the IAB-donor-DU BAP address corresponding to the *iab-IP-AddressIndex*.
  - 2> else if *iPv6-Prefix* is included in *iab-IP-AddressToAddModList*:
    - 3> if *iab-IP-Usage* is set to *f1-C*:
      - 4> store the received IPv6 address prefix for F1-C traffic together with the IAB-donor-DU BAP address corresponding to the *iab-IP-AddressIndex*.
    - 3> else if *iab-IP-Usage* is set to *f1-U*:
      - 4> store the received IPv6 address prefix for F1-U traffic together with the IAB-donor-DU BAP address corresponding to the *iab-IP-AddressIndex*.
    - 3> else if *iab-IP-Usage* is set to *non-F1*:

- 4> store the received IPv6 address prefix for non-F1 traffic together with the IAB-donor-DU BAP address corresponding to the *iab-IP-AddressIndex*.
- 3> else:
  - 4> store the received IPv6 address prefixes for all traffic together with the IAB-donor-DU BAP address corresponding to the *iab-IP-AddressIndex*.
- 1> for each *iab-IP-AddressIndex* value included in the *iab-IP-AddressToAddModList* that is part of the current IAB-MT configuration:
  - 2> modify the IP address configuration(s) in accordance with the *IAB-IP-AddressConfiguration* corresponding to the *iab-IP-AddressIndex*.

### 5.3.5.13 Conditional Reconfiguration

#### 5.3.5.13.1 General

The network configures the UE with one or more candidate target SpCells in the conditional reconfiguration. The UE evaluates the condition of each configured candidate target SpCell. The UE applies the conditional reconfiguration associated with one of the target SpCells which fulfils associated execution condition. The network provides the configuration parameters for the target SpCell in the *ConditionalReconfiguration* IE.

The UE performs the following actions based on a received *ConditionalReconfiguration* IE:

- 1> if the *ConditionalReconfiguration* contains the *condReconfigToRemoveList*:
  - 2> perform conditional reconfiguration removal procedure as specified in 5.3.5.13.2;
- 1> if the *ConditionalReconfiguration* contains the *condReconfigToAddModList*:
  - 2> perform conditional reconfiguration addition/modification as specified in 5.3.5.13.3;

#### 5.3.5.13.2 Conditional reconfiguration removal

The UE shall:

- 1> for each *condReconfigId* value included in the *condReconfigToRemoveList* that is part of the current UE conditional reconfiguration in *VarConditionalReconfig*:
  - 2> remove the entry with the matching *condReconfigId* from the *VarConditionalReconfig*;

NOTE: The UE does not consider the message as erroneous if the *condReconfigToRemoveList* includes any *condReconfigId* value that is not part of the current UE configuration.

#### 5.3.5.13.3 Conditional reconfiguration addition/modification

For each *condReconfigId* received in the *condReconfigToAddModList* IE the UE shall:

- 1> if an entry with the matching *condReconfigId* exists in the *condReconfigToAddModList* within the *VarConditionalReconfig*:
  - 2> if the entry in *condReconfigToAddModList* includes an *condExecutionCond*:
    - 3> replace the entry with the value received for this *condReconfigId*;
  - 2> if the entry in *condReconfigToAddModList* includes an *condRRCReconfig*:
    - 2> replace the entry with the value received for this *condReconfigId*;
- 1> else:
  - 2> add a new entry for this *condReconfigId* within the *VarConditionalReconfig*;
- 1> perform conditional reconfiguration evaluation as specified in 5.3.5.13.4;

#### 5.3.5.13.4 Conditional reconfiguration evaluation

The UE shall:

- 1> for each *condReconfigId* within the *VarConditionalReconfig*:
  - 2> consider the cell which has a physical cell identity matching the value indicated in the *ServingCellConfigCommon* included in the *reconfigurationWithSync* in the received *condRRCReconfig* to be applicable cell;
  - 2> for each *measId* included in the *measIdList* within *VarMeasConfig* indicated in the *condExecutionCond* associated to *condReconfigId*:
    - 3> if the entry condition(s) applicable for this event associated with the *condReconfigId*, i.e. the event corresponding with the *condEventId(s)* of the corresponding *condTriggerConfig* within *VarConditionalReconfig*, is fulfilled for the applicable cells for all measurements after layer 3 filtering taken during the corresponding *timeToTrigger* defined for this event within the *VarConditionalReconfig*:
      - 4> consider the event associated to that *measId* to be fulfilled;
    - 3> if the leaving condition(s) applicable for this event associated with the *condReconfigId*, i.e. the event corresponding with the *condEventId(s)* of the corresponding *condTriggerConfig* within *VarConditionalReconfig*, is fulfilled for the applicable cells for all measurements after layer 3 filtering taken during the corresponding *timeToTrigger* defined for this event within the *VarConditionalReconfig*:
      - 4> consider the event associated to that *measId* to be not fulfilled;
  - 2> if event(s) associated to all *measId(s)* within *condTriggerConfig* for a target candidate cell within the stored *condRRCReconfig* are fulfilled:
    - 3> consider the target candidate cell within the stored *condRRCReconfig*, associated to that *condReconfigId*, as a triggered cell;
    - 3> initiate the conditional reconfiguration execution, as specified in 5.3.5.13.5;

NOTE: Up to 2 *MeasId* can be configured for each *condReconfigId*. The conditional reconfiguration event of the 2 *MeasId* may have the same or different event conditions, triggering quantity, time to trigger, and triggering threshold.

#### 5.3.5.13.5 Conditional reconfiguration execution

The UE shall:

- 1> if more than one triggered cell exists:
  - 2> select one of the triggered cells as the selected cell for conditional reconfiguration execution;
- 1> for the selected cell of conditional reconfiguration execution:
  - 2> apply the stored *condRRCReconfig* of the selected cell and perform the actions as specified in 5.3.5.3;

NOTE: If multiple NR cells are triggered in conditional reconfiguration execution, it is up to UE implementation which one to select, e.g. the UE considers beams and beam quality to select one of the triggered cells for execution.

#### 5.3.5.14 Sidelink dedicated configuration

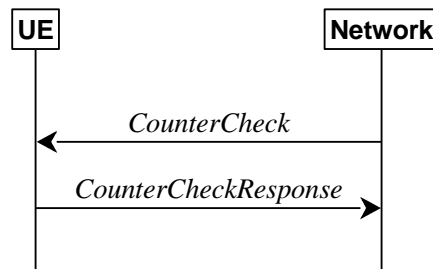
Upon initiating the procedure, the UE shall:

- 1> if *sl-FreqInfoToReleaseList* is included in *sl-ConfigDedicatedNR* within *RRCReconfiguration*:
  - 2> for each entry included in the received *sl-FreqInfoToReleaseList* that is part of the current UE configuration:
    - 3> release the related configurations from the stored NR sidelink communication configurations;
- 1> if *sl-FreqInfoToAddModList* is included in *sl-ConfigDedicatedNR* within *RRCReconfiguration*:

- 2> if configured to receive NR sidelink communication:
  - 3> use the resource pool(s) indicated by *sl-RxPool* for NR sidelink communication reception, as specified in 5.8.7;
- 2> if configured to transmit NR sidelink communication:
  - 3> use the resource pool(s) indicated by *sl-TxPoolSelectedNormal*, *sl-TxPoolScheduling* or *sl-TxPoolExceptional* for NR sidelink communication transmission, as specified in 5.8.8;
  - 2> perform CBR measurement on the transmission resource pools indicated by *sl-TxPoolSelectedNormal*, *sl-TxPoolScheduling* or *sl-TxPoolExceptional* for NR sidelink communication transmission, as specified in 5.5.3;
  - 2> use the synchronization configuration parameters for NR sidelink communication on frequencies included in *sl-FreqInfoToAddModList*, as specified in 5.8.5;
- 1> if *sl-RadioBearerToReleaseList* is included in *sl-ConfigDedicatedNR* within *RRCReconfiguration*:
  - 2> perform sidelink DRB release as specified in 5.8.9.1a.1;
- 1> if *sl-RadioBearerToAddModList* or *sl-RLC-BearerToAddModList* is included in *sl-ConfigDedicatedNR* within *RRCReconfiguration*:
  - 2> perform sidelink DRB addition/modification as specified in 5.8.9.1a.2;
- 1> if *sl-ScheduledConfig* is included in *sl-ConfigDedicatedNR* within *RRCReconfiguration*:
  - 2> configure the MAC entity parameters, which are to be used for NR sidelink communication, in accordance with the received *sl-ScheduledConfig*;
- 1> if *sl-UE-SelectedConfig* is included in *sl-ConfigDedicatedNR* within *RRCReconfiguration*:
  - 2> configure the parameters, which are to be used for NR sidelink communication, in accordance with the received *sl-UE-SelectedConfig*;
- 1> if *sl-MeasConfigInfoToReleaseList* is included in *sl-ConfigDedicatedNR* within *RRCReconfiguration*:
  - 2> for each *sl-DestinationIndex* included in the received *sl-MeasConfigInfoToReleaseList* that is part of the current UE configuration:
    - 3> remove the entry with the matching *sl-DestinationIndex* from the stored NR sidelink measurement configuration information;
- 1> if *sl-MeasConfigInfoToAddModList* is included in *sl-ConfigDedicatedNR* within *RRCReconfiguration*:
  - 2> for each *sl-DestinationIndex* included in the received *sl-MeasConfigInfoToAddModList* that is part of the current stored NR sidelink measurement configuration:
    - 3> replace the entry with the value received for this *sl-DestinationIndex* from the stored NR sidelink measurement configuration information;
  - 2> for each *sl-DestinationIndex* included in the received *sl-MeasConfigInfoToAddModList* that is not part of the current stored NR sidelink measurement configuration:
    - 3> add a new entry for this *sl-DestinationIndex* to the stored NR sidelink measurement configuration.

## 5.3.6 Counter check

### 5.3.6.1 General



**Figure 5.3.6.1-1: Counter check procedure**

The counter check procedure is used by the network to request the UE to verify the amount of data sent/ received on each DRB. More specifically, the UE is requested to check if, for each DRB, the most significant bits of the COUNT match with the values indicated by the network.

NOTE: The procedure enables the network to detect packet insertion by an intruder (a 'man in the middle').

### 5.3.6.2 Initiation

The network initiates the procedure by sending a *CounterCheck* message.

NOTE: The network may initiate the procedure when any of the COUNT values reaches a specific value.

### 5.3.6.3 Reception of the *CounterCheck* message by the UE

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

- 1> for each DRB that is established:
  - 2> if no COUNT exists for a given direction (uplink or downlink) because it is a uni-directional bearer configured only for the other direction:
    - 3> assume the COUNT value to be 0 for the unused direction;
  - 2> if the *drb-Identity* is not included in the *drb-CountMSB-InfoList*:
    - 3> include the DRB in the *drb-CountInfoList* in the *CounterCheckResponse* message by including the *drb-Identity*, the *count-Uplink* and the *count-Downlink* set to the value of TX\_NEXT – 1 and RX\_NEXT – 1 (specified in TS 38.323 [5]), respectively;
  - 2> else if, for at least one direction, the most significant bits of the COUNT are different from the value indicated in the *drb-CountMSB-InfoList*:
    - 3> include the DRB in the *drb-CountInfoList* in the *CounterCheckResponse* message by including the *drb-Identity*, the *count-Uplink* and the *count-Downlink* set to the value of TX\_NEXT – 1 and RX\_NEXT – 1 (specified in TS 38.323 [5]), respectively;
- 1> for each DRB that is included in the *drb-CountMSB-InfoList* in the *CounterCheck* message that is not established:
  - 2> include the DRB in the *drb-CountInfoList* in the *CounterCheckResponse* message by including the *drb-Identity*, the *count-Uplink* and the *count-Downlink* with the most significant bits set identical to the corresponding values in the *drb-CountMSB-InfoList* and the least significant bits set to zero;
- 1> submit the *CounterCheckResponse* message to lower layers for transmission upon which the procedure ends.

## 5.3.7 RRC connection re-establishment

### 5.3.7.1 General

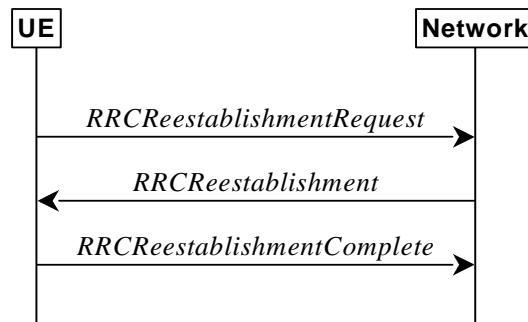


Figure 5.3.7.1-1: RRC connection re-establishment, successful

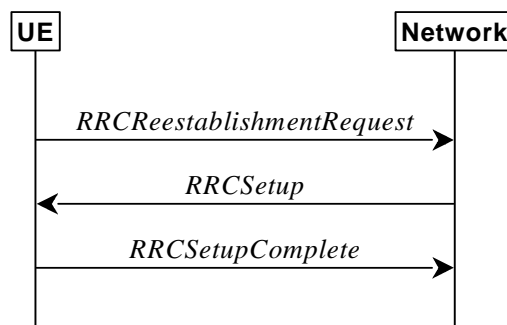


Figure 5.3.7.1-2: RRC re-establishment, fallback to RRC establishment, successful

The purpose of this procedure is to re-establish the RRC connection. A UE in RRC\_CONNECTED, for which AS security has been activated with SRB2 and at least one DRB setup or, for IAB, SRB2, may initiate the procedure in order to continue the RRC connection. The connection re-establishment succeeds if the network is able to find and verify a valid UE context or, if the UE context cannot be retrieved, and the network responds with an *RRCSetup* according to clause 5.3.3.4.

The network applies the procedure e.g as follows:

- When AS security has been activated and the network retrieves or verifies the UE context:
  - to re-activate AS security without changing algorithms;
  - to re-establish and resume the SRB1;
- When UE is re-establishing an RRC connection, and the network is not able to retrieve or verify the UE context:
  - to discard the stored AS Context and release all RBs;
  - to fallback to establish a new RRC connection.

If AS security has not been activated, the UE shall not initiate the procedure but instead moves to RRC\_IDLE directly, with release cause 'other'. If AS security has been activated, but SRB2 and at least one DRB or, for IAB, SRB2, are not setup, the UE does not initiate the procedure but instead moves to RRC\_IDLE directly, with release cause 'RRC connection failure'.

### 5.3.7.2 Initiation

The UE initiates the procedure when one of the following conditions is met:

- 1> upon detecting radio link failure of the MCG and *t316* is not configured, in accordance with 5.3.10; or
- 1> upon detecting radio link failure of the MCG while SCG transmission is suspended, in accordance with 5.3.10; or
- 1> upon detecting radio link failure of the MCG while PSCell change is ongoing, in accordance with 5.3.10; or
- 1> upon re-configuration with sync failure of the MCG, in accordance with sub-clause 5.3.5.8.3; or
- 1> upon mobility from NR failure, in accordance with sub-clause 5.4.3.5; or
- 1> upon integrity check failure indication from lower layers concerning SRB1 or SRB2, except if the integrity check failure is detected on the *RRCReestablishment* message; or
- 1> upon an RRC connection reconfiguration failure, in accordance with sub-clause 5.3.5.8.2; or
- 1> upon detecting radio link failure for the SCG while MCG transmission is suspended, in accordance with subclause 5.3.10.3 in NR-DC or in accordance with TS 36.331 [10] subclause 5.3.11.3 in NE-DC; or
- 1> upon reconfiguration with sync failure of the SCG while MCG transmission is suspended in accordance with subclause 5.3.5.8.3; or
- 1> upon SCG change failure while MCG transmission is suspended in accordance with TS 36.331 [10] subclause 5.3.5.7a; or
- 1> upon SCG configuration failure while MCG transmission is suspended in accordance with subclause 5.3.5.8.2 in NR-DC or in accordance with TS 36.331 [10] subclause 5.3.5.5 in NE-DC; or
- 1> upon integrity check failure indication from SCG lower layers concerning SRB3 while MCG is suspended; or
- 1> upon T316 expiry, in accordance with sub-clause 5.7.3b.5.

Upon initiation of the procedure, the UE shall:

- 1> stop timer T310, if running;
- 1> stop timer T312, if running;
- 1> stop timer T304, if running;
- 1> start timer T311;
- 1> stop timer T316, if running;
- 1> if UE is not configured with *conditionalReconfiguration*:
  - 2> reset MAC;
  - 2> release *spCellConfig*, if configured;
  - 2> suspend all RBs, except SRB0;
  - 2> release the MCG SCell(s), if configured;
  - 2> if MR-DC is configured:
    - 3> perform MR-DC release, as specified in clause 5.3.5.10;
  - 2> release *delayBudgetReportingConfig*, if configured and stop timer T342, if running;
  - 2> release *overheatingAssistanceConfig*, if configured and stop timer T345, if running;
  - 2> release *idc-AssistanceConfig*, if configured;
  - 2> release *btNameList*, if configured;
  - 2> release *wlanNameList*, if configured;



- 2> release *sensorNameList*, if configured;
- 2> release *drx-PreferenceConfig* for the MCG, if configured and stop timer T346a associated with the MCG, if running;
- 2> release *maxBW-PreferenceConfig* for the MCG, if configured and stop timer T346b associated with the MCG, if running;
- 2> release *maxCC-PreferenceConfig* for the MCG, if configured and stop timer T346c associated with the MCG, if running;
- 2> release *maxMIMO-LayerPreferenceConfig* for the MCG, if configured and stop timer T346d associated with the MCG, if running;
- 2> release *minSchedulingOffsetPreferenceConfig* for the MCG, if configured stop timer T346e associated with the MCG, if running;
- 2> release *releasePreferenceConfig*, if configured stop timer T346f, if running;
- 2> release *onDemandSIB-Request* if configured, and stop timer T350, if running;
- 1> if any DAPS bearer is configured:
  - 2> release source SpCell configuration;
  - 2> reset the source MAC and release the source MAC configuration;
  - 2> for each DAPS bearer:
    - 3> release the RLC entity or entities as specified in TS 38.322 [4], clause 5.1.3, and the associated logical channel for the source SpCell;
    - 3> reconfigure the PDCP entity to release DAPS as specified in TS 38.323 [5];
  - 2> for each SRB:
    - 3> release the PDCP entity for the source SpCell;
    - 3> release the RLC entity as specified in TS 38.322 [4], clause 5.1.3, and the associated logical channel for the source SpCell;
  - 2> release the physical channel configuration for the source SpCell;
  - 2> discard the keys used in the source SpCell (the  $K_{gNB}$  key, the  $K_{RRCEnc}$  key, the  $K_{RRCint}$  key, the  $K_{UPint}$  key and the  $K_{UPenc}$  key), if any;
- 1> perform cell selection in accordance with the cell selection process as specified in TS 38.304 [20], clause 5.2.6.

### 5.3.7.3 Actions following cell selection while T311 is running

Upon selecting a suitable NR cell, the UE shall:

- 1> ensure having valid and up to date essential system information as specified in clause 5.2.2.2;
- 1> stop timer T311;
- 1> if T390 is running:
  - 2> stop timer T390 for all access categories;
  - 2> perform the actions as specified in 5.3.14.4;
- 1> if the cell selection is triggered by detecting radio link failure of the MCG or re-configuration with sync failure of the MCG, and
  - 1> if *attemptCondReconfig* is configured; and

- 1> if the selected cell is one of the candidate cells for which the *reconfigurationWithSync* is included in the *masterCellGroup* in *VarConditionalReconfig*:
  - 2> apply the stored *condRRCReconfig* associated to the selected cell and perform actions as specified in 5.3.5.3;
- 1> else:
  - 2> if UE is configured with *conditionalReconfiguration*:
    - 3> reset MAC;
    - 3> release *spCellConfig*, if configured;
    - 3> release the MCG SCell(s), if configured;
    - 3> release *delayBudgetReportingConfig*, if configured and stop timer T342, if running;
    - 3> release *overheatingAssistanceConfig* , if configured and stop timer T345, if running;
    - 3> if MR-DC is configured:
      - 4> perform MR-DC release, as specified in clause 5.3.5.10;
    - 3> release *idc-AssistanceConfig*, if configured;
    - 3> release *btNameList*, if configured;
    - 3> release *wlanNameList*, if configured;
    - 3> release *sensorNameList*, if configured;
    - 3> release *drx-PreferenceConfig* for the MCG, if configured and stop timer T346a associated with the MCG, if running;
    - 3> release *maxBW-PreferenceConfig* for the MCG, if configured and stop timer T346b associated with the MCG, if running;
    - 3> release *maxCC-PreferenceConfig* for the MCG, if configured and stop timer T346c associated with the MCG, if running;
    - 3> release *maxMIMO-LayerPreferenceConfig* for the MCG, if configured and stop timer T346d associated with the MCG, if running;
    - 3> release *minSchedulingOffsetPreferenceConfig* for the MCG, if configured and stop timer T346e associated with the MCG, if running;
    - 3> release *releasePreferenceConfig*, if configured and stop timer T346f, if running;
    - 3> release *onDemandSIB-Request* if configured, and stop timer T350, if running;
    - 3> suspend all RBs, except SRB0;
  - 2> remove all the entries within *VarConditionalReconfig*, if any;
  - 2> for each *measId*, if the associated *reportConfig* has a *reportType* set to *condTriggerConfig*:
    - 3> for the associated *reportConfigId*:
      - 4> remove the entry with the matching *reportConfigId* from the *reportConfigList* within the *VarMeasConfig*;
    - 3> if the associated *measObjectId* is only associated to a *reportConfig* with *reportType* set to *condTriggerConfig*:
      - 4> remove the entry with the matching *measObjectId* from the *measObjectList* within the *VarMeasConfig*;
    - 3> remove the entry with the matching *measId* from the *measIdList* within the *VarMeasConfig*;

- 2> start timer T301;
- 2> apply the default L1 parameter values as specified in corresponding physical layer specifications except for the parameters for which values are provided in *SIB1*;
- 2> apply the default MAC Cell Group configuration as specified in 9.2.2;
- 2> apply the CCCH configuration as specified in 9.1.1.2;
- 2> apply the *timeAlignmentTimerCommon* included in *SIB1*;
- 2> initiate transmission of the *RRCReestablishmentRequest* message in accordance with 5.3.7.4;

NOTE: This procedure applies also if the UE returns to the source PCell.

Upon selecting an inter-RAT cell, the UE shall:

- 1> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'RRC connection failure'.

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

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

- 1> if the procedure was initiated due to radio link failure as specified in 5.3.10.3 or handover failure as specified in 5.3.5.8.3:
  - 2> set the *reestablishmentCellId* in the *VarRLF-Report* to the global cell identity of the selected cell;
- 1> set the *ue-Identity* as follows:
  - 2> set the *c-RNTI* to the C-RNTI used in the source PCell (reconfiguration with sync or mobility from NR 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 (reconfiguration with sync or mobility from NR 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*;
    - 3> with the  $K_{\text{RRCint}}$  key and integrity protection algorithm that was used in the source PCell (reconfiguration with sync or mobility from NR 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> set the *reestablishmentCause* as follows:
  - 2> if the re-establishment procedure was initiated due to reconfiguration failure as specified in 5.3.5.8.2:
    - 3> set the *reestablishmentCause* to the value *reconfigurationFailure*;
  - 2> else if the re-establishment procedure was initiated due to reconfiguration with sync failure as specified in 5.3.5.8.3 (intra-NR handover failure) or 5.4.3.5 (inter-RAT mobility from NR failure):
    - 3> set the *reestablishmentCause* to the value *handoverFailure*;
  - 2> else:
    - 3> set the *reestablishmentCause* to the value *otherFailure*;
- 1> re-establish PDCP for SRB1;
- 1> re-establish RLC for SRB1;
- 1> apply the specified configuration defined in 9.2.1 for SRB1;

1> configure lower layers to suspend integrity protection and ciphering for SRB1;

NOTE: Ciphering is not applied for the subsequent *RRCReestablishment* message used to resume the connection. An integrity check is performed by lower layers, but merely upon request from RRC.

1> resume SRB1;

1> submit the *RRCReestablishmentRequest* message to lower layers for transmission.

### 5.3.7.5 Reception of the *RRCReestablishment* by the UE

The UE shall:

1> stop timer T301;

1> consider the current cell to be the PCell;

1> store the *nextHopChainingCount* value indicated in the *RRCReestablishment* message;

1> update the  $K_{\text{gNB}}$  key based on the current  $K_{\text{gNB}}$  key or the NH, using the stored *nextHopChainingCount* value, as specified in TS 33.501 [11];

1> derive the  $K_{\text{RRcEnc}}$  and  $K_{\text{UPenc}}$  keys associated with the previously configured *cipheringAlgorithm*, as specified in TS 33.501 [11];

1> derive the  $K_{\text{RRcInt}}$  and  $K_{\text{UPint}}$  keys associated with the previously configured *integrityProtAlgorithm*, as specified in TS 33.501 [11].

1> request lower layers to verify the integrity protection of the *RRCReestablishment* message, using the previously configured algorithm and the  $K_{\text{RRcInt}}$  key;

1> if the integrity protection check of the *RRCReestablishment* message fails:

2> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'RRC connection failure', upon which the procedure ends;

1> configure lower layers to resume integrity protection for SRB1 using the previously configured algorithm and the  $K_{\text{RRcInt}}$  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;

1> configure lower layers to resume ciphering for SRB1 using the previously configured algorithm and, the  $K_{\text{RRcEnc}}$  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;

1> release the measurement gap configuration indicated by the *measGapConfig*, if configured;

1> set the content of *RRCReestablishmentComplete* message as follows:

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

3> include the *logMeasAvailable* in the *RRCReestablishmentComplete* message;

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

3> include the *logMeasAvailableBT* in the *RRCReestablishmentComplete* message;

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

3> include the *logMeasAvailableWLAN* in the *RRCReestablishmentComplete* message;

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

3> include *connEstFailInfoAvailable* in the *RRCReestablishmentComplete* message;

- 2> if the UE has radio link failure or handover failure information available in *VarRLF-Report* and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report*; or
- 2> if the UE has radio link failure or handover failure information available in *VarRLF-Report* of TS 36.331 [10] and if the UE is capable of cross-RAT RLF reporting and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report* of TS 36.331 [10]:
  - 3> include *rlf-InfoAvailable* in the *RRCReestablishmentComplete* message;
- 1> submit the *RRCReestablishmentComplete* message to lower layers for transmission;
- 1> the procedure ends.

### 5.3.7.6 T311 expiry

Upon T311 expiry, the UE shall:

- 1> if the procedure was initiated due to radio link failure or handover failure:
  - 2> set the *noSuitableCellFound* in the *VarRLF-Report* to *true*;
- 1> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'RRC connection failure'.

### 5.3.7.7 T301 expiry or selected cell no longer suitable

The UE shall:

- 1> if timer T301 expires; or
- 1> if the selected cell becomes no longer suitable according to the cell selection criteria as specified in TS 38.304 [20]:
  - 2> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'RRC connection failure'.

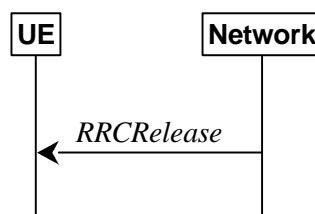
### 5.3.7.8 Reception of the *RRCSetup* by the UE

The UE shall:

- 1> perform the RRC connection establishment procedure as specified in 5.3.3.4.

## 5.3.8 RRC connection release

### 5.3.8.1 General



**Figure 5.3.8.1-1: RRC connection release, successful**

The purpose of this procedure is:

- to release the RRC connection, which includes the release of the established radio bearers as well as all radio resources; or
- to suspend the RRC connection only if SRB2 and at least one DRB or, for IAB, SRB2, are setup, which includes the suspension of the established radio bearers.

### 5.3.8.2 Initiation

The network initiates the RRC connection release procedure to transit a UE in RRC\_CONNECTED to RRC\_IDLE; or to transit a UE in RRC\_CONNECTED to RRC\_INACTIVE only if SRB2 and at least one DRB or, for IAB, SRB2, is setup in RRC\_CONNECTED; or to transit a UE in RRC\_INACTIVE back to RRC\_INACTIVE when the UE tries to resume; or to transit a UE in RRC\_INACTIVE to RRC\_IDLE when the UE tries to resume. The procedure can also be used to release and redirect a UE to another frequency.

### 5.3.8.3 Reception of the *RRCRelease* by the UE

The UE shall:

- 1> delay the following actions defined in this sub-clause 60 ms from the moment the *RRCRelease* message was received or optionally when lower layers indicate that the receipt of the *RRCRelease* message has been successfully acknowledged, whichever is earlier;
- 1> stop timer T380, if running;
- 1> stop timer T320, if running;
- 1> if timer T316 is running;
  - 2> stop timer T316;
  - 2> clear the information included in *VarRLF-Report*, if any;
- 1> stop timer T350, if running;
- 1> if the AS security is not activated:
  - 2> ignore any field included in *RRCRelease* message except *waitTime*;
  - 2> perform the actions upon going to RRC\_IDLE as specified in 5.3.11 with the release cause 'other' upon which the procedure ends;
- 1> if the *RRCRelease* message includes *redirectedCarrierInfo* indicating redirection to *eutra*:
  - 2> if *cnType* is included:
    - 3> after the cell selection, indicate the available CN Type(s) and the received *cnType* 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 *cnType*, is up to UE implementation.

  - 2> if *voiceFallbackIndication* is included:
    - 3> consider the RRC connection release was for EPS fallback for IMS voice (see TS 23.502 [43]);
- 1> if the *RRCRelease* message includes the *cellReselectionPriorities*:
  - 2> store the cell reselection priority information provided by the *cellReselectionPriorities*;
  - 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 *deprioritisationReq* is included:
  - 2> start or restart timer T325 with the timer value set to the *deprioritisationTimer* signalled;
  - 2> store the *deprioritisationReq* until T325 expiry;
- 1> if the *RRCRelease* includes the *measIdleConfig*:

- 2> if T331 is running:
  - 3> stop timer T331;
  - 3> perform the actions as specified in 5.7.8.3;
- 2> if the *measIdleConfig* is set to setup:
  - 3> store the received *measIdleDuration* in *VarMeasIdleConfig*;
  - 3> start timer T331 with the value set to *measIdleDuration*;
  - 3> if the *measIdleConfig* contains *measIdleCarrierListNR*:
    - 4> store the received *measIdleCarrierListNR* in *VarMeasIdleConfig*;
  - 3> if the *measIdleConfig* contains *measIdleCarrierListEUTRA*:
    - 4> store the received *measIdleCarrierListEUTRA* in *VarMeasIdleConfig*;
  - 3> if the *measIdleConfig* contains *validityAreaList*:
    - 4> store the received *validityAreaList* in *VarMeasIdleConfig*;
- 1> if the *RRCRelease* includes *suspendConfig*:
  - 2> apply the received *suspendConfig*;
  - 2> remove all the entries within *VarConditionalReconfig*, if any;
  - 2> for each *measId*, if the associated *reportConfig* has a *reportType* set to *condTriggerConfig*:
    - 3> for the associated *reportConfigId*:
      - 4> remove the entry with the matching *reportConfigId* from the *reportConfigList* within the *VarMeasConfig*;
    - 3> if the associated *measObjectId* is only associated to a *reportConfig* with *reportType* set to *condTriggerConfig*:
      - 4> remove the entry with the matching *measObjectId* from the *measObjectList* within the *VarMeasConfig*;
    - 3> remove the entry with the matching *measId* from the *measIdList* within the *VarMeasConfig*;
  - 2> reset MAC and release the default MAC Cell Group configuration, if any;
  - 2> re-establish RLC entities for SRB1;
  - 2> if the *RRCRelease* message with *suspendConfig* was received in response to an *RRCResumeRequest* or an *RRCResumeRequest1*:
    - 3> stop the timer T319 if running;
    - 3> in the stored UE Inactive AS context:
      - 4> replace the  $K_{gNB}$  and  $K_{RRCint}$  keys with the current  $K_{gNB}$  and  $K_{RRCint}$  keys;
      - 4> replace the C-RNTI with the temporary C-RNTI in the cell the UE has received the *RRCRelease* message;
      - 4> replace the *cellIdentity* with the *cellIdentity* of the cell the UE has received the *RRCRelease* message;
      - 4> replace the physical cell identity with the physical cell identity of the cell the UE has received the *RRCRelease* message;
  - 2> else:

3> store in the UE Inactive AS Context the current  $K_{gNB}$  and  $K_{RRCint}$  keys, the ROHC state, the stored QoS flow to DRB mapping rules, the C-RNTI used in the source PCell, the *cellIdentity* and the physical cell identity of the source PCell, the *spCellConfigCommon* within *ReconfigurationWithSync* of the NR PSCell (if configured) and all other parameters configured except for:

- parameters within *ReconfigurationWithSync* of the PCell;
- parameters within *ReconfigurationWithSync* of the NR PSCell, if configured;
- parameters within *MobilityControlInfoSCG* of the E-UTRA PSCell, if configured;
- *servingCellConfigCommonSIB*;

NOTE 2: NR sidelink communication related configurations and logged measurement configuration are not stored as UE Inactive AS Context, when UE enters RRC\_INACTIVE.

2> suspend all SRB(s) and DRB(s), except SRB0;

2> indicate PDCP suspend to lower layers of all DRBs;

2> if the *t380* is included:

3> start timer T380, with the timer value set to *t380*;

2> if the *RRCRelease* message is including the *waitTime*:

3> start timer T302 with the value set to the *waitTime*;

3> inform upper layers that access barring is applicable for all access categories except categories '0' and '2';

2> if T390 is running:

3> stop timer T390 for all access categories;

3> perform the actions as specified in 5.3.14.4;

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

2> enter RRC\_INACTIVE and perform cell selection as specified in TS 38.304 [20];

1> else

2> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with the release cause 'other'.

#### 5.3.8.4 T320 expiry

The UE shall:

1> if T320 expires:

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

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

#### 5.3.8.5 UE actions upon the expiry of *DataInactivityTimer*

Upon receiving the expiry of *DataInactivityTimer* from lower layers while in RRC\_CONNECTED, the UE shall:

1> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'RRC connection failure'.



## 5.3.9 RRC connection release requested by upper layers

### 5.3.9.1 General

The purpose of this procedure is to release the RRC connection. Access to the current PCell may be barred as a result of this procedure.

### 5.3.9.2 Initiation

The UE initiates the procedure when upper layers request the release of the RRC connection as specified in TS 24.501 [23]. The UE shall not initiate the procedure for power saving purposes.

The UE shall:

- 1> if the upper layers indicate barring of the PCell:
  - 2> treat the PCell used prior to entering RRC\_IDLE as barred according to TS 38.304 [20];
- 1> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'other'.

## 5.3.10 Radio link failure related actions

### 5.3.10.1 Detection of physical layer problems in RRC\_CONNECTED

The UE shall:

- 1> if any DAPS bearer is configured, upon receiving N310 consecutive "out-of-sync" indications for the source SpCell from lower layers and T304 is running:
  - 2> start timer T310 for the source SpCell.
- 1> upon receiving N310 consecutive "out-of-sync" indications for the SpCell from lower layers while neither T300, T301, T304, T311, T316 nor T319 are running:
  - 2> start timer T310 for the corresponding SpCell.

### 5.3.10.2 Recovery of physical layer problems

Upon receiving N311 consecutive "in-sync" indications for the SpCell from lower layers while T310 is running, the UE shall:

- 1> stop timer T310 for the corresponding SpCell.
- 1> stop timer T312 for the corresponding SpCell, if running.

NOTE 1: In this case, the UE maintains the RRC connection without explicit signalling, i.e. the UE maintains the entire radio resource configuration.

NOTE 2: Periods in time where neither "in-sync" nor "out-of-sync" is reported by L1 do not affect the evaluation of the number of consecutive "in-sync" or "out-of-sync" indications.

### 5.3.10.3 Detection of radio link failure

The UE shall:

- 1> if any DAPS bearer is configured and T304 is running:
  - 2> upon T310 expiry in source SpCell; or
  - 2> upon random access problem indication from source MCG MAC; or
  - 2> upon indication from source MCG RLC that the maximum number of retransmissions has been reached; or

- 2> upon consistent uplink LBT failure indication from source MCG MAC:
  - 3> consider radio link failure to be detected for the source MCG i.e. source RLF;
  - 3> suspend the transmission of all DRBs in the source MCG;
  - 3> reset MAC for the source MCG;
  - 3> release the source connection.

1> else:

- 2> during a DAPS handover: the following only applies for the target PCell;
- 2> upon T310 expiry in PCell; or
- 2> upon T312 expiry in PCell; or
- 2> upon random access problem indication from MCG MAC while neither T300, T301, T304, T311 nor T319 are running; or
- 2> upon indication from MCG RLC that the maximum number of retransmissions has been reached; or
- 2> if connected as an IAB-node, upon BH RLF indication received on BAP entity from the MCG; or
- 2> upon consistent uplink LBT failure indication from MCG MAC while T304 is not running:
  - 3> if the indication is from MCG RLC and CA duplication is configured and activated for MCG, and for the corresponding logical channel *allowedServingCells* only includes SCell(s):
    - 4> initiate the failure information procedure as specified in 5.7.5 to report RLC failure.
  - 3> else:
    - 4> consider radio link failure to be detected for the MCG i.e. RLF;
    - 4> discard any segments of segmented RRC messages stored according to 5.7.6.3;

NOTE: Void.

- 4> if AS security has not been activated:
  - 5> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'other';-
- 4> else if AS security has been activated but SRB2 and at least one DRB or, for IAB, SRB2, have not been setup:
  - 5> store the radio link failure information in the *VarRLF-Report* as described in subclause 5.3.10.5;
  - 5> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'RRC connection failure';
- 4> else:
  - 5> store the radio link failure information in the *VarRLF-Report* as described in subclause 5.3.10.5;
  - 5> if T316 is configured; and
  - 5> if SCG transmission is not suspended; and
  - 5> if PSCell change is not ongoing (i.e. timer T304 for the NR PSCell is not running in case of NR-DC or timer T307 of the E-UTRA PSCell is not running as specified in TS 36.331 [10], clause 5.3.10.10, in NE-DC):
    - 6> initiate the MCG failure information procedure as specified in 5.7.3b to report MCG radio link failure.
- 5> else:

6> initiate the connection re-establishment procedure as specified in 5.3.7.

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.

The UE shall:

- 1> upon T310 expiry in PSCell; or
- 1> upon T312 expiry in PSCell; or
- 1> upon random access problem indication from SCG MAC; or
- 1> upon indication from SCG RLC that the maximum number of retransmissions has been reached; or
- 1> if connected as an IAB-node, upon BH RLF indication received on BAP entity from the SCG; or
- 1> upon consistent uplink LBT failure indication from SCG MAC:
  - 2> if the indication is from SCG RLC and CA duplication is configured and activated for SCG; and for the corresponding logical channel *allowedServingCells* only includes SCell(s):
    - 3> initiate the failure information procedure as specified in 5.7.5 to report RLC failure.
  - 2> else:
    - 3> consider radio link failure to be detected for the SCG, i.e. SCG RLF;
    - 3> if MCG transmission is not suspended:
      - 4> initiate the SCG failure information procedure as specified in 5.7.3 to report SCG radio link failure.
    - 3> else:
      - 4> if the UE is in NR-DC:
        - 5> initiate the connection re-establishment procedure as specified in 5.3.7;
      - 4> else (the UE is in (NG)EN-DC):
        - 5> initiate the connection re-establishment procedure as specified in TS 36.331 [10], clause 5.3.7;

#### 5.3.10.4 RLF cause determination

The UE shall set the *rlf-Cause* in the *VarRLF-Report* as follows:

- 1> if the UE declares radio link failure due to T310 expiry:
  - 2> set the *rlf-Cause* as *t310-Expiry*;
- 1> else if the UE declares radio link failure due to the random access problem indication from MCG MAC:
  - 2> if the random access procedure was initiated for beam failure recovery:
    - 3> set the *rlf-Cause* as *beamFailureRecoveryFailure*;
  - 2> else:
    - 3> set the *rlf-Cause* as *randomAccessProblem*;
- 1> else if the UE declares radio link failure due to the reaching of maximum number of retransmissions from the MCG RLC:
  - 2> set the *rlf-Cause* as *rlc-MaxNumRetx*;
- 1> else if the UE declares radio link failure due to consistent uplink LBT failures:
  - 2> set the *rlf-Cause* as *lbtFailure*;

- 1> else if the IAB-MT declares radio link failure due to RLF recovery failure over the backhaul link:
  - 2> set the *rlf-Cause* as *bh-rlfRecoveryFailure*.

### 5.3.10.5 RLF report content determination

The UE shall determine the content in the *VarRLF-Report* as follows:

- 1> clear the information included in *VarRLF-Report*, if any;
- 1> set the *plmn-IdentityList* to include the list of EPLMNs stored by the UE (i.e. includes the RPLMN);
- 1> set the *measResultLastServCell* to include the cell level RSRP, RSRQ and the available SINR, of the source PCell (in case HO failure) or PCell (in case RLF) based on the available SSB and CSI-RS measurements collected up to the moment the UE detected failure;
- 1> if the SS/PBCH block-based measurement quantities are available:
  - 2> set the *rsIndexResults* in *measResultLastServCell* to include all the available measurement quantities of the source PCell (in case HO failure) or PCell (in case RLF), ordered such that the highest SS/PBCH block RSRP is listed first if SS/PBCH block RSRP measurement results are available, otherwise the highest SS/PBCH block RSRQ is listed first if SS/PBCH block RSRQ measurement results are available, otherwise the highest SS/PBCH block SINR is listed first, based on the available SS/PBCH block based measurements collected up to the moment the UE detected failure;
- 1> if the CSI-RS based measurement quantities are available:
  - 2> set the *rsIndexResults* in *measResultLastServCell* to include all the available measurement quantities of the source PCell (in case HO failure) or PCell (in case RLF), ordered such that the highest CSI-RS RSRP is listed first if CSI-RS RSRP measurement results are available, otherwise the highest CSI-RS RSRQ is listed first if CSI-RS RSRQ measurement results are available, otherwise the highest CSI-RS SINR is listed first, based on the available CSI-RS based measurements collected up to the moment the UE detected failure;
- 1> set the *ssbRLMConfigBitmap* and/or *csi-rsRLMConfigBitmap* in *measResultLastServCell* to include the radio link monitoring configuration of the source PCell (in case HO failure) or PCell (in case RLF);
- 1> for each of the configured *measObjectNR* in which measurements are available:
  - 2> if the SS/PBCH block-based measurement quantities are available:
    - 3> set the *measResultListNR* in *measResultNeighCells* to include all the available measurement quantities of the best measured cells, other than the source PCell (in case HO failure) or PCell (in case RLF), ordered such that the cell with highest SS/PBCH block RSRP is listed first if SS/PBCH block RSRP measurement results are available, otherwise the cell with highest SS/PBCH block RSRQ is listed first if SS/PBCH block RSRQ measurement results are available, otherwise the cell with highest SS/PBCH block SINR is listed first, based on the available SS/PBCH block based measurements collected up to the moment the UE detected failure;
    - 4> for each neighbour cell included, include the optional fields that are available;
  - 2> if the CSI-RS based measurement quantities are available:
    - 3> set the *measResultListNR* in *measResultNeighCells* to include all the available measurement quantities of the best measured cells, other than the source PCell, ordered such that the cell with highest CSI-RS RSRP is listed first if CSI-RS RSRP measurement results are available, otherwise the cell with highest CSI-RS RSRQ is listed first if CSI-RS RSRQ measurement results are available, otherwise the cell with highest CSI-RS SINR is listed first, based on the available CSI-RS based measurements collected up to the moment the UE detected radio link failure;
    - 4> for each neighbour cell included, include the optional fields that are available;
- 2> for each of the configured EUTRA frequencies in which measurements are available:
  - 3> set the *measResultListEUTRA* in *measResultNeighCells* to include the best measured cells ordered such that the cell with highest RSRP is listed first if RSRP measurement results are available, otherwise the

cell with highest RSRQ is listed first, and based on measurements collected up to the moment the UE detected failure;

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.

- 1> set the *c-RNTI* to the C-RNTI used in the source PCell (in case HO failure) or PCell (in case RLF);
- 1> if the failure is detected due to reconfiguration with sync failure as described in 5.3.5.8.3, set the fields in *VarRLF-report* as follows:
  - 2> set the *connectionFailureType* to *hof*;
  - 2> if last *RRCReconfiguration* message including *reconfigurationWithSync* concerned a failed intra-RAT handover (NR to NR):
    - 3> set the *nrFailedPCellId* in *failedPCellId* to the global cell identity and tracking area code, if available, and otherwise to the physical cell identity and carrier frequency of the target PCell of the failed handover;
  - 2> else if last *MobilityFromNRCommand* concerned a failed inter-RAT handover from NR to E-UTRA and if the UE supports Radio Link Failure Report for Inter-RAT MRO (NR to EUTRA):
    - 3> set the *eutraFailedPCellId* in *failedPCellId* to the global cell identity and tracking area code, if available, and otherwise to the physical cell identity and carrier frequency of the target PCell of the failed handover;
  - 2> include *nrPreviousCell* in *previousPCellId* and set it to the global cell identity and tracking area code of the PCell where the last *RRCReconfiguration* message including *reconfigurationWithSync* was received;
  - 2> set the *timeConnFailure* to the elapsed time since reception of the last *RRCReconfiguration* message including the *reconfigurationWithSync*;
- 1> else if the failure is detected due to radio link failure as described in 5.3.10.3, set the fields in *VarRLF-report* as follows:
  - 2> set the *connectionFailureType* to *rlf*;
  - 2> set the *rlf-Cause* to the trigger for detecting radio link failure in accordance with clause 5.3.10.4;
  - 2> set the *nrFailedPCellId* in *failedPCellId* to the global cell identity and the tracking area code, if available, and otherwise to the physical cell identity and carrier frequency of the PCell where radio link failure is detected;
  - 2> if an *RRCReconfiguration* message including the *reconfigurationWithSync* was received before the connection failure:
    - 3> if the last *RRCReconfiguration* message including the *reconfigurationWithSync* concerned an intra NR handover:
      - 4> include the *nrPreviousCell* in *previousPCellId* and set it to the global cell identity and the tracking area code of the PCell where the last *RRCReconfiguration* message including *reconfigurationWithSync* was received;
      - 4> set the *timeConnFailure* to the elapsed time since reception of the last *RRCReconfiguration* message including the *reconfigurationWithSync*;
    - 3> else if the last *RRCReconfiguration* message including the *reconfigurationWithSync* concerned a handover to NR from E-UTRA and if the UE supports Radio Link Failure Report for Inter-RAT MRO:
      - 4> include the *eutraPreviousCell* in *previousPCellId* and set it to the global cell identity and the tracking area code of the E-UTRA PCell where the last *RRCReconfiguration* message including *reconfigurationWithSync* was received embedded in E-UTRA RRC message *MobilityFromEUTRACommand* message as specified in TS 36.331 [10] clause 5.4.3.3;

- 4> set the *timeConnFailure* to the elapsed time since reception of the last *RRCReconfiguration* message including the *reconfigurationWithSync* embedded in E-UTRA RRC message *MobilityFromEUTRACommand* message as specified in TS 36.331 [10] clause 5.4.3.3;
- 1> if *connectionfailureType* is *rlf* and the *rlf-Cause* is set to *randomAccessProblem* or *beamFailureRecoveryFailure*; or
- 1> if *connectionfailureType* is *hof*:
  - 2> set the *ra-InformationCommon* to include the random-access related information as described in subclause 5.7.10.5;
- 1> if location information is available, set the content of *locationInfo* as follows:
  - 2> if available, set the *commonLocationInfo* to include the detailed location information;
  - 2> if available, set the *bt-LocationInfo* in *locationInfo* to include the Bluetooth measurement results, in order of decreasing RSSI for Bluetooth beacons;
  - 2> if available, set the *wlan-LocationInfo* in *locationInfo* to include the WLAN measurement results, in order of decreasing RSSI for WLAN APs;
  - 2> if available, set the *sensor-LocationInfo* in *locationInfo* to include the sensor measurement results;

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

NOTE 2: In this clause, the term 'handover failure' has been used to refer to 'reconfiguration with sync failure'.

### 5.3.11 UE actions upon going to RRC\_IDLE

The UE shall:

- 1> reset MAC;
- 1> set the variable *pendingRNA-Update* to *false*, if that is set to *true*;
- 1> if going to RRC\_IDLE was triggered by reception of the *RRCRelease* message including a *waitTime*:
  - 2> if T302 is running:
    - 3> stop timer T302;
  - 2> start timer T302 with the value set to the *waitTime*;
  - 2> inform upper layers that access barring is applicable for all access categories except categories '0' and '2'.
- 1> else:
  - 2> if T302 is running:
    - 3> stop timer T302;
    - 3> perform the actions as specified in 5.3.14.4;
- 1> if T390 is running:
  - 2> stop timer T390 for all access categories;
  - 2> perform the actions as specified in 5.3.14.4;
- 1> if the UE is leaving RRC\_INACTIVE:
  - 2> if going to RRC\_IDLE was not triggered by reception of the *RRCRelease* message:
    - 3> if stored, discard the cell reselection priority information provided by the *cellReselectionPriorities*;

- 3> stop the timer T320, if running;
- 1> stop all timers that are running except T302, T320, T325, T330, T331 and T400;
- 1> discard the UE Inactive AS context, if any;
- 1> release the *suspendConfig*, if configured;
- 1> remove all the entries within *VarConditionalReconfig*, if any;
- 1> for each *measId*, if the associated *reportConfig* has a *reportType* set to *condTriggerConfig*:
  - 2> for the associated *reportConfigId*:
    - 3> remove the entry with the matching *reportConfigId* from the *reportConfigList* within the *VarMeasConfig*;
  - 2> if the associated *measObjectId* is only associated to a *reportConfig* with *reportType* set to *condTriggerConfig*:
    - 3> remove the entry with the matching *measObjectId* from the *measObjectList* within the *VarMeasConfig*;
  - 2> remove the entry with the matching *measId* from the *measIdList* within the *VarMeasConfig*;
- 1> discard the  $K_{gNB}$  key, the S- $K_{gNB}$  key, the S- $K_{eNB}$  key, the  $K_{RRCenc}$  key, the  $K_{RRCint}$  key, the  $K_{UPint}$  key and the  $K_{UPenc}$  key, if any;
- 1> release all radio resources, including release of the RLC entity, the BAP entity, the MAC configuration and the associated PDCP entity and SDAP for all established RBs;
- 1> indicate the release of the RRC connection to upper layers together with the release cause;
- 1> except if going to RRC\_IDLE was triggered by inter-RAT cell reselection while the UE is in RRC\_INACTIVE or RRC\_IDLE or when selecting an inter-RAT cell while T311 was running or when selecting an E-UTRA cell for EPS fallback for IMS voice as specified in 5.4.3.5:
  - 2> enter RRC\_IDLE and perform cell selection as specified in TS 38.304 [20];

### 5.3.12 UE actions upon PUCCH/SRS release request

Upon receiving a PUCCH release request from lower layers, for all bandwidth parts of an indicated serving cell the UE shall:

- 1> release PUCCH-CSI-Resources configured in *CSI-ReportConfig*;
- 1> release *SchedulingRequestResourceConfig* instances configured in *PUCCH-Config*.

Upon receiving an SRS release request from lower layers, for all bandwidth parts of an indicated serving cell the UE shall:

- 1> release *SRS-Resource* instances configured in *SRS-Config*.

### 5.3.13 RRC connection resume

#### 5.3.13.1 General

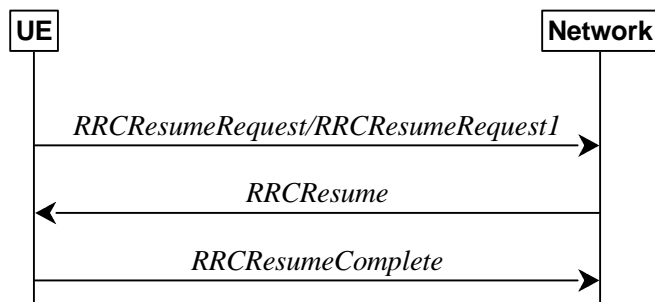


Figure 5.3.13.1-1: RRC connection resume, successful

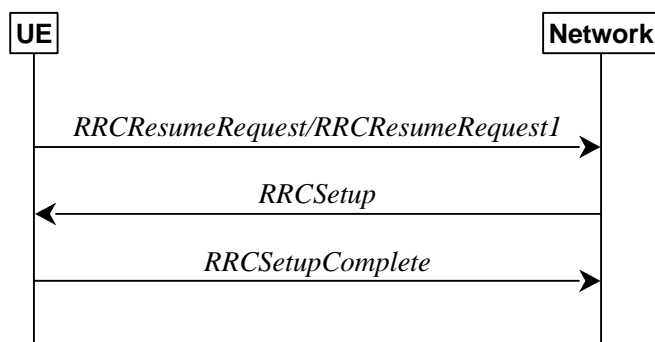


Figure 5.3.13.1-2: RRC connection resume fallback to RRC connection establishment, successful

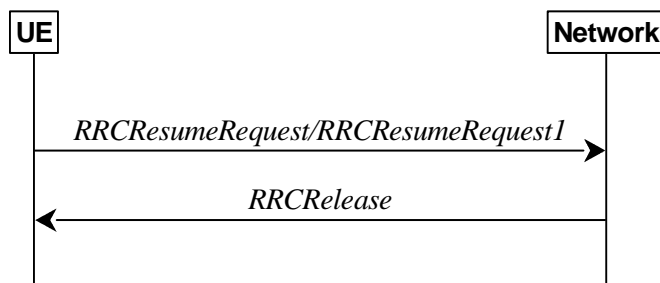


Figure 5.3.13.1-3: RRC connection resume followed by network release, successful

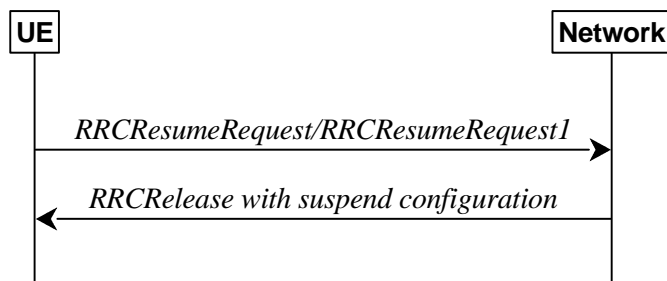
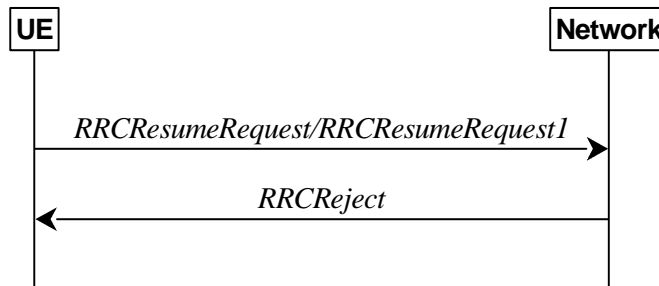


Figure 5.3.13.1-4: RRC connection resume followed by network suspend, successful





**Figure 5.3.13.1-5: RRC connection resume, network reject**

The purpose of this procedure is to resume a suspended RRC connection, including resuming SRB(s) and DRB(s) or perform an RNA update.

### 5.3.13.1a Conditions for resuming RRC Connection for sidelink communication

For NR sidelink communication an RRC connection is resumed only in the following cases:

- 1> if configured by upper layers to transmit NR sidelink communication and related data is available for transmission;
- 2> if the frequency on which the UE is configured to transmit NR sidelink communication is included in *sl-FreqInfoList* within *SIB12* provided by the cell on which the UE camps; and if the valid version of *SIB12* does not include *sl-TxPoolSelectedNormal* for the concerned frequency;

For V2X sidelink communication an RRC connection resume is initiated only when the conditions specified for V2X sidelink communication in subclause 5.3.3.1a of TS 36.331 [10] are met.

NOTE: Upper layers initiate an RRC connection resume. The interaction with NAS is left to UE implementation.

### 5.3.13.2 Initiation

The UE initiates the procedure when upper layers or AS (when responding to RAN paging, upon triggering RNA updates while the UE is in RRC\_INACTIVE, or for sidelink communication as specified in sub-clause 5.3.13.1a) requests the resume of a suspended RRC connection.

The UE shall ensure having valid and up to date essential system information as specified in clause 5.2.2.2 before initiating this procedure.

Upon initiation of the procedure, the UE shall:

- 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 5.3.14 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 5.3.14 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 RNA update as specified in 5.3.13.8:

2> if an emergency service is ongoing:

NOTE: How the RRC layer in the UE is aware of an ongoing emergency service is up to UE implementation.

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 5.3.14 using the selected Access Category and one or more Access Identities to be applied as specified in TS 24.501 [23];

3> if the access attempt is barred:

4> set the variable *pendingRNA-Update* to *true*;

4> the procedure ends;

1> if the UE is in NE-DC or NR-DC:

2> if the UE does not support maintaining SCG configuration upon connection resumption:

3> release the MR-DC related configurations (i.e., as specified in 5.3.5.10) from the UE Inactive AS context, if stored;

1> if the UE does not support maintaining the MCG SCell configurations upon connection resumption:

2> release the MCG SCell(s) from the UE Inactive AS context, if stored;

1> apply the default L1 parameter values as specified in corresponding physical layer specifications, except for the parameters for which values are provided in *SIB1*;

1> apply the default SRB1 configuration as specified in 9.2.1;

1> apply the default MAC Cell Group configuration as specified in 9.2.2;

1> release *delayBudgetReportingConfig* from the UE Inactive AS context, if stored;

1> stop timer T342, if running;

1> release *overheatingAssistanceConfig* from the UE Inactive AS context, if stored;

1> stop timer T345, if running;

1> release *idc-AssistanceConfig* from the UE Inactive AS context, if stored;

1> release *drx-PreferenceConfig* for all configured cell groups from the UE Inactive AS context, if stored;

1> stop all instances of timer T346a, if running;

1> release *maxBW-PreferenceConfig* for all configured cell groups from the UE Inactive AS context, if stored;

1> stop all instances of timer T346b, if running;

1> release *maxCC-PreferenceConfig* for all configured cell groups from the UE Inactive AS context, if stored;

1> stop all instances of timer T346c, if running;

1> release *maxMIMO-LayerPreferenceConfig* for all configured cell groups from the UE Inactive AS context, if stored;

1> stop all instances of timer T346d, if running;

1> release *minSchedulingOffsetPreferenceConfig* for all configured cell groups from the UE Inactive AS context, if stored;

- 1> stop all instances of timer T346e, if running;
- 1> release *releasePreferenceConfig* from the UE Inactive AS context, if stored;
- 1> stop timer T346f, if running;
- 1> apply the CCCH configuration as specified in 9.1.1.2;
- 1> apply the *timeAlignmentTimerCommon* included in *SIB1*;
- 1> start timer T319;
- 1> set the variable *pendingRNA-Update* to *false*;
- 1> initiate transmission of the *RRCResumeRequest* message or *RRCResumeRequest1* in accordance with 5.3.13.3.

### 5.3.13.3 Actions related to transmission of *RRCResumeRequest* or *RRCResumeRequest1* message

The UE shall set the contents of *RRCResumeRequest* or *RRCResumeRequest1* message as follows:

- 1> if field *useFullResumeID* is signalled in *SIB1*:
    - 2> select *RRCResumeRequest1* as the message to use;
    - 2> set the *resumeIdentity* to the stored *fullI-RNTI* value;
  - 1> else:
    - 2> select *RRCResumeRequest* as the message to use;
    - 2> set the *resumeIdentity* to the stored *shortI-RNTI* value;
  - 1> restore the RRC configuration, RoHC state, the stored QoS flow to DRB mapping rules and the  $K_{gNB}$  and  $K_{RRcInt}$  keys from the stored UE Inactive AS context except for the following:
    - *masterCellGroup*;
    - *mrdc-SecondaryCellGroup*, if stored; and
    - *pdcp-Config*;
  - 1> set the *resumeMAC-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) *VarResumeMAC-Input*;
    - 2> with the  $K_{RRcInt}$  key in the UE Inactive AS Context and the previously configured integrity protection algorithm; and
    - 2> with all input bits for COUNT, BEARER and DIRECTION set to binary ones;
  - 1> derive the  $K_{gNB}$  key based on the current  $K_{gNB}$  key or the NH, using the stored *nextHopChainingCount* value, as specified in TS 33.501 [11];
  - 1> derive the  $K_{RRcEnc}$  key, the  $K_{RRcInt}$  key, the  $K_{UPint}$  key and the  $K_{UPenc}$  key;
  - 1> configure lower layers to apply integrity protection for all radio bearers except SRB0 using the configured algorithm and the  $K_{RRcInt}$  key and  $K_{UPint}$  key derived in this subclause immediately, i.e., integrity protection shall be applied to all subsequent messages received and sent by the UE;
- NOTE 1: Only DRBs with previously configured UP integrity protection shall resume integrity protection.
- 1> configure lower layers to apply ciphering for all radio bearers except SRB0 and to apply the configured ciphering algorithm, the  $K_{RRcEnc}$  key and the  $K_{UPenc}$  key derived in this subclause, i.e. the ciphering configuration shall be applied to all subsequent messages received and sent by the UE;
  - 1> re-establish PDCP entities for SRB1;

1> resume SRB1;

1> submit the selected message *RRCResumeRequest* or *RRCResumeRequest1* for transmission to lower layers.

NOTE 2: Only DRBs with previously configured UP ciphering shall resume ciphering.

If lower layers indicate an integrity check failure while T319 is running, perform actions specified in 5.3.13.5.

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 5.3.13.6.

#### 5.3.13.4 Reception of the *RRCResume* by the UE

The UE shall:

1> stop timer T319;

1> stop timer T380, if running;

1> if T331 is running:

2> stop timer T331;

2> perform the actions as specified in 5.7.8.3;

1> if the *RRCResume* includes the *fullConfig*:

2> perform the full configuration procedure as specified in 5.3.5.11;

1> else:

2> if the *RRCResume* does not include the *restoreMCG-SCells*:

3> release the MCG SCell(s) from the UE Inactive AS context, if stored;

2> if the *RRCResume* does not include the *restoreSCG*:

3> release the MR-DC related configurations (i.e., as specified in 5.3.5.10) from the UE Inactive AS context, if stored;

2> restore the *masterCellGroup*, *mrdc-SecondaryCellGroup*, if stored, and *pdcp-Config* from the UE Inactive AS context;

2> configure lower layers to consider the restored MCG and SCG SCell(s) (if any) to be in deactivated state;

1> discard the UE Inactive AS context;

1> release the *suspendConfig* except the *ran-NotificationAreaInfo*;

1> if the *RRCResume* includes the *masterCellGroup*:

2> perform the cell group configuration for the received *masterCellGroup* according to 5.3.5.5;

1> if the *RRCResume* includes the *mrdc-SecondaryCellGroup*:

2> if the received *mrdc-SecondaryCellGroup* is set to *nr-SCG*:

3> perform the RRC reconfiguration according to 5.3.5.3 for the *RRCReconfiguration* message included in *nr-SCG*;

2> if the received *mrdc-SecondaryCellGroup* is set to *eutra-SCG*:

3> perform the RRC connection reconfiguration as specified in TS 36.331 [10], clause 5.3.5.3 for the *RRCConnectionReconfiguration* message included in *eutra-SCG*;

1> if the *RRCResume* includes the *radioBearerConfig*:

2> perform the radio bearer configuration according to 5.3.5.6;

- 1> if the *RRCResume* message includes the *sk-Counter*:
  - 2> perform security key update procedure as specified in 5.3.5.7;
- 1> if the *RRCResume* message includes the *radioBearerConfig2*:
  - 2> perform the radio bearer configuration according to 5.3.5.6;
- 1> if the *RRCResume* message includes the *needForGapsConfigNR*:
  - 2> if *needForGapsConfigNR* is set to *setup*:
    - 3> consider itself to be configured to provide the measurement gap requirement information of NR target bands;
  - 2> else:
    - 3> consider itself not to be configured to provide the measurement gap requirement information of NR target bands;
- 1> resume SRB2, SRB3 (if configured), and all DRBs;
- 1> if stored, discard the cell reselection priority information provided by the *cellReselectionPriorities* or inherited from another RAT;
- 1> stop timer T320, if running;
- 1> if the *RRCResume* message includes the *measConfig*:
  - 2> perform the measurement configuration procedure as specified in 5.5.2;
- 1> resume measurements if suspended;
- 1> if T390 is running:
  - 2> stop timer T390 for all access categories;
  - 2> perform the actions as specified in 5.3.14.4;
- 1> if T302 is running:
  - 2> stop timer T302;
  - 2> perform the actions as specified in 5.3.14.4;
- 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 the of *RRCResumeComplete* message as follows:
  - 2> if the upper layer provides NAS PDU, set the *dedicatedNAS-Message* to include the information received from upper layers;
  - 2> if the upper layer provides a PLMN, set the *selectedPLMN-Identity* to PLMN selected by upper layers (TS 24.501 [23]) from the PLMN(s) included in the *plmn-IdentityList* or in the *nprn-IdentityInfoList* in *SIB1*;
  - 2> if the *masterCellGroup* contains the *reportUplinkTxDirectCurrent*:
    - 3> include the *uplinkTxDirectCurrentList* for each MCG serving cell with UL;
    - 3> include *uplinkDirectCurrentBWP-SUL* for each MCG serving cell configured with SUL carrier, if any, within the *uplinkTxDirectCurrentList*;

- 2> if the UE has idle/inactive measurement information concerning cells other than the PCell available in *VarMeasIdleReport*:
  - 3> if the *idleModeMeasurementReq* is included in the *RRCResume* message:
    - 4> set the *measResultIdleEUTRA* in the *RRCResumeComplete* message to the value of *measReportIdleEUTRA* in the *VarMeasIdleReport*, if available;
    - 4> set the *measResultIdleNR* in the *RRCResumeComplete* message to the value of *measReportIdleNR* in the *VarMeasIdleReport*, if available;
    - 4> discard the *VarMeasIdleReport* upon successful delivery of the *RRCResumeComplete* message is confirmed by lower layers;
  - 3> else:
    - 4> if the SIB1 contains *idleModeMeasurementsNR* and the UE has NR idle/inactive measurement information concerning cells other than the PCell available in *VarMeasIdleReport*; or
    - 4> if the SIB1 contains *idleModeMeasurementsEUTRA* and the UE has E-UTRA idle/inactive measurement information available in *VarMeasIdleReport*:
      - 5> include the *idleMeasAvailable*;
- 2> if the *RRCResume* message includes the *mrdc-SecondaryCellGroupConfig* with *mrdc-SecondaryCellGroup* set to *eutra-SCG*:
  - 3> include in the *eutra-SCG-Response* the E-UTRA *RRCConnectionReconfigurationComplete* message in accordance with TS 36.331 [10] clause 5.3.5.3;
- 2> if the *RRCResume* message includes the *mrdc-SecondaryCellGroupConfig* with *mrdc-SecondaryCellGroup* set to *nr-SCG*:
  - 3> include in the *nr-SCG-Response* the SCG *RRCReconfigurationComplete* message;
- 2> if the UE has logged measurements available for NR and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:
  - 3> include the *logMeasAvailable* in the *RRCResumeComplete* message;
- 2> if the UE has Bluetooth logged measurements available and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:
  - 3> include the *logMeasAvailableBT* in the *RRCResumeComplete* message;
- 2> if the UE has WLAN logged measurements available and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport*:
  - 3> include the *logMeasAvailableWLAN* in the *RRCResumeComplete* message;
- 2> if the UE has connection establishment failure or connection resume failure information available in *VarConnEstFailReport* and if the RPLMN is equal to *plmn-Identity* stored in *VarConnEstFailReport*:
  - 3> include *connEstFailInfoAvailable* in the *RRCResumeComplete* message;
- 2> if the UE has radio link failure or handover failure information available in *VarRLF-Report* and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report*; or
- 2> if the UE has radio link failure or handover failure information available in *VarRLF-Report* of TS 36.331 [10] and if the UE is capable of cross-RAT RLF reporting and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report* of TS 36.331 [10]:
  - 3> include *rlf-InfoAvailable* in the *RRCResumeComplete* message;
- 2> if the UE supports storage of mobility history information and the UE has mobility history information available in *VarMobilityHistoryReport*:

- 3> include the *mobilityHistoryAvail* in the *RRCResumeComplete* message;
- 2> if *speedStateReselectionPars* is configured in the *SIB2*:
  - 3> include the *mobilityState* in the *RRCResumeComplete* message and set it to the mobility state (as specified in TS 38.304 [20]) of the UE just prior to entering *RRC\_CONNECTED* state;
- 2> if the UE is configured to provide the measurement gap requirement information of NR target bands:
  - 3> include the *NeedForGapsInfoNR* and set the contents as follows:
    - 4> include *intraFreq-needForGap* and set the gap requirement information of intra-frequency measurement for each NR serving cell;
    - 4> if *requestedTargetBandFilterNR* is configured, for each supported NR band that is also included in *requestedTargetBandFilterNR*, include an entry in *interFreq-needForGap* and set the gap requirement information for that band; otherwise, include an entry in *interFreq-needForGap* and set the corresponding gap requirement information for each supported NR band;
- 1> submit the *RRCResumeComplete* message to lower layers for transmission;
- 1> the procedure ends.

### 5.3.13.5 T319 expiry or Integrity check failure from lower layers while T319 is running

The UE shall:

- 1> if timer T319 expires or upon receiving Integrity check failure indication from lower layers while T319 is running:
  - 2> if the UE has connection establishment failure information or connection resume failure information available in *VarConnEstFailReport* and if the RPLMN is not equal to plmn-identity stored in *VarConnEstFailReport*; or
  - 2> if the cell identity of current cell is not equal to the cell identity stored in *measResultFailedCell* in *VarConnEstFailReport*:
    - 3> reset the *numberOfConnFail* to 0;
  - 2> clear the content included in *VarConnEstFailReport* except for the *numberOfConnFail*, if any;
  - 2> store the following connection resume failure information in the *VarConnEstFailReport* by setting its fields as follows:
    - 3> set the *plmn-Identity* to the PLMN selected by upper layers (see TS 24.501 [23]) from the PLMN(s) included in the *plmn-IdentityList* in *SIB1*;
    - 3> set the *measResultFailedCell* to include the global cell identity, tracking area code, the cell level and SS/PBCH block level RSRP, and RSRQ, and SS/PBCH block indexes, of the failed cell based on the available SSB measurements collected up to the moment the UE detected connection resume failure;
    - 3> if available, set the *measResultNeighCells*, in order of decreasing ranking-criterion as used for cell reselection, 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 per RAT and according to the following:
      - 4> for each neighbour cell included, include the optional fields that are available;

NOTE: 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 38.133 [14].

- 3> if available, set the *locationInfo* as in 5.3.3.7;
- 3> set *perRAInfoList* to indicate random access failure information as specified in 5.7.10.5;
- 3> if *numberOfConnFail* is smaller than 8:

- 4> increment the *numberOfConnFail* by 1;
- 2> perform the actions upon going to RRC\_IDLE as specified in 5.3.11 with release cause 'RRC Resume failure'.

The UE may discard the connection resume failure or connection establishment failure information, i.e. release the UE variable *VarConnEstFailReport*, 48 hours after the last connection resume failure is detected.

### 5.3.13.6 Cell re-selection or cell selection while T390, T319 or T302 is running (UE in RRC\_INACTIVE)

The UE shall:

- 1> if cell reselection occurs while T319 or T302 is running:
  - 2> perform the actions upon going to RRC\_IDLE as specified in 5.3.11 with release cause 'RRC Resume failure';
- 1> else if cell selection or reselection occurs while T390 is running:
  - 2> stop T390 for all access categories;
  - 2> perform the actions as specified in 5.3.14.4.

### 5.3.13.7 Reception of the *RRCSetup* by the UE

The UE shall:

- 1> perform the RRC connection setup procedure as specified in 5.3.3.4.

### 5.3.13.8 RNA update

In RRC\_INACTIVE state, the UE shall:

- 1> if T380 expires; or
- 1> if RNA Update is triggered at reception of SIB1, as specified in 5.2.2.4.2:
  - 2> initiate RRC connection resume procedure in 5.3.13.2 with *resumeCause* set to *rna-Update*;
- 1> if barring is alleviated for Access Category '8' or Access Category '2', as specified in 5.3.14.4:
  - 2> if upper layers do not request RRC the resumption of an RRC connection, and
  - 2> if the variable *pendingRNA-Update* is set to *true*:
    - 3> initiate RRC connection resume procedure in 5.3.13.2 with *resumeCause* value set to *rna-Update*.

If the UE in RRC\_INACTIVE state fails to find a suitable cell and camps on the acceptable cell to obtain limited service as defined in TS 38.304 [20], the UE shall:

- 1> perform the actions upon going to RRC\_IDLE as specified in 5.3.11 with release cause 'other'.

NOTE: It is left to UE implementation how to behave when T380 expires while the UE is camped neither on a suitable nor on an acceptable cell.

### 5.3.13.9 Reception of the *RRCRelease* by the UE

The UE shall:

- 1> perform the actions as specified in 5.3.8.



### 5.3.13.10 Reception of the *RRCReject* by the UE

The UE shall:

- 1> perform the actions as specified in 5.3.15.

### 5.3.13.11 Inability to comply with *RRCResume*

The UE shall:

- 1> if the UE is unable to comply with (part of) the configuration included in the *RRCResume* message;
- 2> perform the actions upon going to RRC\_IDLE as specified in 5.3.11 with release cause 'RRC Resume failure'.

NOTE 1: The UE may apply above failure handling also in case the *RRCResume* message causes a protocol error for which the generic error handling as defined in 10 specifies that the UE shall ignore the message.

NOTE 2: If the UE is unable to comply with part of the configuration, it does not apply any part of the configuration, i.e. there is no partial success/failure.

### 5.3.13.12 Inter RAT cell reselection

Upon reselecting to an inter-RAT cell, the UE shall:

- 1> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'other'.

## 5.3.14 Unified Access Control

### 5.3.14.1 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 [23] or the RRC layer. This procedure does not apply to IAB-MT.

After a PCell change in RRC\_CONNECTED the UE shall defer access barring checks until it has obtained *SIB1* (as specified in 5.2.2.2) from the target cell.

### 5.3.14.2 Initiation

Upon initiation of the procedure, the UE shall:

- 1> if timer T390 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:
    - 3> if *SIB1* includes *uac-BarringPerPLMN-List* and the *uac-BarringPerPLMN-List* contains an *UAC-BarringPerPLMN* entry with the *plmn-IdentityIndex* corresponding to the PLMN or SNPN selected by upper layers (see TS 24.501 [23]):

- 4> if the upper layers selected a PNI-NPN (identified by a PLMN identity and a CAG-ID) and *UAC-BarringPerPLMN* has an entry with the *plmn-IdentityIndex* corresponding to the PNI-NPN selected by upper layers:
  - 5> select the *UAC-BarringPerPLMN* entry with the *plmn-IdentityIndex* corresponding to the PNI-NPN selected by upper layers;
- 4> else:
  - 54> select the *UAC-BarringPerPLMN* entry with the *plmn-IdentityIndex* corresponding to the PLMN or to the SNPN 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 *SIB1*;
- 3> else if *SIB1* includes *uac-BarringForCommon*:
  - 4> in the remainder of this procedure use the *uac-BarringForCommon* (i.e. presence or absence of these parameters) included in *SIB1*;
- 3> else:
  - 4> consider the access attempt as allowed;
- 3> if *uac-BarringForCommon* is applicable or the *uac-ACBarringListType* indicates that *uac-ExplicitACBarringList* 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* contains a *UAC-BarringInfoSet* entry corresponding to the selected *uac-barringInfoSetIndex* in the *UAC-BarringPerCat*:
      - 6> select the *UAC-BarringInfoSet* entry;
      - 6> perform access barring check for the Access Category as specified in 5.3.14.5, using the selected *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-ACBarringListType* indicates that *uac-ImplicitACBarringList* is used:
  - 4> select the *uac-BarringInfoSetIndex* corresponding to the Access Category in the *uac-ImplicitACBarringList*;
  - 4> if the *uac-BarringInfoSetList* contains 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 5.3.14.5, using the selected *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 T390 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.

### 5.3.14.3 Void

### 5.3.14.4 T302, T390 expiry or stop (Barring alleviation)

The UE shall:

- 1> if timer T302 expires or is stopped:
  - 2> for each Access Category for which T390 is not running:
    - 3> consider the barring for this Access Category to be alleviated:
  - 1> else if timer T390 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 T390 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 5.3.13.8;

### 5.3.14.5 Access barring check

The UE shall:

- 1> if one or more Access Identities are indicated according to TS 24.501 [23], and
- 1> if for at least one of these Access Identities the corresponding bit in the *uac-BarringForAccessIdentity* contained in "UAC barring parameter" is set to *zero*:
  - 2> consider the access attempt as allowed;
- 1> else:
  - 2> draw a random number '*rand*' uniformly distributed in the range:  $0 \leq rand < 1$ ;
  - 2> if '*rand*' is lower than the value indicated by *uac-BarringFactor* included in "UAC barring parameter":
    - 3> consider the access attempt as allowed;
  - 2> else:
    - 3> consider the access attempt as barred;
- 1> if the access attempt is considered as barred:
  - 2> draw a random number '*rand*' that is uniformly distributed in the range  $0 \leq rand < 1$ ;
  - 2> start timer T390 for the Access Category with the timer value calculated as follows, using the *uac-BarringTime* included in "AC barring parameter":
 
$$T390 = (0.7 + 0.6 * rand) * uac-BarringTime.$$

## 5.3.15 RRC connection reject

### 5.3.15.1 Initiation

The UE initiates the procedure upon the reception of *RRCReject* when the UE tries to establish or resume an RRC connection.

### 5.3.15.2 Reception of the *RRCReject* by the UE

The UE shall:

- 1> stop timer T300, if running;
- 1> stop timer T319, if running;
- 1> stop timer T302, if running;
- 1> reset MAC and release the default MAC Cell Group configuration;
- 1> if *waitTime* is configured in the *RRCReject*:
  - 2> start timer T302, with the timer value set to the *waitTime*;
- 1> if *RRCReject* is received in response to a request from upper layers:
  - 2> inform the upper layer that access barring is applicable for all access categories except categories '0' and '2';
- 1> if *RRCReject* is received in response to an *RRCSetupRequest*:
  - 2> inform upper layers about the failure to setup the RRC connection, upon which the procedure ends;
- 1> else if *RRCReject* is received in response to an *RRCResumeRequest* or an *RRCResumeRequest1*:
  - 2> if resume is triggered by upper layers:
    - 3> inform upper layers about the failure to resume the RRC connection;
  - 2> if resume is triggered due to an RNA update:

- 3> set the variable *pendingRNA-Update* to true;
- 2> discard the current  $K_{gNB}$  key, the  $K_{RRCenc}$  key, the  $K_{RRCint}$  key, the  $K_{UPint}$  key and the  $K_{UPenc}$  key derived in accordance with 5.3.13.3;
- 2> suspend SRB1, upon which the procedure ends;

The RRC\_INACTIVE UE shall continue to monitor paging while the timer T302 is running.

NOTE: If timer T331 is running, the UE continues to perform idle/inactive measurements according to 5.7.8.

## 5.4 Inter-RAT mobility

### 5.4.1 Introduction

Network controlled inter-RAT mobility between NR and E-UTRA is supported, where E-UTRA can be connected to either EPC or 5GC.

### 5.4.2 Handover to NR

#### 5.4.2.1 General

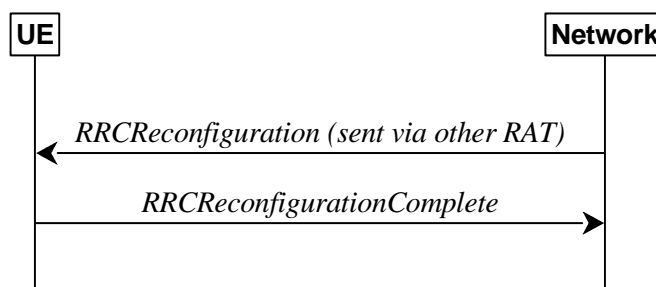


Figure 5.4.2.1-1: Handover to NR, successful

The purpose of this procedure is to, under the control of the network, transfer a connection between the UE and another Radio Access Network (e.g. E-UTRAN) to NR.

The handover to NR procedure applies when SRBs, possibly in combination with DRBs, are established in another RAT. Handover from E-UTRA to NR applies only after integrity has been activated in E-UTRA.

#### 5.4.2.2 Initiation

The RAN using another RAT initiates the handover to NR procedure, in accordance with the specifications applicable for the other RAT, by sending the *RRCReconfiguration* message via the radio access technology from which the inter-RAT handover is performed.

The network applies the procedure as follows:

- to activate ciphering, possibly using NULL algorithm, if not yet activated in the other RAT;
- to re-establish SRBs and one or more DRBs;

#### 5.4.2.3 Reception of the *RRCReconfiguration* by the UE

The UE shall:

- 1> apply the default L1 parameter values as specified in corresponding physical layer specifications except for the parameters for which values are provided in *SIB1*;
- 1> apply the default MAC Cell Group configuration as specified in 9.2.2;

1> perform RRC reconfiguration procedure as specified in 5.3.5;

NOTE: If the UE is connected to 5GC of the source E-UTRA cell, the delta configuration for PDCP and SDAP can be used for intra-system inter-RAT handover. For other cases, source RAT configuration is not considered when the UE applies the reconfiguration message of target RAT.

## 5.4.3 Mobility from NR

### 5.4.3.1 General



Figure 5.4.3.1-1: Mobility from NR, successful

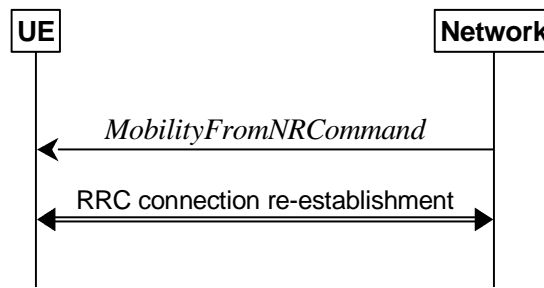


Figure 5.4.3.1-2: Mobility from NR, failure

The purpose of this procedure is to move a UE in RRC\_CONNECTED to a cell using other RAT, e.g. E-UTRA, UTRA-FDD. The mobility from NR procedure covers the following type of mobility:

- handover, i.e. the *MobilityFromNRCommand* message includes radio resources that have been allocated for the UE in the target cell;

### 5.4.3.2 Initiation

The network initiates the mobility from NR procedure to a UE in RRC\_CONNECTED, possibly in response to a *MeasurementReport* or an *MCGFailureInformation* message, by sending a *MobilityFromNRCommand* message. The network applies the procedure as follows:

- the procedure is initiated only when AS security has been activated, and SRB2 with at least one DRB or, for IAB, SRB2, are setup and not suspended;
- the procedure is not initiated if any DAPS bearer is configured;

### 5.4.3.3 Reception of the *MobilityFromNRCommand* by the UE

The UE shall:

- 1> stop timer T310, if running;
- 1> stop timer T312, if running;
- 1> if T316 is running:
  - 2> stop timer T316;
  - 2> clear the information included in *VarRLF-Report*, if any;

- 1> if T390 is running:
  - 2> stop timer T390 for all access categories;
  - 2> perform the actions as specified in 5.3.14.4;
- 1> if the *targetRAT-Type* is set to *eutra*:
  - 2> consider inter-RAT mobility as initiated towards E-UTRA;
  - 2> forward the *nas-SecurityParamFromNR* to the upper layers, if included;
- 1> else if the *targetRAT-Type* is set to *utra-fdd*:
  - 2> consider inter-RAT mobility as initiated towards UTRA-FDD;
  - 2> forward the *nas-SecurityParamFromNR* to the upper layers, if included;
- 1> access the target cell indicated in the inter-RAT message in accordance with the specifications of the target RAT.

#### 5.4.3.4 Successful completion of the mobility from NR

Upon successfully completing the handover, at the source side the UE shall:

- 1> reset MAC;
  - 1> stop all timers that are running except T400;
  - 1> release *ran-NotificationAreaInfo*, if stored;
  - 1> release the AS security context including the  $K_{RRCCenc}$  key, the  $K_{RRCCint}$  key, the  $K_{UPint}$  key and the  $K_{UPenc}$  key, if stored;
  - 1> release all radio resources, including release of the RLC entity and the MAC configuration;
  - 1> release the associated PDCP entity and SDAP entity for all established RBs;
- NOTE : PDCP and SDAP configured by the source RAT prior to the handover that are reconfigured and re-used by target RAT when delta signalling (i.e., during inter-RAT intra-system handover when *fullConfig* is not present) is used, are not released as part of this procedure.
- 1> if the *targetRAT-Type* is set to *eutra* and the *nas-SecurityParamFromNR* is included:
    - 2> indicate the release of the RRC connection to upper layers together with the release cause 'other'.

#### 5.4.3.5 Mobility from NR failure

The UE shall:

- 1> if the UE does not succeed in establishing the connection to the target radio access technology:
  - 2> if the UE supports Radio Link Failure Report for Inter-RAT MRO:
    - 3> store handover failure information in *VarRLF-Report* according to 5.3.10.5;
  - 2> if *voiceFallbackIndication* is included in the *MobilityFromNRCommand* message:
    - 3> attempt to select an E-UTRA cell:
      - 4> if a suitable E-UTRA cell is selected:
        - 5> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'RRC connection failure';
      - 4> else:
        - 5> revert back to the configuration used in the source PCell;

- 5> initiate the connection re-establishment procedure as specified in subclause 5.3.7;
- 2> else:
  - 3> revert back to the configuration used in the source PCell;
  - 3> initiate the connection re-establishment procedure as specified in subclause 5.3.7;
- 1> else if the UE is unable to comply with any part of the configuration included in the *MobilityFromNRCommand* message; or
- 1> if there is a protocol error in the inter RAT information included in the *MobilityFromNRCommand* message, causing the UE to fail the procedure according to the specifications applicable for the target RAT:
  - 2> revert back to the configuration used in the source PCell;
  - 2> initiate the connection re-establishment procedure as specified in subclause 5.3.7.

## 5.5 Measurements

### 5.5.1 Introduction

The network may configure an RRC\_CONNECTED UE to perform measurements. The network may configure the UE to report them in accordance with the measurement configuration or perform conditional reconfiguration evaluation in accordance with the conditional reconfiguration. The measurement configuration is provided by means of dedicated signalling i.e. using the *RRCReconfiguration* or *RRCResume*.

The network may configure the UE to perform the following types of measurements:

- NR measurements;
- Inter-RAT measurements of E-UTRA frequencies.
- Inter-RAT measurements of UTRA-FDD frequencies.

The network may configure the UE to report the following measurement information based on SS/PBCH block(s):

- Measurement results per SS/PBCH block;
- Measurement results per cell based on SS/PBCH block(s);
- SS/PBCH block(s) indexes.

The network may configure the UE to report the following measurement information based on CSI-RS resources:

- Measurement results per CSI-RS resource;
- Measurement results per cell based on CSI-RS resource(s);
- CSI-RS resource measurement identifiers.

The network may configure the UE to perform the following types of measurements for sidelink:

- CBR measurements.

The network may configure the UE to report the following CLI measurement information based on SRS resources:

- Measurement results per SRS resource;
- SRS resource(s) indexes.

The network may configure the UE to report the following CLI measurement information based on CLI-RSSI resources:

- Measurement results per CLI-RSSI resource;



- CLI-RSSI resource(s) indexes.

The measurement configuration includes the following parameters:

**1. Measurement objects:** A list of objects on which the UE shall perform the measurements.

- For intra-frequency and inter-frequency measurements a measurement object indicates the frequency/time location and subcarrier spacing of reference signals to be measured. Associated with this measurement object, the network may configure a list of cell specific offsets, a list of 'blacklisted' cells and a list of 'whitelisted' cells. Blacklisted cells are not applicable in event evaluation or measurement reporting. Whitelisted cells are the only ones applicable in event evaluation or measurement reporting.
- The *measObjectId* of the MO which corresponds to each serving cell is indicated by *-servingCellMO* within the serving cell configuration.
- For inter-RAT E-UTRA measurements a measurement object is a single E-UTRA carrier frequency. Associated with this E-UTRA carrier frequency, the network can configure a list of cell specific offsets, a list of 'blacklisted' cells and a list of 'whitelisted' cells. Blacklisted cells are not applicable in event evaluation or measurement reporting. Whitelisted cells are the only ones applicable in event evaluation or measurement reporting.
- For inter-RAT UTRA-FDD measurements a measurement object is a set of cells on a single UTRA-FDD carrier frequency.
- For CBR measurement of NR sidelink communication, a measurement object is a set of transmission resource pool(s) on a single carrier frequency for NR sidelink communication.
- For CLI measurements a measurement object indicates the frequency/time location of SRS resources and/or CLI-RSSI resources, and subcarrier spacing of SRS resources to be measured.

**2. Reporting configurations:** A list of reporting configurations where there can be one or multiple reporting configurations per measurement object. Each measurement reporting configuration consists of the following:

- Reporting criterion: The criterion that triggers the UE to send a measurement report. This can either be periodical or a single event description.
- RS type: The RS that the UE uses for beam and cell measurement results (SS/PBCH block or CSI-RS).
- Reporting format: The quantities per cell and per beam that the UE includes in the measurement report (e.g. RSRP) and other associated information such as the maximum number of cells and the maximum number beams per cell to report.

In case of conditional reconfiguration, each configuration consists of the following:

- Execution criteria: The criteria the UE uses for conditional reconfiguration execution.
- RS type: The RS that the UE uses for obtaining beam and cell measurement results (SS/PBCH block-based or CSI-RS-based), used for evaluating conditional reconfiguration execution condition.

**3. Measurement identities:** For measurement reporting, a list of measurement identities where each measurement identity links one measurement object with one reporting configuration. By configuring multiple measurement identities, it is possible to link more than one measurement object to the same reporting configuration, as well as to link more than one reporting configuration to the same measurement object. The measurement identity is also included in the measurement report that triggered the reporting, serving as a reference to the network. For conditional reconfiguration triggering, one measurement identity links to exactly one conditional reconfiguration trigger configuration. And up to 2 measurement identities can be linked to one conditional reconfiguration execution condition.

**4. Quantity configurations:** The quantity configuration defines the measurement filtering configuration used for all event evaluation and related reporting, and for periodical reporting of that measurement. For NR measurements, the network may configure up to 2 quantity configurations with a reference in the NR measurement object to the configuration that is to be used. In each configuration, different filter coefficients can be configured for different measurement quantities, for different RS types, and for measurements per cell and per beam.

**5. Measurement gaps:** Periods that the UE may use to perform measurements.

A UE in RRC\_CONNECTED maintains a measurement object list, a reporting configuration list, and a measurement identities list according to signalling and procedures in this specification. The measurement object list possibly includes NR measurement object(s), CLI measurement object(s) and inter-RAT objects. Similarly, the reporting configuration list includes NR and inter-RAT reporting configurations. Any measurement object can be linked to any reporting configuration of the same RAT type. Some reporting configurations may not be linked to a measurement object. Likewise, some measurement objects may not be linked to a reporting configuration.

The measurement procedures distinguish the following types of cells:

1. The NR serving cell(s) – these are the SpCell and one or more SCells.
2. Listed cells – these are cells listed within the measurement object(s).
3. Detected cells – these are cells that are not listed within the measurement object(s) but are detected by the UE on the SSB frequency(ies) and subcarrier spacing(s) indicated by the measurement object(s).

For NR measurement object(s), the UE measures and reports on the serving cell(s), listed cells and/or detected cells. For inter-RAT measurements object(s) of E-UTRA, the UE measures and reports on listed cells and detected cells and, for RSSI and channel occupancy measurements, the UE measures and reports on the configured resources on the indicated frequency. For inter-RAT measurements object(s) of UTRA-FDD, the UE measures and reports on listed cells. For CLI measurement object(s), the UE measures and reports on configured measurement resources (i.e. SRS resources and/or CLI-RSSI resources).

Whenever the procedural specification, other than contained in sub-clause 5.5.2, refers to a field it concerns a field included in the *VarMeasConfig* unless explicitly stated otherwise i.e. only the measurement configuration procedure covers the direct UE action related to the received *measConfig*.

In NR-DC, the UE may receive two independent *measConfig*:

- a *measConfig*, associated with MCG, that is included in the *RRCReconfiguration* message received via SRB1; and
- a *measConfig*, associated with SCG, that is included in the *RRCReconfiguration* message received via SRB3, or, alternatively, included within a *RRCReconfiguration* message embedded in a *RRCReconfiguration* message received via SRB1.

In this case, the UE maintains two independent *VarMeasConfig* and *VarMeasReportList*, one associated with each *measConfig*, and independently performs all the procedures in clause 5.5 for each *measConfig* and the associated *VarMeasConfig* and *VarMeasReportList*, unless explicitly stated otherwise.

The configurations related to CBR measurements are only included in the *measConfig* associated with MCG.

## 5.5.2 Measurement configuration

### 5.5.2.1 General

The network applies the procedure as follows:

- to ensure that, whenever the UE has a *measConfig* associated with a CG, it includes a *measObject* for the SpCell and for each NR SCell of the CG to be measured;
- to configure at most one measurement identity across all CGs using a reporting configuration with the *reportType* set to *reportCGI*;
- to configure at most one measurement identity per CG using a reporting configuration with the *ul-DelayValueConfig*;
- to ensure that, in the *measConfig* associated with a CG:
  - for all SSB based measurements there is at most one measurement object with the same *ssbFrequency*;
  - an *smtc1* included in any measurement object with the same *ssbFrequency* has the same value and that an *smtc2* included in any measurement object with the same *ssbFrequency* has the same value;

- to ensure that all measurement objects configured in this specification and in TS 36.331 [10] with the same *ssbFrequency* have the same *ssbSubcarrierSpacing*;
- to ensure that, if a measurement object associated with the MCG has the same *ssbFrequency* as a measurement object associated with the SCG:
  - for that *ssbFrequency*, the measurement window according to the *smtc1* configured by the MCG includes the measurement window according to the *smtc1* configured by the SCG, or vice-versa, with an accuracy of the maximum receive timing difference specified in TS 38.133 [14].
  - if both measurement objects are used for RSSI measurements, bits in *measurementSlots* in both objects corresponding to the same slot are set to the same value. Also, the *endSymbol* is the same in both objects.
- to ensure that, if a measurement object has the same *ssbFrequency* as a measurement object configured in TS 36.331 [10]:
  - for that *ssbFrequency*, the measurement window according to the *smtc* configured in TS 36.331 [10] includes the measurement window according to the *smtc1* configured in TS 38.331, or vice-versa, with an accuracy of the maximum receive timing difference specified in TS 38.133 [14].
  - if both measurement objects are used for RSSI measurements, bits in *measurementSlots* in both objects corresponding to the same slot are set to the same value. Also, the *endSymbol* is the same in both objects.
- when the UE is in NE-DC, NR-DC, or NR standalone, to configure at most one measurement identity across all CGs using a reporting configuration with the *reportType* set to *reportSFTD*;

For CSI-RS resources, the network applies the procedure as follows:

- to ensure that all CSI-RS resources configured in each measurement object have the same center frequency, ( $startPRB + \text{floor}(nrofPRBs/2)$ )

The UE shall:

- 1> if the received *measConfig* includes the *measObjectToRemoveList*:
  - 2> perform the measurement object removal procedure as specified in 5.5.2.4;
- 1> if the received *measConfig* includes the *measObjectToAddModList*:
  - 2> perform the measurement object addition/modification procedure as specified in 5.5.2.5;
- 1> if the received *measConfig* includes the *reportConfigToRemoveList*:
  - 2> perform the reporting configuration removal procedure as specified in 5.5.2.6;
- 1> if the received *measConfig* includes the *reportConfigToAddModList*:
  - 2> perform the reporting configuration addition/modification procedure as specified in 5.5.2.7;
- 1> if the received *measConfig* includes the *quantityConfig*:
  - 2> perform the quantity configuration procedure as specified in 5.5.2.8;
- 1> if the received *measConfig* includes the *measIdToRemoveList*:
  - 2> perform the measurement identity removal procedure as specified in 5.5.2.2;
- 1> if the received *measConfig* includes the *measIdToAddModList*:
  - 2> perform the measurement identity addition/modification procedure as specified in 5.5.2.3;
- 1> if the received *measConfig* includes the *measGapConfig*:
  - 2> perform the measurement gap configuration procedure as specified in 5.5.2.9;
- 1> if the received *measConfig* includes the *measGapSharingConfig*:
  - 2> perform the measurement gap sharing configuration procedure as specified in 5.5.2.11;

- 1> if the received *measConfig* includes the *s-MeasureConfig*:
  - 2> if *s-MeasureConfig* is set to *ssb-RSRP*, set parameter *ssb-RSRP* of *s-MeasureConfig* within *VarMeasConfig* to the lowest value of the RSRP ranges indicated by the received value of *s-MeasureConfig*;
  - 2> else, set parameter *csi-RSRP* of *s-MeasureConfig* within *VarMeasConfig* to the lowest value of the RSRP ranges indicated by the received value of *s-MeasureConfig*.

### 5.5.2.2 Measurement identity removal

The UE shall:

- 1> for each *measId* included in the received *measIdToRemoveList* that is part of the current UE configuration in *VarMeasConfig*:
  - 2> remove the entry with the matching *measId* from the *measIdList* within the *VarMeasConfig*;
  - 2> remove the measurement reporting entry for this *measId* from the *VarMeasReportList*, if included;
  - 2> stop the periodical reporting timer or timer T321 or timer T322, whichever one is running, and reset the associated information (e.g. *timeToTrigger*) for this *measId*.

NOTE: The UE does not consider the message as erroneous if the *measIdToRemoveList* includes any *measId* value that is not part of the current UE configuration.

### 5.5.2.3 Measurement identity addition/modification

The network applies the procedure as follows:

- configure a *measId* only if the corresponding measurement object, the corresponding reporting configuration and the corresponding quantity configuration, are configured.

The UE shall:

- 1> for each *measId* included in the received *measIdToAddModList*:
  - 2> if an entry with the matching *measId* exists in the *measIdList* within the *VarMeasConfig*:
    - 3> replace the entry with the value received for this *measId*;
  - 2> else:
    - 3> add a new entry for this *measId* within the *VarMeasConfig*;
  - 2> remove the measurement reporting entry for this *measId* from the *VarMeasReportList*, if included;
  - 2> stop the periodical reporting timer or timer T321 or timer T322, whichever one is running, and reset the associated information (e.g. *timeToTrigger*) for this *measId*;
  - 2> if the *reportType* is set to *reportCGI* in the *reportConfig* associated with this *measId*:
    - 3> if the *measObject* associated with this *measId* concerns E-UTRA:
      - 4> if the *useAutonomousGaps* is included in the *reportConfig* associated with this *measId*:
        - 5> start timer T321 with the timer value set to [FFS] for this *measId*;
      - 4> else:
        - 5> start timer T321 with the timer value set to 1 second for this *measId*;
    - 3> if the *measObject* associated with this *measId* concerns NR:
      - 4> if the *measObject* associated with this *measId* concerns FR1:
        - 5> if the *useAutonomousGaps* is included in the *reportConfig* associated with this *measId*:

- 6> start timer T321 with the timer value set to 2 seconds for this *measId*;
- 5> else:
  - 6> start timer T321 with the timer value set to 2 seconds for this *measId*;
- 4> if the *measObject* associated with this *measId* concerns FR2:
  - 5> if the *useAutonomousGaps* is included in the *reportConfig* associated with this *measId*:
    - 6> start timer T321 with the timer value set to [FFS] for this *measId*;
  - 5> else:
    - 6> start timer T321 with the timer value set to 16 seconds for this *measId*.
- 2> if the *reportType* is set to *reportSFTD* in the *reportConfigNR* associated with this *measId* and the *drx-SFTD-NeighMeas* is included:
  - 3> if the *measObject* associated with this *measId* concerns FR1:
    - 4> start timer T322 with the timer value set to 3 seconds for this *measId*;
  - 3> if the *measObject* associated with this *measId* concerns FR2:
    - 4> start timer T322 with the timer value set to 24 seconds for this *measId*.

#### 5.5.2.4 Measurement object removal

The UE shall:

- 1> for each *measObjectId* included in the received *measObjectToRemoveList* that is part of *measObjectList* in *VarMeasConfig*:
  - 2> remove the entry with the matching *measObjectId* from the *measObjectList* within the *VarMeasConfig*;
  - 2> remove all *measId* associated with this *measObjectId* from the *measIdList* within the *VarMeasConfig*, if any;
  - 2> if a *measId* is removed from the *measIdList*:
    - 3> remove the measurement reporting entry for this *measId* from the *VarMeasReportList*, if included;
    - 3> stop the periodical reporting timer or timer T321 or timer T322, whichever is running, and reset the associated information (e.g. *timeToTrigger*) for this *measId*.

NOTE: The UE does not consider the message as erroneous if the *measObjectToRemoveList* includes any *measObjectId* value that is not part of the current UE configuration.

#### 5.5.2.5 Measurement object addition/modification

The UE shall:

- 1> for each *measObjectId* included in the received *measObjectToAddModList*:
  - 2> if an entry with the matching *measObjectId* exists in the *measObjectList* within the *VarMeasConfig*, for this entry:
    - 3> reconfigure the entry with the value received for this *measObject*, except for the fields *cellsToAddModList*, *blackCellsToAddModList*, *whiteCellsToAddModList*, *cellsToRemoveList*, *blackCellsToRemoveList* and *whiteCellsToRemoveList*;
  - 3> if the received *measObject* includes the *cellsToRemoveList*:
    - 4> for each *physCellId* included in the *cellsToRemoveList*:
      - 5> remove the entry with the matching *physCellId* from the *cellsToAddModList*;

- 3> if the received *measObject* includes the *cellsToAddModList*:
  - 4> for each *physCellId* value included in the *cellsToAddModList*:
    - 5> if an entry with the matching *physCellId* exists in the *cellsToAddModList*:
      - 6> replace the entry with the value received for this *physCellId*;
    - 5> else:
      - 6> add a new entry for the received *physCellId* to the *cellsToAddModList*;

- 3> if the received *measObject* includes the *blackCellsToRemoveList*:
  - 4> for each *pci-RangeIndex* included in the *blackCellsToRemoveList*:
    - 5> remove the entry with the matching *pci-RangeIndex* from the *blackCellsToAddModList*;

NOTE 1: For each *pci-RangeIndex* included in the *blackCellsToRemoveList* that concerns overlapping ranges of cells, a cell is removed from the blacklist of cells only if all PCI ranges containing it are removed.

- 3> if the received *measObject* includes the *blackCellsToAddModList*:
  - 4> for each *pci-RangeIndex* included in the *blackCellsToAddModList*:
    - 5> if an entry with the matching *pci-RangeIndex* is included in the *blackCellsToAddModList*:
      - 6> replace the entry with the value received for this *pci-RangeIndex*;
    - 5> else:
      - 6> add a new entry for the received *pci-RangeIndex* to the *blackCellsToAddModList*;

- 3> if the received *measObject* includes the *whiteCellsToRemoveList*:
  - 4> for each *pci-RangeIndex* included in the *whiteCellsToRemoveList*:
    - 5> remove the entry with the matching *pci-RangeIndex* from the *whiteCellsToAddModList*;

NOTE2: For each *pci-RangeIndex* included in the *whiteCellsToRemoveList* that concerns overlapping ranges of cells, a cell is removed from the whitelist of cells only if all PCI ranges containing it are removed.

- 3> if the received *measObject* includes the *whiteCellsToAddModList*:
  - 4> for each *pci-RangeIndex* included in the *whiteCellsToAddModList*:
    - 5> if an entry with the matching *pci-RangeIndex* is included in the *whiteCellsToAddModList*:
      - 6> replace the entry with the value received for this *pci-RangeIndex*;
    - 5> else:
      - 6> add a new entry for the received *pci-RangeIndex* to the *whiteCellsToAddModList*

- 3> for each *measId* associated with this *measObjectId* in the *measIdList* within the *VarMeasConfig*, if any:
  - 4> remove the measurement reporting entry for this *measId* from the *VarMeasReportList*, if included;
  - 4> stop the periodical reporting timer or timer T321 or timer T322, whichever one is running, and reset the associated information (e.g. *timeToTrigger*) for this *measId*;

- 3> if the received *measObject* includes the *tx-PoolMeasToRemoveList*:
  - 4> for each transmission resource pool indicated in *tx-PoolMeasToRemoveList*:
    - 5> remove the entry with the matching identity of the transmission resource pool from the *tx-PoolMeasToAddModList*;

- 3> if the received *measObject* includes the *tx-PoolMeasToAddModList*:

- 4> for each transmission resource pool indicated in *tx-PoolMeasToAddModList*:
  - 5> if an entry with the matching identity of the transmission resource pool exists in the *tx-PoolMeasToAddModList*:
    - 6> replace the entry with the value received for this transmission resource pool;
  - 5> else:
    - 6> add a new entry for the received identity of the transmission resource pool to the *tx-PoolMeasToAddModList*;
- 3> if the received *measObject* includes the *ssb-PositionQCL-CellsToRemoveList*:
  - 4> for each *physCellId* included in the *ssb-PositionQCL-CellsToRemoveList*:
    - 5> remove the entry with the matching *physCellId* from the *ssb-PositionQCL-CellsToAddModList*;
- 3> if the received *measObject* includes the *ssb-PositionQCL-CellsToAddModList*:
  - 4> for each *physCellId* included in the *ssb-PositionQCL-CellsToAddModList*:
    - 5> if an entry with the matching *physCellId* exists in the *ssb-PositionQCL-CellsToAddModList*:
      - 6> replace the entry with the value received for this *physCellId*;
    - 5> else:
      - 6> add a new entry for the received *physCellId* to the *ssb-PositionQCL-CellsToAddModList*;
- 2> else:
  - 3> add a new entry for the received *measObject* to the *measObjectList* within *VarMeasConfig*.

### 5.5.2.6 Reporting configuration removal

The UE shall:

- 1> for each *reportConfigId* included in the received *reportConfigToRemoveList* that is part of the current UE configuration in *VarMeasConfig*:
  - 2> remove the entry with the matching *reportConfigId* from the *reportConfigList* within the *VarMeasConfig*;
  - 2> remove all *measId* associated with the *reportConfigId* from the *measIdList* within the *VarMeasConfig*, if any;
  - 2> if a *measId* is removed from the *measIdList*:
    - 3> remove the measurement reporting entry for this *measId* from the *VarMeasReportList*, if included;
    - 3> stop the periodical reporting timer or timer T321 or timer T322, whichever one is running, and reset the associated information (e.g. *timeToTrigger*) for this *measId*.

NOTE: The UE does not consider the message as erroneous if the *reportConfigToRemoveList* includes any *reportConfigId* value that is not part of the current UE configuration.

### 5.5.2.7 Reporting configuration addition/modification

The UE shall:

- 1> for each *reportConfigId* included in the received *reportConfigToAddModList*:
  - 2> if an entry with the matching *reportConfigId* exists in the *reportConfigList* within the *VarMeasConfig*, for this entry:
    - 3> reconfigure the entry with the value received for this *reportConfig*;

- 3> for each *measId* associated with this *reportConfigId* included in the *measIdList* within the *VarMeasConfig*, if any:
  - 4> remove the measurement reporting entry for this *measId* from the *VarMeasReportList*, if included;
  - 4> stop the periodical reporting timer or timer T321 or timer T322, whichever one is running, and reset the associated information (e.g. *timeToTrigger*) for this *measId*;
- 2> else:
  - 3> add a new entry for the received *reportConfig* to the *reportConfigList* within the *VarMeasConfig*.

### 5.5.2.8 Quantity configuration

The UE shall:

- 1> for each RAT for which the received *quantityConfig* includes parameter(s):
  - 2> set the corresponding parameter(s) in *quantityConfig* within *VarMeasConfig* to the value of the received *quantityConfig* parameter(s);
- 1> for each *measId* included in the *measIdList* within *VarMeasConfig*:
  - 2> remove the measurement reporting entry for this *measId* from the *VarMeasReportList*, if included;
  - 2> stop the periodical reporting timer or timer T321 or timer T322, whichever one is running, and reset the associated information (e.g. *timeToTrigger*) for this *measId*.

### 5.5.2.9 Measurement gap configuration

The UE shall:

- 1> if *gapFR1* is set to *setup*:
  - 2> if an FR1 measurement gap configuration is already setup, release the FR1 measurement gap configuration;
  - 2> setup the FR1 measurement gap configuration indicated by the *measGapConfig* in accordance with the received *gapOffset*, i.e., the first subframe of each gap occurs at an SFN and subframe meeting the following condition:
    - $SFN \bmod T = \text{FLOOR}(gapOffset/10)$ ;
    - $subframe = gapOffset \bmod 10$ ;
    - with  $T = MGRP/10$  as defined in TS 38.133 [14];
  - 2> apply the specified timing advance *mgta* to the gap occurrences calculated above (i.e. the UE starts the measurement *mgta* ms before the gap subframe occurrences);
- 1> else if *gapFR1* is set to *release*:
  - 2> release the FR1 measurement gap configuration;
- 1> if *gapFR2* is set to *setup*:
  - 2> if an FR2 measurement gap configuration is already setup, release the FR2 measurement gap configuration;
  - 2> setup the FR2 measurement gap configuration indicated by the *measGapConfig* in accordance with the received *gapOffset*, i.e., the first subframe of each gap occurs at an SFN and subframe meeting the following condition:
    - $SFN \bmod T = \text{FLOOR}(gapOffset/10)$ ;
    - $subframe = gapOffset \bmod 10$ ;
    - with  $T = MGRP/10$  as defined in TS 38.133 [14];



- 2> apply the specified timing advance *mgta* to the gap occurrences calculated above (i.e. the UE starts the measurement *mgta* ms before the gap subframe occurrences);
- 1> else if *gapFR2* is set to *release*:
- 2> release the FR2 measurement gap configuration;
- 1> if *gapUE* is set to *setup*:
- 2> if a per UE measurement gap configuration is already setup, release the per UE measurement gap configuration;
- 2> setup the per UE measurement gap configuration indicated by the *measGapConfig* in accordance with the received *gapOffset*, i.e., the first subframe of each gap occurs at an SFN and subframe meeting the following condition:
- $$\text{SFN mod } T = \text{FLOOR}(\text{gapOffset}/10);$$
- $$\text{subframe} = \text{gapOffset mod } 10;$$
- with  $T = \text{MGRP}/10$  as defined in TS 38.133 [14];
- 2> apply the specified timing advance *mgta* to the gap occurrences calculated above (i.e. the UE starts the measurement *mgta* ms before the gap subframe occurrences);
- 1> else if *gapUE* is set to *release*:
- 2> release the per UE measurement gap configuration.

NOTE 1: For *gapFR2* configuration with synchronous CA, for the UE in NE-DC or NR-DC, the SFN and subframe of the serving cell indicated by the *refServCellIndicator* in *gapFR2* is used in the gap calculation. Otherwise, the SFN and subframe of a serving cell on FR2 frequency is used in the gap calculation

NOTE 2: For *gapFR1* or *gapUE* configuration, for the UE in NE-DC or NR-DC, the SFN and subframe of the serving cell indicated by the *refServCellIndicator* in corresponding *gapFR1* or *gapUE* is used in the gap calculation. Otherwise, the SFN and subframe of the PCell is used in the gap calculation.

NOTE 3: For *gapFR2* configuration with asynchronous CA, for the UE in NE-DC or NR-DC, the SFN and subframe of the serving cell indicated by the *refServCellIndicator* and *refFR2ServCellAsyncCA* in *gapFR2* is used in the gap calculation. Otherwise, the SFN and subframe of a serving cell on FR2 frequency indicated by the *refFR2ServCellAsyncCA* in *gapFR2* is used in the gap calculation

### 5.5.2.10 Reference signal measurement timing configuration

The UE shall setup the first SS/PBCH block measurement timing configuration (SMTC) in accordance with the received *periodicityAndOffset* parameter (providing *Periodicity* and *Offset* value for the following condition) in the *smtc1* configuration. The first subframe of each SMTC occasion occurs at an SFN and subframe of the NR SpCell meeting the following condition:

$$\text{SFN mod } T = (\text{FLOOR}(\text{Offset}/10));$$

if the *Periodicity* is larger than *sf5*:

$$\text{subframe} = \text{Offset mod } 10;$$

else:

$$\text{subframe} = \text{Offset or } (\text{Offset} + 5);$$

with  $T = \text{CEIL}(\text{Periodicity}/10)$ .

If *smtc2* is present, for cells indicated in the *pci-List* parameter in *smtc2* in the same *MeasObjectNR*, the UE shall setup an additional SS/PBCH block measurement timing configuration (SMTC) in accordance with the received *periodicity* parameter in the *smtc2* configuration and use the *Offset* (derived from parameter *periodicityAndOffset*) and *duration*

parameter from the *smtc1* configuration. The first subframe of each SMTC occasion occurs at an SFN and subframe of the NR SpCell meeting the above condition.

If *smtc2-LP* is present, for cells indicated in the *pci-List* parameter in *smtc2-LP* in the same frequency (for intra frequency cell reselection) or different frequency (for inter frequency cell reselection), the UE shall setup an additional SS/PBCH block measurement timing configuration (SMTC) in accordance with the received *periodicity* parameter in the *smtc2-LP* configuration and use the *Offset* (derived from parameter *periodicityAndOffset*) and *duration* parameter from the *smtc* configuration for that frequency. The first subframe of each SMTC occasion occurs at an SFN and subframe of the NR SpCell or serving cell (for cell reselection) meeting the above condition.

If *smtc3list* is present, for cells indicated in the *pci-List* parameter in each *SSB-MTC3* element of the list in the same *MeasObjectNR*, the IAB-MT shall setup an additional SS block measurement timing configuration in accordance with the received *periodicityAndOffset* parameter (using same condition as *smtc1* to identify the SFN and the subframe for SMTC occasion) in each *SSB-MTC3* configuration and use the *duration* and *ssb-ToMeasure* parameters from each *SSB-MTC3* configuration.

On the indicated *ssbFrequency*, the UE shall not consider SS/PBCH block transmission in subframes outside the SMTC occasion for RRM measurements based on SS/PBCH blocks and for RRM measurements based on CSI-RS except for SFTD measurement (see TS 38.133 [14], subclause 9.3.8).

### 5.5.2.10a RSSI measurement timing configuration

The UE shall setup the RSSI measurement timing configuration (RMTC) in accordance with the received *rmtc-Periodicity* and, if configured, with *rmtc-SubframeOffset* i.e. the first symbol of each RMTC occasion occurs at first symbol of an SFN and subframe of the PCell meeting the following condition:

$$\text{SFN mod } T = \text{FLOOR}(\text{rmtc-SubframeOffset}/10);$$

$$\text{subframe} = \text{rmtc-SubframeOffset mod } 10;$$

$$\text{with } T = \text{rmtc-Periodicity}/10;$$

On the frequency configured by *rmtc-Frequency*, the UE shall not consider RSSI measurements outside the configured RMTC occasion which lasts for *measDuration* for RSSI and channel occupancy measurements.

The UE derives the RSSI measurement duration from a combination of *measDurationSymbols* and *ref-SCS-CP*. At least for RSSI measurement confined within the active DL BWP, the UE performs RSSI measurement using the numerology of the active DL BWP during the derived measurement duration. Otherwise, the numerology used by the UE for measurements is up to UE implementation.

### 5.5.2.11 Measurement gap sharing configuration

The UE shall:

- 1> if *gapSharingFR1* is set to *setup*:
  - 2> if an FR1 measurement gap sharing configuration is already setup:
    - 3> release the FR1 measurement gap sharing configuration;
  - 2> setup the FR1 measurement gap sharing configuration indicated by the *measGapSharingConfig* in accordance with the received *gapSharingFR1* as defined in TS 38.133 [14];
- 1> else if *gapSharingFR1* is set to *release*:
  - 2> release the FR1 measurement gap sharing configuration;
- 1> if *gapSharingFR2* is set to *setup*:
  - 2> if an FR2 measurement gap sharing configuration is already setup:
    - 3> release the FR2 measurement gap sharing configuration;
  - 2> setup the FR2 measurement gap sharing configuration indicated by the *measGapSharingConfig* in accordance with the received *gapSharingFR2* as defined in TS 38.133 [14];

- 1> else if *gapSharingFR2* is set to *release*:
  - 2> release the FR2 measurement gap sharing configuration.
- 1> if *gapSharingUE* is set to *setup*:
  - 2> if a per UE measurement gap sharing configuration is already setup:
    - 3> release the per UE measurement gap sharing configuration;
  - 2> setup the per UE measurement gap sharing configuration indicated by the *measGapSharingConfig* in accordance with the received *gapSharingUE* as defined in TS 38.133 [14];
- 1> else if *gapSharingUE* is set to *release*:
  - 2> release the per UE measurement gap sharing configuration.

## 5.5.3 Performing measurements

### 5.5.3.1 General

An RRC\_CONNECTED UE shall derive cell measurement results by measuring one or multiple beams associated per cell as configured by the network, as described in 5.5.3.3. For all cell measurement results, except for RSSI, and CLI measurement results in RRC\_CONNECTED, the UE applies the layer 3 filtering as specified in 5.5.3.2, before using the measured results for evaluation of reporting criteria, measurement reporting or the criteria to trigger conditional reconfiguration execution. For cell measurements, the network can configure RSRP, RSRQ, SINR, RSCP or EcN0 as trigger quantity. For CLI measurements, the network can configure SRS-RSRP or CLI-RSSI as trigger quantity. For cell and beam measurements, reporting quantities can be any combination of quantities (i.e. only RSRP; only RSRQ; only SINR; RSRP and RSRQ; RSRP and SINR; RSRQ and SINR; RSRP, RSRQ and SINR; only RSCP; only EcN0; RSCP and EcN0), irrespective of the trigger quantity, and for CLI measurements, reporting quantities can be either SRS-RSRP or CLI-RSSI. For conditional reconfiguration execution, the network can configure up to 2 quantities, both using same RS type. The UE does not apply the layer 3 filtering as specified in 5.5.3.2 to derive the CBR measurements.

The network may also configure the UE to report measurement information per beam (which can either be measurement results per beam with respective beam identifier(s) or only beam identifier(s)), derived as described in 5.5.3.3a. If beam measurement information is configured to be included in measurement reports, the UE applies the layer 3 beam filtering as specified in 5.5.3.2. On the other hand, the exact L1 filtering of beam measurements used to derive cell measurement results is implementation dependent.

The UE shall:

- 1> whenever the UE has a *measConfig*, perform RSRP and RSRQ measurements for each serving cell for which *servingCellMO* is configured as follows:
  - 2> if the *reportConfig* associated with at least one *measId* included in the *measIdList* within *VarMeasConfig* contains an *rsType* set to *ssb* and *ssb-ConfigMobility* is configured in the *measObject* indicated by the *servingCellMO*:
    - 3> if the *reportConfig* associated with at least one *measId* included in the *measIdList* within *VarMeasConfig* contains a *reportQuantityRS-Indexes* and *maxNrofRS-IndexesToReport* and contains an *rsType* set to *ssb*:
      - 4> derive layer 3 filtered RSRP and RSRQ per beam for the serving cell based on SS/PBCH block, as described in 5.5.3.3a;
    - 3> derive serving cell measurement results based on SS/PBCH block, as described in 5.5.3.3;
  - 2> if the *reportConfig* associated with at least one *measId* included in the *measIdList* within *VarMeasConfig* contains an *rsType* set to *csi-rs* and *CSI-RS-ResourceConfigMobility* is configured in the *measObject* indicated by the *servingCellMO*:
    - 3> if the *reportConfig* associated with at least one *measId* included in the *measIdList* within *VarMeasConfig* contains a *reportQuantityRS-Indexes* and *maxNrofRS-IndexesToReport* and contains an *rsType* set to *csi-rs*:

- 4> derive layer 3 filtered RSRP and RSRQ per beam for the serving cell based on CSI-RS, as described in 5.5.3.3a;
- 3> derive serving cell measurement results based on CSI-RS, as described in 5.5.3.3;
- 1> for each serving cell for which *servingCellMO* is configured, if the *reportConfig* associated with at least one *measId* included in the *measIdList* within *VarMeasConfig* contains SINR as trigger quantity and/or reporting quantity:
  - 2> if the *reportConfig* contains *rsType* set to *ssb* and *ssb-ConfigMobility* is configured in the *servingCellMO*:
    - 3> if the *reportConfig* contains a *reportQuantityRS-Indexes* and *maxNrofRS-IndexesToReport*:
      - 4> derive layer 3 filtered SINR per beam for the serving cell based on SS/PBCH block, as described in 5.5.3.3a;
      - 3> derive serving cell SINR based on SS/PBCH block, as described in 5.5.3.3;
    - 2> if the *reportConfig* contains *rsType* set to *csi-rs* and *CSI-RS-ResourceConfigMobility* is configured in the *servingCellMO*:
      - 3> if the *reportConfig* contains a *reportQuantityRS-Indexes* and *maxNrofRS-IndexesToReport*:
        - 4> derive layer 3 filtered SINR per beam for the serving cell based on CSI-RS, as described in 5.5.3.3a;
        - 3> derive serving cell SINR based on CSI-RS, as described in 5.5.3.3;
  - 1> for each *measId* included in the *measIdList* within *VarMeasConfig*:
    - 2> if the *reportType* for the associated *reportConfig* is set to *reportCGI* and timer T321 is running:
      - 3> if *useAutonomousGaps* is configured for the associated *reportConfig*:
        - 4> perform the corresponding measurements on the frequency and RAT indicated in the associated *measObject* using autonomous gaps as necessary;
      - 3> else:
        - 4> perform the corresponding measurements on the frequency and RAT indicated in the associated *measObject* using available idle periods;
      - 3> if the cell indicated by *reportCGI* field for the associated *measObject* is an NR cell and that indicated cell is broadcasting *SIB1* (see TS 38.213 [13], clause 13):
        - 4> try to acquire *SIB1* in the concerned cell;
      - 3> if the cell indicated by *reportCGI* field is an E-UTRA cell:
        - 4> try to acquire *SystemInformationBlockType1* in the concerned cell;
    - 2> if the *ul-DelayValueConfig* is configured for the associated *reportConfig*:
      - 3> ignore the *measObject*;
      - 3> for each of the configured DRBs, configure the PDCP layer to perform corresponding average UL PDCP packet delay measurement per DRB;
    - 2> if the *reportType* for the associated *reportConfig* is *periodical*, *eventTriggered* or *condTriggerConfig*:
      - 3> if a measurement gap configuration is setup, or
      - 3> if the UE does not require measurement gaps to perform the concerned measurements:
        - 4> if *s-MeasureConfig* is not configured, or
        - 4> if *s-MeasureConfig* is set to *ssb-RSRP* and the NR SpCell RSRP based on SS/PBCH block, after layer 3 filtering, is lower than *ssb-RSRP*, or

- 4> if *s-MeasureConfig* is set to *csi-RSRP* and the NR SpCell RSRP based on CSI-RS, after layer 3 filtering, is lower than *csi-RSRP*:
    - 5> if the *measObject* is associated to NR and the *rsType* is set to *csi-rs*:
      - 6> if *reportQuantityRS-Indexes* and *maxNrofRS-IndexesToReport* for the associated *reportConfig* are configured:
        - 7> derive layer 3 filtered beam measurements only based on CSI-RS for each measurement quantity indicated in *reportQuantityRS-Indexes*, as described in 5.5.3.3a;
      - 6> derive cell measurement results based on CSI-RS for the trigger quantity and each measurement quantity indicated in *reportQuantityCell* using parameters from the associated *measObject*, as described in 5.5.3.3;
    - 5> if the *measObject* is associated to NR and the *rsType* is set to *ssb*:
      - 6> if *reportQuantityRS-Indexes* and *maxNrofRS-IndexesToReport* for the associated *reportConfig* are configured:
        - 7> derive layer 3 beam measurements only based on SS/PBCH block for each measurement quantity indicated in *reportQuantityRS-Indexes*, as described in 5.5.3.3a;
      - 6> derive cell measurement results based on SS/PBCH block for the trigger quantity and each measurement quantity indicated in *reportQuantityCell* using parameters from the associated *measObject*, as described in 5.5.3.3;
    - 5> if the *measObject* is associated to E-UTRA:
      - 6> perform the corresponding measurements associated to neighbouring cells on the frequencies indicated in the concerned *measObject*, as described in 5.5.3.2;
    - 5> if the *measObject* is associated to UTRA-FDD:
      - 6> perform the corresponding measurements associated to neighbouring cells on the frequencies indicated in the concerned *measObject*, as described in 5.5.3.2;
  - 4> if the *measRSSI-ReportConfig* is configured in the associated *reportConfig*:
    - 5> perform the RSSI and channel occupancy measurements on the frequency indicated in the associated *measObject*;
- 2> if the *reportType* for the associated *reportConfig* is set to *reportSFTD* and the *numberOfReportsSent* as defined within the *VarMeasReportList* for this *measId* is less than one:
  - 3> if the *reportSFTD-Meas* is set to *true*:
    - 4> if the *measObject* is associated to E-UTRA:
      - 5> perform SFTD measurements between the PCell and the E-UTRA PSCell;
      - 5> if the *reportRSRP* is set to *true*;
        - 6> perform RSRP measurements for the E-UTRA PSCell;
    - 4> else if the *measObject* is associated to NR:
      - 5> perform SFTD measurements between the PCell and the NR PSCell;
      - 5> if the *reportRSRP* is set to *true*;
        - 6> perform RSRP measurements for the NR PSCell based on SSB;
  - 3> else if the *reportSFTD-NeighMeas* is included:
    - 4> if the *measObject* is associated to NR:

- 5> if the *drx-SFTD-NeighMeas* is included:
  - 6> perform SFTD measurements between the PCell and the NR neighbouring cell(s) detected based on parameters in the associated *measObject* using available idle periods;
- 5> else:
  - 6> perform SFTD measurements between the PCell and the NR neighbouring cell(s) detected based on parameters in the associated *measObject*;
- 5> if the *reportRSRP* is set to *true*:
  - 6> perform RSRP measurements based on SSB for the NR neighbouring cell(s) detected based on parameters in the associated *measObject*;
- 2> if the *reportType* for the associated *reportConfig* is *cli-Periodical* or *cli-EventTriggered*:
  - 3> perform the corresponding measurements associated to CLI measurement resources indicated in the concerned *measObjectCLI*;
- 2> perform the evaluation of reporting criteria as specified in 5.5.4, except if *reportConfig* is *condTriggerConfig*.

NOTE 1: The evaluation of conditional reconfiguration execution criteria is specified in 5.3.5.13.

The UE capable of CBR measurement when configured to transmit NR sidelink communication shall:

- 1> If the frequency used for NR sidelink communication is included in *sl-FreqInfoToAddModList* in *sl-ConfigDedicatedNR* within *RRCReconfiguration* message or included in *sl-ConfigCommonNR* within *SIB12*:
  - 2> if the UE is in *RRC\_IDLE* or in *RRC\_INACTIVE*:
    - 3> if the cell chosen for NR sidelink communication provides *SIB12* which includes *sl-TxPoolSelectedNormal* or *sl-TxPoolExceptional* for the concerned frequency:
      - 4> perform CBR measurement on pools in *sl-TxPoolSelectedNormal* and *sl-TxPoolExceptional* for the concerned frequency in *SIB12*;
  - 2> if the UE is in *RRC\_CONNECTED*:
    - 3> if *tx-PoolMeasToAddModList* is included in *VarMeasConfig*:
      - 4> perform CBR measurements on each transmission resource pool indicated in the *tx-PoolMeasToAddModList*;
    - 3> if *sl-TxPoolSelectedNormal*, *sl-TxPoolScheduling* or *sl-TxPoolExceptional* is included in *sl-ConfigDedicatedNR* for the concerned frequency within *RRCReconfiguration*:
      - 4> perform CBR measurement on pools in *sl-TxPoolSelectedNormal*, *sl-TxPoolScheduling* or *sl-TxPoolExceptional* if included in *sl-ConfigDedicatedNR* for the concerned frequency within *RRCReconfiguration*;
    - 3> else if the cell chosen for NR sidelink communication provides *SIB12* which includes *sl-TxPoolSelectedNormal* or *sl-TxPoolExceptional* for the concerned frequency:
      - 4> perform CBR measurement on pools in *sl-TxPoolSelectedNormal* and *sl-TxPoolExceptional* for the concerned frequency in *SIB12*;
- 1> else:
  - 2> perform CBR measurement on pools in *sl-TxPoolSelectedNormal* and *sl-TxPoolExceptional* in *SidelinkPreconfigNR* for the concerned frequency.

NOTE 2: In case the configurations for NR sidelink communication and CBR measurement are acquired via the E-UTRA, configurations for NR sidelink communication in *SIB12*, *sl-ConfigDedicatedNR* within *RRCReconfiguration* used in this subclause are provided by the configurations in *SystemInformationBlockType28*, *sl-ConfigDedicatedNR* within *RRCConnectionReconfiguration* as specified in TS 36.331[10], respectively.

NOTE 3: If a UE that is configured by upper layers to transmit V2X sidelink communication is configured by NR with transmission resource pool(s) and the measurement objects concerning V2X sidelink communication (i.e. by *sl-ConfigDedicatedEUTRA-Info*), it shall perform CBR measurement as specified in subclause 5.5.3 of TS 36.331 [10], based on the transmission resource pool(s) and the measurement object(s) concerning V2X sidelink communication configured by NR.

NOTE 4: For V2X sidelink communication, each of the CBR measurement results is associated with a resource pool, as indicated by the *poolReportId* (see TS 36.331 [10]), that refers to a pool as included in *sl-ConfigDedicatedEUTRA-Info* or *SIB13*.

### 5.5.3.2 Layer 3 filtering

The UE shall:

- 1> for each cell measurement quantity, each beam measurement quantity, each sidelink measurement quantity as needed in sub-clause 5.8.10, and for each CLI measurement quantity that the UE performs measurements according to 5.5.3.1:
- 2> filter the measured result, before using for evaluation of reporting criteria or for measurement reporting, by the following formula:

$$F_n = (1 - a) * F_{n-1} + a * M_n$$

where

$M_n$  is the latest received measurement result from the physical layer;

$F_n$  is the updated filtered measurement result, that is used for evaluation of reporting criteria or for measurement reporting;

$F_{n-1}$  is the old filtered measurement result, where  $F_0$  is set to  $M_1$  when the first measurement result from the physical layer is received; and for *MeasObjectNR*,  $a = 1/2^{(k_i/4)}$ , where  $k_i$  is the *filterCoefficient* for the corresponding measurement quantity of the  $i$ :th *QuantityConfigNR* in *quantityConfigNR-List*, and  $i$  is indicated by *quantityConfigIndex* in *MeasObjectNR*; for other measurements,  $a = 1/2^{(k/4)}$ , where  $k$  is the *filterCoefficient* for the corresponding measurement quantity received by the *quantityConfig*; for UTRA-FDD,  $a = 1/2^{(k/4)}$ , where  $k$  is the *filterCoefficient* for the corresponding measurement quantity received by *quantityConfigUTRA-FDD* in the *QuantityConfig*;

- 2> adapt the filter such that the time characteristics of the filter are preserved at different input rates, observing that the *filterCoefficient*  $k$  assumes a sample rate equal to X ms; The value of X is equivalent to one intra-frequency L1 measurement period as defined in TS 38.133 [14] assuming non-DRX operation, and depends on frequency range.

NOTE 1: If  $k$  is set to 0, no layer 3 filtering is applicable.

NOTE 2: The filtering is performed in the same domain as used for evaluation of reporting criteria or for measurement reporting, i.e., logarithmic filtering for logarithmic measurements.

NOTE 3: The filter input rate is implementation dependent, to fulfil the performance requirements set in TS 38.133 [14]. For further details about the physical layer measurements, see TS 38.133 [14].

NOTE 4: For CLI-RSSI measurement, it is up to UE implementation whether to reset filtering upon BWP switch.

### 5.5.3.3 Derivation of cell measurement results

The network may configure the UE in *RRC\_CONNECTED* to derive RSRP, RSRQ and SINR measurement results per cell associated to NR measurement objects based on parameters configured in the *measObject* (e.g. maximum number

of beams to be averaged and beam consolidation thresholds) and in the *reportConfig* (*rsType* to be measured, SS/PBCH block or CSI-RS).

The network may configure the UE in RRC\_IDLE or in RRC\_INACTIVE to derive RSRP and RSRQ measurement results per cell associated to NR carriers based on parameters configured in *measIdleCarrierListNR* within *VarMeasIdleConfig* for measurements performed according to 5.7.8.2a.

The UE shall:

- 1> for each cell measurement quantity to be derived based on SS/PBCH block:
  - 2> if *nrofSS-BlocksToAverage* is not configured in the associated *measObject* in RRC\_CONNECTED or in the associated entry in *measIdleCarrierListNR* within *VarMeasIdleConfig* in RRC\_IDLE/RRC\_INACTIVE; or
  - 2> if *absThreshSS-BlocksConsolidation* is not configured in the associated *measObject* in RRC\_CONNECTED or in the associated entry in *measIdleCarrierListNR* within *VarMeasIdleConfig* in RRC\_IDLE/RRC\_INACTIVE; or
  - 2> if the highest beam measurement quantity value is below or equal to *absThreshSS-BlocksConsolidation*:
    - 3> derive each cell measurement quantity based on SS/PBCH block as the highest beam measurement quantity value, where each beam measurement quantity is described in TS 38.215 [9];
  - 2> else:
    - 3> derive each cell measurement quantity based on SS/PBCH block as the linear power scale average of the highest beam measurement quantity values above *absThreshSS-BlocksConsolidation* where the total number of averaged beams shall not exceed *nrofSS-BlocksToAverage*;
  - 2> if in RRC\_CONNECTED, apply layer 3 cell filtering as described in 5.5.3.2;
- 1> for each cell measurement quantity to be derived based on CSI-RS:
  - 2> consider a CSI-RS resource to be applicable for deriving cell measurements when the concerned CSI-RS resource is included in the *csi-rs-CellMobility* including the *physCellId* of the cell in the *CSI-RS-ResourceConfigMobility* in the associated *measObject*;
  - 2> if *nrofCSI-RS-ResourcesToAverage* in the associated *measObject* is not configured; or
  - 2> if *absThreshCSI-RS-Consolidation* in the associated *measObject* is not configured; or
  - 2> if the highest beam measurement quantity value is below or equal to *absThreshCSI-RS-Consolidation*:
    - 3> derive each cell measurement quantity based on applicable CSI-RS resources for the cell as the highest beam measurement quantity value, where each beam measurement quantity is described in TS 38.215 [9];
  - 2> else:
    - 3> derive each cell measurement quantity based on CSI-RS as the linear power scale average of the highest beam measurement quantity values above *absThreshCSI-RS-Consolidation* where the total number of averaged beams shall not exceed *nrofCSI-RS-ResourcesToAverage*;
  - 2> apply layer 3 cell filtering as described in 5.5.3.2.

### 5.5.3.3a Derivation of layer 3 beam filtered measurement

The UE shall:

- 1> for each layer 3 beam filtered measurement quantity to be derived based on SS/PBCH block;
  - 2> derive each configured beam measurement quantity based on SS/PBCH block as described in TS 38.215[9], and apply layer 3 beam filtering as described in 5.5.3.2;
- 1> for each layer 3 beam filtered measurement quantity to be derived based on CSI-RS;



- 2> derive each configured beam measurement quantity based on CSI-RS as described in TS 38.215 [9], and apply layer 3 beam filtering as described in 5.5.3.2.

## 5.5.4 Measurement report triggering

### 5.5.4.1 General

If AS security has been activated successfully, the UE shall:

- 1> for each *measId* included in the *measIdList* within *VarMeasConfig*:
  - 2> if the corresponding *reportConfig* includes a *reportType* set to *eventTriggered* or *periodical*:
    - 3> if the corresponding *measObject* concerns NR:
      - 4> if the *eventA1* or *eventA2* is configured in the corresponding *reportConfig*:
        - 5> consider only the serving cell to be applicable;
      - 4> if the *eventA3* or *eventA5* is configured in the corresponding *reportConfig*:
        - 5> if a serving cell is associated with a *measObjectNR* and neighbours are associated with another *measObjectNR*, consider any serving cell associated with the other *measObjectNR* to be a neighbouring cell as well;
      - 4> if corresponding *reportConfig* includes *reportType* set to *periodical*; or
      - 4> for measurement events other than *eventA1* or *eventA2*:
        - 5> if *useWhiteCellList* is set to *true*:
          - 6> consider any neighbouring cell detected based on parameters in the associated *measObjectNR* to be applicable when the concerned cell is included in the *whiteCellsToAddModList* defined within the *VarMeasConfig* for this *measId*;
        - 5> else:
          - 6> consider any neighbouring cell detected based on parameters in the associated *measObjectNR* to be applicable when the concerned cell is not included in the *blackCellsToAddModList* defined within the *VarMeasConfig* for this *measId*;
    - 3> else if the corresponding *measObject* concerns E-UTRA:
      - 4> if *eventB1* or *eventB2* is configured in the corresponding *reportConfig*:
        - 5> consider a serving cell, if any, on the associated E-UTRA frequency as neighbour cell;
      - 4> else:
        - 5> consider any neighbouring cell detected on the associated frequency to be applicable when the concerned cell is not included in the *blackCellsToAddModListEUTRAN* defined within the *VarMeasConfig* for this *measId*;
    - 3> else if the corresponding *measObject* concerns UTRA-FDD:
      - 4> if *eventB1-UTRA-FDD* or *eventB2-UTRA-FDD* is configured in the corresponding *reportConfig*; or
      - 4> if corresponding *reportConfig* includes *reportType* set to *periodical*:
        - 5> consider a neighbouring cell on the associated frequency to be applicable when the concerned cell is included in the *cellsToAddModList* defined within the *VarMeasConfig* for this *measId*;
  - 2> else if the corresponding *reportConfig* includes a *reportType* set to *reportCGI*:

- 3> consider the cell detected on the associated *measObject* which has a physical cell identity matching the value of the *cellForWhichToReportCGI* included in the corresponding *reportConfig* within the *VarMeasConfig* to be applicable;
- 2> else if the corresponding *reportConfig* includes a *reportType* set to *reportSFTD*:
  - 3> if the corresponding *measObject* concerns NR:
    - 4> if the *reportSFTD-Meas* is set to *true*:
      - 5> consider the NR PSCell to be applicable;
    - 4> else if the *reportSFTD-NeighMeas* is included:
      - 5> if *cellsForWhichToReportSFTD* is configured in the corresponding *reportConfig*:
        - 6> consider any NR neighbouring cell detected on the associated *measObjectNR* which has a physical cell identity that is included in the *cellsForWhichToReportSFTD* to be applicable;
      - 5> else:
        - 6> consider up to 3 strongest NR neighbouring cells detected based on parameters in the associated *measObjectNR* to be applicable when the concerned cells are not included in the *blackCellsToAddModList* defined within the *VarMeasConfig* for this *measId*;
  - 3> else if the corresponding *measObject* concerns E-UTRA:
    - 4> if the *reportSFTD-Meas* is set to *true*:
      - 5> consider the E-UTRA PSCell to be applicable;
- 2> else if the corresponding *reportConfig* includes *measRSSI-ReportConfig*:
  - 3> consider the resource indicated by the *rmtc-Config* on the associated frequency to be applicable;
- 2> else if the corresponding *reportConfig* includes a *reportType* set to *cli-Periodical* or *cli-EventTriggered*:
  - 3> consider all CLI measurement resources included in the corresponding *measObject* to be applicable;
- 2> if the corresponding *reportConfig* concerns the reporting for NR sidelink communication (i.e. *reportConfigNR-SL*):
  - 3> consider the transmission resource pools indicated by the *tx-PoolMeasToAddModList* defined within the *VarMeasConfig* for this *measId* to be applicable;
- 2> if the *reportType* is set to *eventTriggered* and if the entry condition applicable for this event, i.e. the event corresponding with the *eventId* of the corresponding *reportConfig* within *VarMeasConfig*, is fulfilled for one or more applicable cells for all measurements after layer 3 filtering taken during *timeToTrigger* defined for this event within the *VarMeasConfig*, while the *VarMeasReportList* does not include a measurement reporting entry for this *measId* (a first cell triggers the event):
  - 3> include a measurement reporting entry within the *VarMeasReportList* for this *measId*;
  - 3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;
  - 3> include the concerned cell(s) in the *cellsTriggeredList* defined within the *VarMeasReportList* for this *measId*;
  - 3> if *useT312* is included in *reportConfig* for this event:
    - 4> if T310 for the corresponding SpCell is running; and
    - 4> if T312 is not running for corresponding SpCell:
      - 5> start timer T312 for the corresponding SpCell with the value of T312 configured in the corresponding *measObjectNR*;

- 3> initiate the measurement reporting procedure, as specified in 5.5.5;
- 2> else if the *reportType* is set to *eventTriggered* and if the entry condition applicable for this event, i.e. the event corresponding with the *eventId* of the corresponding *reportConfig* within *VarMeasConfig*, is fulfilled for one or more applicable cells not included in the *cellsTriggeredList* for all measurements after layer 3 filtering taken during *timeToTrigger* defined for this event within the *VarMeasConfig* (a subsequent cell triggers the event):
  - 3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;
  - 3> include the concerned cell(s) in the *cellsTriggeredList* defined within the *VarMeasReportList* for this *measId*;
  - 3> if *useT312* is included in *reportConfig* for this event:
    - 4> if T310 for the corresponding SpCell is running; and
    - 4> if T312 is not running for corresponding SpCell:
      - 5> start timer T312 for the corresponding SpCell with the value of T312 configured in the corresponding *measObjectNR*;
  - 3> initiate the measurement reporting procedure, as specified in 5.5.5;
- 2> else if the *reportType* is set to *eventTriggered* and if the leaving condition applicable for this event is fulfilled for one or more of the cells included in the *cellsTriggeredList* defined within the *VarMeasReportList* for this *measId* for all measurements after layer 3 filtering taken during *timeToTrigger* defined within the *VarMeasConfig* for this event:
  - 3> remove the concerned cell(s) in the *cellsTriggeredList* defined within the *VarMeasReportList* for this *measId*;
  - 3> if *reportOnLeave* is set to *true* for the corresponding reporting configuration:
    - 4> initiate the measurement reporting procedure, as specified in 5.5.5;
  - 3> if the *cellsTriggeredList* defined within the *VarMeasReportList* for this *measId* is empty:
    - 4> remove the measurement reporting entry within the *VarMeasReportList* for this *measId*;
    - 4> stop the periodical reporting timer for this *measId*, if running;
- 2> else if the *reportType* is set to *eventTriggered* and if the entry condition applicable for this event, i.e. the event corresponding with the *eventId* of the corresponding *reportConfig* within *VarMeasConfig*, is fulfilled for one or more applicable transmission resource pools for all measurements taken during *timeToTrigger* defined for this event within the *VarMeasConfig*, while the *VarMeasReportList* does not include a measurement reporting entry for this *measId* (a first transmission resource pool triggers the event):
  - 3> include a measurement reporting entry within the *VarMeasReportList* for this *measId*;
  - 3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;
  - 3> include the concerned transmission resource pool(s) in the *poolsTriggeredList* defined within the *VarMeasReportList* for this *measId*;
  - 3> initiate the measurement reporting procedure, as specified in 5.5.5;
- 2> else if the *reportType* is set to *eventTriggered* and if the entry condition applicable for this event, i.e. the event corresponding with the *eventId* of the corresponding *reportConfig* within *VarMeasConfig*, is fulfilled for one or more applicable transmission resource pools not included in the *poolsTriggeredList* for all measurements taken during *timeToTrigger* defined for this event within the *VarMeasConfig* (a subsequent transmission resource pool triggers the event):
  - 3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;
  - 3> include the concerned transmission resource pool(s) in the *poolsTriggeredList* defined within the *VarMeasReportList* for this *measId*;

- 3> initiate the measurement reporting procedure, as specified in 5.5.5;
- 2> else if the *reportType* is set to *eventTriggered* and if the leaving condition applicable for this event is fulfilled for one or more applicable transmission resource pools included in the *poolsTriggeredList* defined within the *VarMeasReportList* for this *measId* for all measurements taken during *timeToTrigger* defined within the *VarMeasConfig* for this event:
  - 3> remove the concerned transmission resource pool(s) in the *poolsTriggeredList* defined within the *VarMeasReportList* for this *measId*;
  - 3> if the *poolsTriggeredList* defined within the *VarMeasReportList* for this *measId* is empty:
    - 4> remove the measurement reporting entry within the *VarMeasReportList* for this *measId*;
    - 4> stop the periodical reporting timer for this *measId*, if running

NOTE 1: Void.

- 2> if *reportType* is set to *periodical* and if a (first) measurement result is available:
  - 3> include a measurement reporting entry within the *VarMeasReportList* for this *measId*;
  - 3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;
  - 3> if the corresponding *reportConfig* includes *measRSSI-ReportConfig*:
    - 4> initiate the measurement reporting procedure as specified in 5.5.5 immediately when RSSI sample values are reported by the physical layer after the first L1 measurement duration;
  - 3> else if the *reportAmount* exceeds 1:
    - 4> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after the quantity to be reported becomes available for the NR SpCell;
  - 3> else (i.e. the *reportAmount* is equal to 1):
    - 4> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after the quantity to be reported becomes available for the NR SpCell and for the strongest cell among the applicable cells;
- 2> if, in case the corresponding *reportConfig* concerns the reporting for NR sidelink communication, *reportType* is set to *periodical* and if a (first) measurement result is available:
  - 3> include a measurement reporting entry within the *VarMeasReportList* for this *measId*;
  - 3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;
  - 3> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after the quantity to be reported becomes available for the NR SpCell and CBR measurement results become available;
- 2> if the *reportType* is set to *cli-EventTriggered* and if the entry condition applicable for this event, i.e. the event corresponding with the *eventId* of the corresponding *reportConfig* within *VarMeasConfig*, is fulfilled for one or more applicable CLI measurement resources for all measurements after layer 3 filtering taken during *timeToTrigger* defined for this event within the *VarMeasConfig*, while the *VarMeasReportList* does not include a measurement reporting entry for this *measId* (a first CLI measurement resource triggers the event):
  - 3> include a measurement reporting entry within the *VarMeasReportList* for this *measId*;
  - 3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;
  - 3> include the concerned CLI measurement resource(s) in the *cli-TriggeredList* defined within the *VarMeasReportList* for this *measId*;
  - 3> initiate the measurement reporting procedure, as specified in 5.5.5;
- 2> else if the *reportType* is set to *cli-EventTriggered* and if the entry condition applicable for this event, i.e. the event corresponding with the *eventId* of the corresponding *reportConfig* within *VarMeasConfig*, is fulfilled for one or more CLI measurement resources not included in the *cli-TriggeredList* for all measurements after

- layer 3 filtering taken during *timeToTrigger* defined for this event within the *VarMeasConfig* (a subsequent CLI measurement resource triggers the event):
- 3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;
  - 3> include the concerned CLI measurement resource(s) in the *cli-TriggeredList* defined within the *VarMeasReportList* for this *measId*;
  - 3> initiate the measurement reporting procedure, as specified in 5.5.5;
- 2> else if the *reportType* is set to *cli-EventTriggered* and if the leaving condition applicable for this event is fulfilled for one or more of the CLI measurement resources included in the *cli-TriggeredList* defined within the *VarMeasReportList* for this *measId* for all measurements after layer 3 filtering taken during *timeToTrigger* defined within the *VarMeasConfig* for this event:
- 3> remove the concerned CLI measurement resource(s) in the *cli-TriggeredList* defined within the *VarMeasReportList* for this *measId*;
  - 3> if *reportOnLeave* is set to *true* for the corresponding reporting configuration:
    - 4> initiate the measurement reporting procedure, as specified in 5.5.5;
  - 3> if the *cli-TriggeredList* defined within the *VarMeasReportList* for this *measId* is empty:
    - 4> remove the measurement reporting entry within the *VarMeasReportList* for this *measId*;
    - 4> stop the periodical reporting timer for this *measId*, if running;
- 2> if *reportType* is set to *cli-Periodical* and if a (first) measurement result is available:
- 3> include a measurement reporting entry within the *VarMeasReportList* for this *measId*;
  - 3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;
  - 3> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after the quantity to be reported becomes available for at least one CLI measurement resource;
- 2> upon expiry of the periodical reporting timer for this *measId*:
- 3> initiate the measurement reporting procedure, as specified in 5.5.5.
- 2> if the corresponding *reportConfig* includes a *reportType* is set to *reportSFTD*:
- 3> if the corresponding *measObject* concerns NR:
    - 4> if the *drx-SFTD-NeighMeas* is included:
      - 5> if the quantity to be reported becomes available for each requested pair of PCell and NR cell:
        - 6> stop timer T322;
        - 6> initiate the measurement reporting procedure, as specified in 5.5.5;
    - 4> else
      - 5> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after the quantity to be reported becomes available for each requested pair of PCell and NR cell or the maximal measurement reporting delay as specified in TS 38.133 [14];
  - 3> else if the corresponding *measObject* concerns E-UTRA:
    - 4> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after the quantity to be reported becomes available for the pair of PCell and E-UTRA PSCell or the maximal measurement reporting delay as specified in TS 38.133 [14];
- 2> if *reportType* is set to *reportCGI*:
- 3> if the UE acquired the *SIB1* or *SystemInformationBlockType1* for the requested cell; or

- 3> if the UE detects that the requested NR cell is not transmitting *SIB1* (see TS 38.213 [13], clause 13):
  - 4> stop timer T321;
  - 4> include a measurement reporting entry within the *VarMeasReportList* for this *measId*;
  - 4> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;
  - 4> initiate the measurement reporting procedure, as specified in 5.5.5;
- 2> if the corresponding *reportConfig* includes the *ul-DelayValueConfig*:
  - 3> initiate the measurement reporting procedure, as specified in 5.5.5, immediately after a first measurement result is provided by all lower layers of the associated DRB identity;
- 2> upon the expiry of T321 for this *measId*:
  - 3> include a measurement reporting entry within the *VarMeasReportList* for this *measId*;
  - 3> set the *numberOfReportsSent* defined within the *VarMeasReportList* for this *measId* to 0;
  - 3> initiate the measurement reporting procedure, as specified in 5.5.5.
- 2> upon the expiry of T322 for this *measId*:
  - 3> initiate the measurement reporting procedure, as specified in 5.5.5.

#### 5.5.4.2 Event A1 (Serving becomes better than threshold)

The UE shall:

- 1> consider the entering condition for this event to be satisfied when condition A1-1, as specified below, is fulfilled;
- 1> consider the leaving condition for this event to be satisfied when condition A1-2, as specified below, is fulfilled;
- 1> for this measurement, consider the NR serving cell corresponding to the associated *measObjectNR* associated with this event.

Inequality A1-1 (Entering condition)

$$Ms - Hys > Thresh$$

Inequality A1-2 (Leaving condition)

$$Ms + Hys < Thresh$$

The variables in the formula are defined as follows:

***Ms*** is the measurement result of the serving cell, not taking into account any offsets.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigNR* for this event).

***Thresh*** is the threshold parameter for this event (i.e. *a1-Threshold* as defined within *reportConfigNR* for this event).

***Ms*** is expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

***Hys*** is expressed in dB.

***Thresh*** is expressed in the same unit as ***Ms***.

#### 5.5.4.3 Event A2 (Serving becomes worse than threshold)

The UE shall:

- 1> consider the entering condition for this event to be satisfied when condition A2-1, as specified below, is fulfilled;
- 1> consider the leaving condition for this event to be satisfied when condition A2-2, as specified below, is fulfilled;

1> for this measurement, consider the serving cell indicated by the *measObjectNR* associated to this event.

Inequality A2-1 (Entering condition)

$$Ms + Hys < Thresh$$

Inequality A2-2 (Leaving condition)

$$Ms - Hys > Thresh$$

The variables in the formula are defined as follows:

**Ms** is the measurement result of the serving cell, not taking into account any offsets.

**Hys** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigNR* for this event).

**Thresh** is the threshold parameter for this event (i.e. *a2-Threshold* as defined within *reportConfigNR* for this event).

**Ms** is expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

**Hys** is expressed in dB.

**Thresh** is expressed in the same unit as **Ms**.

#### 5.5.4.4 Event A3 (Neighbour becomes offset better than SpCell)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition A3-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition A3-2, as specified below, is fulfilled;

1> use the SpCell for *Mp*, *Ofp* and *Ocp*.

NOTE 1: The cell(s) that triggers the event has reference signals indicated in the *measObjectNR* associated to this event which may be different from the NR SpCell *measObjectNR*.

Inequality A3-1 (Entering condition)

$$Mn + Ofn + Ocn - Hys > Mp + Ofp + Ocp + Off$$

Inequality A3-2 (Leaving condition)

$$Mn + Ofn + Ocn + Hys < Mp + Ofp + Ocp + Off$$

The variables in the formula are defined as follows:

**Mn** is the measurement result of the neighbouring cell, not taking into account any offsets.

**Ofn** is the measurement object specific offset of the reference signal of the neighbour cell (i.e. *offsetMO* as defined within *measObjectNR* corresponding to the neighbour cell).

**Ocn** is the cell specific offset of the neighbour cell (i.e. *cellIndividualOffset* as defined within *measObjectNR* corresponding to the frequency of the neighbour cell), and set to zero if not configured for the neighbour cell.

**Mp** is the measurement result of the SpCell, not taking into account any offsets.

**Ofp** is the measurement object specific offset of the SpCell (i.e. *offsetMO* as defined within *measObjectNR* corresponding to the SpCell).

**Ocp** is the cell specific offset of the SpCell (i.e. *cellIndividualOffset* as defined within *measObjectNR* corresponding to the SpCell), and is set to zero if not configured for the SpCell.

**Hys** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigNR* for this event).

**Off** is the offset parameter for this event (i.e. *a3-Offset* as defined within *reportConfigNR* for this event).

**Mn**, **Mp** are expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

*Ofn*, *Ocn*, *Ocp*, *Hys*, *Off* are expressed in dB.

NOTE 2: The definition of Event A3 also applies to CondEvent A3.

#### 5.5.4.5 Event A4 (Neighbour becomes better than threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition A4-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition A4-2, as specified below, is fulfilled.

Inequality A4-1 (Entering condition)

$$Mn + Ofn + Ocn - Hys > Thresh$$

Inequality A4-2 (Leaving condition)

$$Mn + Ofn + Ocn + Hys < Thresh$$

The variables in the formula are defined as follows:

***Mn*** is the measurement result of the neighbouring cell, not taking into account any offsets.

***Ofn*** is the measurement object specific offset of the neighbour cell (i.e. *offsetMO* as defined within *measObjectNR* corresponding to the neighbour cell).

***Ocn*** is the measurement object specific offset of the neighbour cell (i.e. *cellIndividualOffset* as defined within *measObjectNR* corresponding to the neighbour cell), and set to zero if not configured for the neighbour cell.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigNR* for this event).

***Thresh*** is the threshold parameter for this event (i.e. *a4-Threshold* as defined within *reportConfigNR* for this event).

***Mn*** is expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

***Ofn***, ***Ocn***, ***Hys*** are expressed in dB.

***Thresh*** is expressed in the same unit as ***Mn***.

#### 5.5.4.6 Event A5 (SpCell becomes worse than threshold1 and neighbour becomes better than threshold2)

The UE shall:

1> consider the entering condition for this event to be satisfied when both condition A5-1 and condition A5-2, as specified below, are fulfilled;

1> consider the leaving condition for this event to be satisfied when condition A5-3 or condition A5-4, i.e. at least one of the two, as specified below, is fulfilled;

1> use the SpCell for *Mp*.

NOTE 1: The parameters of the reference signal(s) of the cell(s) that triggers the event are indicated in the *measObjectNR* associated to the event which may be different from the *measObjectNR* of the NR SpCell.

Inequality A5-1 (Entering condition 1)

$$Mp + Hys < Thresh1$$

Inequality A5-2 (Entering condition 2)

$$Mn + Ofn + Ocn - Hys > Thresh2$$

Inequality A5-3 (Leaving condition 1)

$$Mp - Hys > Thresh1$$



Inequality A5-4 (Leaving condition 2)

$$Mn + Ofn + Ocn + Hys < Thresh2$$

The variables in the formula are defined as follows:

***Mp*** is the measurement result of the NR SpCell, not taking into account any offsets.

***Mn*** is the measurement result of the neighbouring cell, not taking into account any offsets.

***Ofn*** is the measurement object specific offset of the neighbour cell (i.e. *offsetMO* as defined within *measObjectNR* corresponding to the neighbour cell).

***Ocn*** is the cell specific offset of the neighbour cell (i.e. *cellIndividualOffset* as defined within *measObjectNR* corresponding to the neighbour cell), and set to zero if not configured for the neighbour cell.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigNR* for this event).

***Thresh1*** is the threshold parameter for this event (i.e. *a5-Threshold1* as defined within *reportConfigNR* for this event).

***Thresh2*** is the threshold parameter for this event (i.e. *a5-Threshold2* as defined within *reportConfigNR* for this event).

***Mn, Mp*** are expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

***Ofn, Ocn, Hys*** are expressed in dB.

***Thresh1*** is expressed in the same unit as ***Mp***.

***Thresh2*** is expressed in the same unit as ***Mn***.

NOTE 2: The definition of Event A5 also applies to CondEvent A5.

#### 5.5.4.7 Event A6 (Neighbour becomes offset better than SCell)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition A6-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition A6-2, as specified below, is fulfilled;

1> for this measurement, consider the (secondary) cell corresponding to the *measObjectNR* associated to this event to be the serving cell.

NOTE: The reference signal(s) of the neighbour(s) and the reference signal(s) of the SCell are both indicated in the associated *measObjectNR*.

Inequality A6-1 (Entering condition)

$$Mn + Ocn - Hys > Ms + Ocs + Off$$

Inequality A6-2 (Leaving condition)

$$Mn + Ocn + Hys < Ms + Ocs + Off$$

The variables in the formula are defined as follows:

***Mn*** is the measurement result of the neighbouring cell, not taking into account any offsets.

***Ocn*** is the cell specific offset of the neighbour cell (i.e. *cellIndividualOffset* as defined within the associated *measObjectNR*), and set to zero if not configured for the neighbour cell.

***Ms*** is the measurement result of the serving cell, not taking into account any offsets.

***Ocs*** is the cell specific offset of the serving cell (i.e. *cellIndividualOffset* as defined within the associated *measObjectNR*), and is set to zero if not configured for the serving cell.

**Hys** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigNR* for this event).

**Off** is the offset parameter for this event (i.e. *a6-Offset* as defined within *reportConfigNR* for this event).

**Mn, Ms** are expressed in dBm in case of RSRP, or in dB in case of RSRQ and RS-SINR.

**Ocn, Ocs, Hys, Off** are expressed in dB.

#### 5.5.4.8 Event B1 (Inter RAT neighbour becomes better than threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition B1-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition B1-2, as specified below, is fulfilled.

Inequality B1-1 (Entering condition)

$$Mn + Ofn + Ocn - Hys > Thresh$$

Inequality B1-2 (Leaving condition)

$$Mn + Ofn + Ocn + Hys < Thresh$$

The variables in the formula are defined as follows:

**Mn** is the measurement result of the inter-RAT neighbour cell, not taking into account any offsets.

**Ofn** is the measurement object specific offset of the frequency of the inter-RAT neighbour cell (i.e. *eutra-Q-OffsetRange* as defined within the *measObjectEUTRA* corresponding to the frequency of the neighbour inter-RAT cell, *utra-FDD-Q-OffsetRange* as defined within the *measObjectUTRA-FDD* corresponding to the frequency of the neighbour inter-RAT cell).

**Ocn** is the cell specific offset of the inter-RAT neighbour cell (i.e. *cellIndividualOffset* as defined within the *measObjectEUTRA* corresponding to the neighbour inter-RAT cell), and set to zero if not configured for the neighbour cell.

**Hys** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigInterRAT* for this event).

**Thresh** is the threshold parameter for this event (i.e. *b1-ThresholdEUTRA* as defined within *reportConfigInterRAT* for this event, *b1-ThresholdUTRA-FDD* as defined for UTRA-FDD within *reportConfigInterRAT* for this event).

**Mn** is expressed in dBm or in dB, depending on the measurement quantity of the inter-RAT neighbour cell.

**Ofn, Ocn, Hys** are expressed in dB.

**Thresh** is expressed in the same unit as **Mn**.

#### 5.5.4.9 Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2)

The UE shall:

1> consider the entering condition for this event to be satisfied when both condition B2-1 and condition B2-2, as specified below, are fulfilled;

1> consider the leaving condition for this event to be satisfied when condition B2-3 or condition B2-4, i.e. at least one of the two, as specified below, is fulfilled;

Inequality B2-1 (Entering condition 1)

$$Mp + Hys < Thresh1$$

Inequality B2-2 (Entering condition 2)

$$Mn + Ofn + Ocn - Hys > Thresh2$$

Inequality B2-3 (Leaving condition 1)

$$M_p - H_{ys} > Thresh1$$

Inequality B2-4 (Leaving condition 2)

$$M_n + O_{fn} + O_{cn} + H_{ys} < Thresh2$$

The variables in the formula are defined as follows:

***M<sub>p</sub>*** is the measurement result of the PCell, not taking into account any offsets.

***M<sub>n</sub>*** is the measurement result of the inter-RAT neighbour cell, not taking into account any offsets.

***O<sub>fn</sub>*** is the measurement object specific offset of the frequency of the inter-RAT neighbour cell (i.e. *eutra-Q-OffsetRange* as defined within the *measObjectEUTRA* corresponding to the frequency of the inter-RAT neighbour cell, *utra-FDD-Q-OffsetRange* as defined within the *measObjectUTRA-FDD* corresponding to the frequency of the neighbour inter-RAT cell).

***O<sub>cn</sub>*** is the cell specific offset of the inter-RAT neighbour cell (i.e. *cellIndividualOffset* as defined within the *measObjectEUTRA* corresponding to the neighbour inter-RAT cell), and set to zero if not configured for the neighbour cell.

***H<sub>ys</sub>*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigInterRAT* for this event).

***Thresh1*** is the threshold parameter for this event (i.e. *b2-Threshold1* as defined within *reportConfigInterRAT* for this event).

***Thresh2*** is the threshold parameter for this event (i.e. *b2-Threshold2EUTRA* as defined within *reportConfigInterRAT* for this event, *b2-Threshold2UTRA-FDD* as defined for UTRA-FDD within *reportConfigInterRAT* for this event).

***M<sub>p</sub>*** is expressed in dBm in case of RSRP, or in dB in case of RSRQ and SINR.

***M<sub>n</sub>*** is expressed in dBm or dB, depending on the measurement quantity of the inter-RAT neighbour cell.

***O<sub>fn</sub>*, ***O<sub>cn</sub>*, ***H<sub>ys</sub>*** are expressed in dB.****

***Thresh1*** is expressed in the same unit as ***M<sub>p</sub>***.

***Thresh2*** is expressed in the same unit as ***M<sub>n</sub>***.

#### 5.5.4.10 Event I1 (Interference becomes higher than threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition I1-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition I1-2, as specified below, is fulfilled.

Inequality I1-1 (Entering condition)

$$M_i - H_{ys} > Thresh$$

Inequality I1-2 (Leaving condition)

$$M_i + H_{ys} < Thresh$$

The variables in the formula are defined as follows:

***M<sub>i</sub>*** is the measurement result of the interference, not taking into account any offsets.

***H<sub>ys</sub>*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigNR* for this event).

***Thresh*** is the threshold parameter for this event (i.e. *i1-Threshold* as defined within *reportConfigNR* for this event).

***M<sub>i</sub>*, ***Thresh*** are expressed in dBm.**

*Hys* is expressed in dB.

#### 5.5.4.11 Event C1 (The NR sidelink channel busy ratio is above a threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition C1-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition C1-2, as specified below, is fulfilled;

Inequality C1-1 (Entering condition)

$$Ms - Hys > Thresh$$

Inequality C1-2 (Leaving condition)

$$Ms + Hys < Thresh$$

The variables in the formula are defined as follows:

*Ms* is the measurement result of channel busy ratio of the transmission resource pool, not taking into account any offsets.

*Hys* is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigNR-SL* for this event).

*Thresh* is the threshold parameter for this event (i.e. *c1-Threshold* as defined within *reportConfigNR-SL* for this event).

*Ms* is expressed in decimal from 0 to 1 in steps of 0.01.

*Hys* is expressed in the same unit as *Ms*.

*Thresh* is expressed in the same unit as *Ms*.

#### 5.5.4.12 Event C2 (The NR sidelink channel busy ratio is below a threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition C2-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition C2-2, as specified below, is fulfilled;

Inequality C2-1 (Entering condition)

$$Ms + Hys < Thresh$$

Inequality C2-2 (Leaving condition)

$$Ms - Hys > Thresh$$

The variables in the formula are defined as follows:

*Ms* is the measurement result of channel busy ratio of the transmission resource pool, not taking into account any offsets.

*Hys* is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *reportConfigNR-SL* for this event).

*Thresh* is the threshold parameter for this event (i.e. *c2-Threshold* as defined within *reportConfigNR-SL* for this event).

*Ms* is expressed in decimal from 0 to 1 in steps of 0.01.

*Hys* is expressed in the same unit as *Ms*.

*Thresh* is expressed in the same unit as *Ms*.

5.5.4.13 Void

5.5.4.14 Void

## 5.5.5 Measurement reporting

5.5.5.1 General



**Figure 5.5.5.1-1: Measurement reporting**

The purpose of this procedure is to transfer measurement results from the UE to the network. The UE shall initiate this procedure only after successful AS security activation.

For the *measId* for which the measurement reporting procedure was triggered, the UE shall set the *measResults* within the *MeasurementReport* message as follows:

- 1> set the *measId* to the measurement identity that triggered the measurement reporting;
- 1> for each serving cell configured with *servingCellMO*:
  - 2> if the *reportConfig* associated with the *measId* that triggered the measurement reporting includes *rsType*:
    - 3> if the serving cell measurements based on the *rsType* included in the *reportConfig* that triggered the measurement report are available:
      - 4> set the *measResultServingCell* within *measResultServingMOList* to include RSRP, RSRQ and the available SINR of the serving cell, derived based on the *rsType* included in the *reportConfig* that triggered the measurement report;
    - 2> else:
      - 3> if SSB based serving cell measurements are available:
        - 4> set the *measResultServingCell* within *measResultServingMOList* to include RSRP, RSRQ and the available SINR of the serving cell, derived based on SSB;
      - 3> else if CSI-RS based serving cell measurements are available:
        - 4> set the *measResultServingCell* within *measResultServingMOList* to include RSRP, RSRQ and the available SINR of the serving cell, derived based on CSI-RS;
  - 1> set the *servCellId* within *measResultServingMOList* to include each NR serving cell that is configured with *servingCellMO*, if any;
  - 1> if the *reportConfig* associated with the *measId* that triggered the measurement reporting includes *reportQuantityRS-Indexes* and *maxNrofRS-IndexesToReport*:
    - 2> for each serving cell configured with *servingCellMO*, include beam measurement information according to the associated *reportConfig* as described in 5.5.5.2;
  - 1> if the *reportConfig* associated with the *measId* that triggered the measurement reporting includes *reportAddNeighMeas*:
    - 2> for each *measObjectId* referenced in the *measIdList* which is also referenced with *servingCellMO*, other than the *measObjectId* corresponding with the *measId* that triggered the measurement reporting:

- 3> if the *measObjectNR* indicated by the *servingCellMO* includes the RS resource configuration corresponding to the *rsType* indicated in the *reportConfig*:
  - 4> set the *measResultBestNeighCell* within *measResultServingMOList* to include the *physCellId* and the available measurement quantities based on the *reportQuantityCell* and *rsType* indicated in *reportConfig* of the non-serving cell corresponding to the concerned *measObjectNR* with the highest measured RSRP if RSRP measurement results are available for cells corresponding to this *measObjectNR*, otherwise with the highest measured RSRQ if RSRQ measurement results are available for cells corresponding to this *measObjectNR*, otherwise with the highest measured SINR;
  - 4> if the *reportConfig* associated with the *measId* that triggered the measurement reporting includes *reportQuantityRS-Indexes* and *maxNrofRS-IndexesToReport*:
    - 5> for each best non-serving cell included in the measurement report:
      - 6> include beam measurement information according to the associated *reportConfig* as described in 5.5.5.2;
- 1> if the *reportConfig* associated with the *measId* that triggered the measurement reporting is set to *eventTriggered* and *eventID* is set to *eventA3*, or *eventA4*, or *eventA5*, or *eventB1*, or *eventB2*:
  - 2> if the UE is in NE-DC and the measurement configuration that triggered this measurement report is associated with the MCG:
    - 3> set the *measResultServFreqListEUTRA-SCG* to include an entry for each E-UTRA SCG serving frequency with the following:
      - 4> include *carrierFreq* of the E-UTRA serving frequency;
      - 4> set the *measResultServingCell* to include the available measurement quantities that the UE is configured to measure by the measurement configuration associated with the SCG;
      - 4> if *reportConfig* associated with the *measId* that triggered the measurement reporting includes *reportAddNeighMeas*:
        - 5> set the *measResultServFreqListEUTRA-SCG* to include within *measResultBestNeighCell* the quantities of the best non-serving cell, based on RSRP, on the concerned serving frequency;
  - 1> if *reportConfig* associated with the *measId* that triggered the measurement reporting is set to *eventTriggered* and *eventID* is set to *eventA3*, or *eventA4*, or *eventA5*:
    - 2> if the UE is in NR-DC and the measurement configuration that triggered this measurement report is associated with the MCG:
      - 3> set the *measResultServFreqListNR-SCG* to include for each NR SCG serving cell that is configured with *servingCellMO*, if any, the following:
        - 4> if the *reportConfig* associated with the *measId* that triggered the measurement reporting includes *rsType*:
          - 5> if the serving cell measurements based on the *rsType* included in the *reportConfig* that triggered the measurement report are available according to the measurement configuration associated with the SCG:
            - 6> set the *measResultServingCell* within *measResultServFreqListNR-SCG* to include RSRP, RSRQ and the available SINR of the serving cell, derived based on the *rsType* included in the *reportConfig* that triggered the measurement report;
        - 4> else:
          - 5> if SSB based serving cell measurements are available according to the measurement configuration associated with the SCG:
            - 6> set the *measResultServingCell* within *measResultServFreqListNR-SCG* to include RSRP, RSRQ and the available SINR of the serving cell, derived based on SSB;

- 5> else if CSI-RS based serving cell measurements are available according to the measurement configuration associated with the SCG:
  - 6> set the *measResultServingCell* within *measResultServFreqListNR-SCG* to include RSRP, RSRQ and the available SINR of the serving cell, derived based on CSI-RS;
- 4> if results for the serving cell derived based on SSB are included:
  - 5> include the *ssbFrequency* to the value indicated by *ssbFrequency* as included in the *MeasObjectNR* of the serving cell;
- 4> if results for the serving cell derived based on CSI-RS are included:
  - 5> include the *refFreqCSI-RS* to the value indicated by *refFreqCSI-RS* as included in the *MeasObjectNR* of the serving cell;
- 4> if the *reportConfig* associated with the *measId* that triggered the measurement reporting includes *reportQuantityRS-Indexes* and *maxNrofRS-IndexesToReport*:
  - 5> for each serving cell configured with *servingCellMO*, include beam measurement information according to the associated *reportConfig* as described in 5.5.5.2, where availability is considered according to the measurement configuration associated with the SCG;
- 4> if *reportConfig* associated with the *measId* that triggered the measurement reporting includes *reportAddNeighMeas*:
  - 5> if the *measObjectNR* indicated by the *servingCellMO* includes the RS resource configuration corresponding to the *rsType* indicated in the *reportConfig*:
    - 6> set the *measResultBestNeighCellListNR* within *measResultServFreqListNR-SCG* to include one entry with the *physCellId* and the available measurement quantities based on the *reportQuantityCell* and *rsType* indicated in *reportConfig* of the non-serving cell corresponding to the concerned *measObjectNR* with the highest measured RSRP if RSRP measurement results are available for cells corresponding to this *measObjectNR*, otherwise with the highest measured RSRQ if RSRQ measurement results are available for cells corresponding to this *measObjectNR*, otherwise with the highest measured SINR, where availability is considered according to the measurement configuration associated with the SCG;
  - 7> if the *reportConfig* associated with the *measId* that triggered the measurement reporting includes *reportQuantityRS-Indexes* and *maxNrofRS-IndexesToReport*:
    - 8> for each best non-serving cell included in the measurement report:
      - 9> include beam measurement information according to the associated *reportConfig* as described in 5.5.5.2, where availability is considered according to the measurement configuration associated with the SCG;
- 1> if the *measRSSI-ReportConfig* is configured within the corresponding *reportConfig* for this *measId*:
  - 2> set the *rsi-Result* to the average of sample value(s) provided by lower layers in the *reportInterval*;
  - 2> set the *channelOccupancy* to the rounded percentage of sample values which are beyond the *channelOccupancyThreshold* within all the sample values in the *reportInterval*;
- 1> if there is at least one applicable neighbouring cell to report:
  - 2> if the *reportType* is set to *eventTriggered* or *periodical*:
    - 3> set the *measResultNeighCells* to include the best neighbouring cells up to *maxReportCells* in accordance with the following:
      - 4> if the *reportType* is set to *eventTriggered*:
        - 5> include the cells included in the *cellsTriggeredList* as defined within the *VarMeasReportList* for this *measId*;

- 4> else:
    - 5> include the applicable cells for which the new measurement results became available since the last periodical reporting or since the measurement was initiated or reset;
    - 4> for each cell that is included in the *measResultNeighCells*, include the *physCellId*;
    - 4> if the *reportType* is set to *eventTriggered* or *periodical*:
      - 5> for each included cell, include the layer 3 filtered measured results in accordance with the *reportConfig* for this *measId*, ordered as follows:
        - 6> if the *measObject* associated with this *measId* concerns NR:
          - 7> if *rsType* in the associated *reportConfig* is set to *ssb*:
            - 8> set *resultsSSB-Cell* within the *measResult* to include the SS/PBCH block based quantity(ies) indicated in the *reportQuantityCell* within the concerned *reportConfig*, in decreasing order of the sorting quantity, determined as specified in 5.5.5.3, i.e. the best cell is included first;
            - 8> if *reportQuantityRS-Indexes* and *maxNrofRS-IndexesToReport* are configured, include beam measurement information as described in 5.5.5.2;
          - 7> else if *rsType* in the associated *reportConfig* is set to *csi-rs*:
            - 8> set *resultsCSI-RS-Cell* within the *measResult* to include the CSI-RS based quantity(ies) indicated in the *reportQuantityCell* within the concerned *reportConfig*, in decreasing order of the sorting quantity, determined as specified in 5.5.5.3, i.e. the best cell is included first;
            - 8> if *reportQuantityRS-Indexes* and *maxNrofRS-IndexesToReport* are configured, include beam measurement information as described in 5.5.5.2;
        - 6> if the *measObject* associated with this *measId* concerns E-UTRA:
          - 7> set the *measResult* to include the quantity(ies) indicated in the *reportQuantity* within the concerned *reportConfigInterRAT* in decreasing order of the sorting quantity, determined as specified in 5.5.5.3, i.e. the best cell is included first;
        - 6> if the *measObject* associated with this *measId* concerns UTRA-FDD and if *ReportConfigInterRAT* includes the *reportQuantityUTRA-FDD*:
          - 7> set the *measResult* to include the quantity(ies) indicated in the *reportQuantityUTRA-FDD* within the concerned *reportConfigInterRAT* in decreasing order of the sorting quantity, determined as specified in 5.5.5.3, i.e. the best cell is included first;
- 2> else:
  - 3> if the cell indicated by *cellForWhichToReportCGI* is an NR cell:
    - 4> if *plmn-IdentityInfoList* of the *cgi-Info* for the concerned cell has been obtained:
      - 5> include the *plmn-IdentityInfoList* including *plmn-IdentityList*, *trackingAreaCode* (if available), *ranac* (if available), *cellIdentity* and *cellReservedForOperatorUse* for each entry of the *plmn-IdentityInfoList*;
      - 5> include *frequencyBandList* if available;
    - 4> if *nr-CGI-Reporting-NPN* is supported by the UE and *npn-IdentityInfoList* of the *cgi-Info* for the concerned cell has been obtained:
      - 5> include the *npn-IdentityInfoList* including *npn-IdentityList*, *trackingAreaCode*, *ranac* (if available), *cellIdentity* and *cellReservedForOperatorUse* for each entry of the *npn-IdentityInfoList*;
    - 4> else if *MIB* indicates the *SIB1* is not broadcast:



- 5> include the *noSIB1* including the *ssb-SubcarrierOffset* and *pdccch-ConfigSIB1* obtained from *MIB* of the concerned cell;
- 3> if the cell indicated by *cellForWhichToReportCGI* is an E-UTRA cell:
  - 4> if all mandatory fields of the *cgi-Info-EPC* for the concerned cell have been obtained:
    - 5> include in the *cgi-Info-EPC* the fields broadcasted in E-UTRA *SystemInformationBlockType1* associated to EPC;
  - 4> if the UE is E-UTRA/5GC capable and all mandatory fields of the *cgi-Info-5GC* for the concerned cell have been obtained:
    - 5> include in the *cgi-Info-5GC* the fields broadcasted in E-UTRA *SystemInformationBlockType1* associated to 5GC;
  - 4> if the mandatory present fields of the *cgi-Info* for the cell indicated by the *cellForWhichToReportCGI* in the associated *measObject* have been obtained:
    - 5> include the *freqBandIndicator*;
    - 5> if the cell broadcasts the *multiBandInfoList*, include the *multiBandInfoList*;
    - 5> if the cell broadcasts the *freqBandIndicatorPriority*, include the *freqBandIndicatorPriority*;
- 1> if the corresponding *measObject* concerns NR:
  - 2> if the *reportSFTD-Meas* is set to *true* within the corresponding *reportConfigNR* for this *measId*:
    - 3> set the *measResultSFTD-NR* in accordance with the following:
      - 4> set *sfm-OffsetResult* and *frameBoundaryOffsetResult* to the measurement results provided by lower layers;
      - 4> if the *reportRSRP* is set to *true*;
        - 5> set *rsrp-Result* to the RSRP of the NR PSCell derived based on SSB;
    - 2> else if the *reportSFTD-NeighMeas* is included within the corresponding *reportConfigNR* for this *measId*:
      - 3> for each applicable cell which measurement results are available, include an entry in the *measResultCellListSFTD-NR* and set the contents as follows:
        - 4> set *physCellId* to the physical cell identity of the concerned NR neighbour cell.
        - 4> set *sfm-OffsetResult* and *frameBoundaryOffsetResult* to the measurement results provided by lower layers;
        - 4> if the *reportRSRP* is set to *true*:
          - 5> set *rsrp-Result* to the RSRP of the concerned cell derived based on SSB;
    - 1> else if the corresponding *measObject* concerns E-UTRA:
      - 2> if the *reportSFTD-Meas* is set to *true* within the corresponding *reportConfigInterRAT* for this *measId*:
        - 3> set the *measResultSFTD-EUTRA* in accordance with the following:
          - 4> set *sfm-OffsetResult* and *frameBoundaryOffsetResult* to the measurement results provided by lower layers;
          - 4> if the *reportRSRP* is set to *true*;
            - 5> set *rsrpResult-EUTRA* to the RSRP of the EUTRA PSCell;
      - 1> if average uplink PDCP delay values are available:
        - 2> set the *ul-PDCP-DelayValueResultList* to include the corresponding average uplink PDCP delay values;

- 1> if the *includeCommonLocationInfo* is configured in the corresponding *reportConfig* for this *measId* and detailed location information that has not been reported is available, set the content of *commonLocationInfo* of the *locationInfo* as follows:
  - 2> include the *locationTimestamp*;
  - 2> include the *locationCoordinate*, if available;
  - 2> include the *velocityEstimate*, if available;
  - 2> include the *locationError*, if available;
  - 2> include the *locationSource*, if available;
  - 2> if available, include the *gnss-TOD-msec*,
- 1> if the *includeWLAN-Meas* is configured in the corresponding *reportConfig* for this *measId*, set the *wlan-LocationInfo* of the *locationInfo* in the *measResults* as follows:
  - 2> if available, include the *LogMeasResultWLAN*, in order of decreasing RSSI for WLAN APs;
- 1> if the *includeBT-Meas* is configured in the corresponding *reportConfig* for this *measId*, set the *BT-LocationInfo* of the *locationInfo* in the *measResults* as follows:
  - 2> if available, include the *LogMeasResultBT*, in order of decreasing RSSI for Bluetooth beacons;
- 1> if the *includeSensor-Meas* is configured in the corresponding *reportConfig* for this *measId*, set the *sensor-LocationInfo* of the *locationInfo* in the *measResults* as follows:
  - 2> if available, include the *sensor-MeasurementInformation*;
  - 2> if available, include the *sensor-MotionInformation*;
- 1> if there is at least one applicable transmission resource pool for NR sidelink communication (for *measResultsSL*):
  - 2> set the *measResultsListSL* to include the CBR measurement results in accordance with the following:
    - 3> if the *reportType* is set to *eventTriggered*:
      - 4> include the transmission resource pools included in the *poolsTriggeredList* as defined within the *VarMeasReportList* for this *measId*;
    - 3> else:
      - 4> include the applicable transmission resource pools for which the new measurement results became available since the last periodical reporting or since the measurement was initiated or reset;
    - 3> if the corresponding *measObject* concerns NR sidelink communication, then for each transmission resource pool to be reported:
      - 4> set the *sl-poolReportIdentity* to the identity of this transmission resource pool;
      - 4> set the *sl-CBR-ResultsNR* to the CBR measurement results on PSSCH and PSCCH of this transmission resource pool provided by lower layers, if available;

NOTE 1: Void.

- 1> if there is at least one applicable CLI measurement resource to report:
  - 2> if the *reportType* is set to *cli-EventTriggered* or *cli-Periodical*:
    - 3> set the *measResultCLI* to include the most interfering SRS resources or most interfering CLI-RSSI resources up to *maxReportCLI* in accordance with the following:
      - 4> if the *reportType* is set to *cli-EventTriggered*:
        - 5> if trigger quantity is set to *srs-RSRP* i.e. *i1-Threshold* is set to *srs-RSRP*:

- 6> include the SRS resource included in the *cli-TriggeredList* as defined within the *VarMeasReportList* for this *measId*;
- 5> if trigger quantity is set to *cli-RSSI* i.e. *i1-Threshold* is set to *cli-RSSI*:
  - 6> include the CLI-RSSI resource included in the *cli-TriggeredList* as defined within the *VarMeasReportList* for this *measId*;
- 4> else:
  - 5> if *reportQuantityCLI* is set to *srs-rsrp*:
    - 6> include the applicable SRS resources for which the new measurement results became available since the last periodical reporting or since the measurement was initiated or reset;
  - 5> else:
    - 6> include the applicable CLI-RSSI resources for which the new measurement results became available since the last periodical reporting or since the measurement was initiated or reset;
- 4> for each SRS resource that is included in the *measResultCLI*:
  - 5> include the *srs-ResourceId*;
  - 5> set *srs-RSRP-Result* to include the layer 3 filtered measured results in decreasing order, i.e. the most interfering SRS resource is included first;
- 4> for each CLI-RSSI resource that is included in the *measResultCLI*:
  - 5> include the *rsi-ResourceId*;
  - 5> set *cli-RSSI-Result* to include the layer 3 filtered measured results in decreasing order, i.e. the most interfering CLI-RSSI resource is included first;
- 1> increment the *numberOfReportsSent* as defined within the *VarMeasReportList* for this *measId* by 1;
- 1> stop the periodical reporting timer, if running;
- 1> if the *numberOfReportsSent* as defined within the *VarMeasReportList* for this *measId* is less than the *reportAmount* as defined within the corresponding *reportConfig* for this *measId*:
  - 2> start the periodical reporting timer with the value of *reportInterval* as defined within the corresponding *reportConfig* for this *measId*;
- 1> else:
  - 2> if the *reportType* is set to *periodical* or *cli-Periodical*:
    - 3> remove the entry within the *VarMeasReportList* for this *measId*;
    - 3> remove this *measId* from the *measIdList* within *VarMeasConfig*;
- 1> if the measurement reporting was configured by a *sl-ConfigDedicatedNR* received within the *RRCConnectionReconfiguration*:
  - 2> submit the *MeasurementReport* message to lower layers for transmission via SRB1, embedded in E-UTRA RRC message *ULInformationTransferIRAT* as specified TS 36.331 [10], clause 5.6.28;
- 1> else if the UE is in (NG)EN-DC:
  - 2> if SRB3 is configured:
    - 3> submit the *MeasurementReport* message via SRB3 to lower layers for transmission, upon which the procedure ends;
  - 2> else:

- 3> submit the *MeasurementReport* message via E-UTRA embedded in E-UTRA RRC message *ULInformationTransferMRDC* as specified in TS 36.331 [10].
- 1> else if the UE is in NR-DC:
  - 2> if the measurement configuration that triggered this measurement report is associated with the SCG:
    - 3> if SRB3 is configured:
      - 4> submit the *MeasurementReport* message via SRB3 to lower layers for transmission, upon which the procedure ends;
    - 3> else:
      - 4> submit the *MeasurementReport* message via SRB1 embedded in NR RRC message *ULInformationTransferMRDC* as specified in 5.7.2a.3;
  - 2> else:
    - 3> submit the *MeasurementReport* message via SRB1 to lower layers for transmission, upon which the procedure ends;
- 1> else:
  - 2> submit the *MeasurementReport* message to lower layers for transmission, upon which the procedure ends.

### 5.5.5.2 Reporting of beam measurement information

For beam measurement information to be included in a measurement report the UE shall:

- 1> if *reportType* is set to *eventTriggered*:
  - 2> consider the trigger quantity as the sorting quantity if available, otherwise RSRP as sorting quantity if available, otherwise RSRQ as sorting quantity if available, otherwise SINR as sorting quantity;
- 1> if *reportType* is set to *periodical*:
  - 2> if a single reporting quantity is set to *true* in *reportQuantityRS-Indexes*;
    - 3> consider the configured single quantity as the sorting quantity;
  - 2> else:
    - 3> if *rsrp* is set to *true*;
      - 4> consider RSRP as the sorting quantity;
    - 3> else:
      - 4> consider RSRQ as the sorting quantity;
- 1> set *rsIndexResults* to include up to *maxNrofRS-IndexesToReport* SS/PBCH block indexes or CSI-RS indexes in order of decreasing sorting quantity as follows:
  - 2> if the measurement information to be included is based on SS/PBCH block:
    - 3> include within *resultsSSB-Indexes* the index associated to the best beam for that SS/PBCH block sorting quantity and if *absThreshSS-BlocksConsolidation* is included in the *VarMeasConfig* for the *measObject* associated to the cell for which beams are to be reported, the remaining beams whose sorting quantity is above *absThreshSS-BlocksConsolidation*;
    - 3> if *includeBeamMeasurements* is configured, include the SS/PBCH based measurement results for the quantities in *reportQuantityRS-Indexes* set to *true* for each SS/PBCH block index;
  - 2> else if the beam measurement information to be included is based on CSI-RS:

- 3> include within *resultsCSI-RS-Indexes* the index associated to the best beam for that CSI-RS sorting quantity and, if *absThreshCSI-RS-Consolidation* is included in the *VarMeasConfig* for the *measObject* associated to the cell for which beams are to be reported, the remaining beams whose sorting quantity is above *absThreshCSI-RS-Consolidation*;
- 3> if *includeBeamMeasurements* is configured, include the CSI-RS based measurement results for the quantities in *reportQuantityRS-Indexes* set to *true* for each CSI-RS index.

### 5.5.5.3 Sorting of cell measurement results

The UE shall determine the sorting quantity according to parameters of the *reportConfig* associated with the *measId* that triggered the reporting:

- 1> if the *reportType* is set to *eventTriggered*:
  - 2> for an NR cell, consider the quantity used in the *aN-Threshold* (for *eventA1*, *eventA2* and *eventA4*) or in the *a5-Threshold2* (for *eventA5*) or in the *aN-Offset* (for *eventA3* and *eventA6*) as the sorting quantity;
  - 2> for an E-UTRA cell, consider the quantity used in the *bN-ThresholdEUTRA* as the sorting quantity;
  - 2> for an UTRA-FDD cell, consider the quantity used in the *bN-ThresholdUTRA-FDD* as the sorting quantity;
- 1> if the *reportType* is set to *periodical*:
  - 2> determine the sorting quantity according to *reportQuantityCell* for an NR cell, and according to *reportQuantity* for an E-UTRA cell, as below:
    - 3> if a single quantity is set to *true*:
      - 4> consider this quantity as the sorting quantity;
    - 3> else:
      - 4> if *rsrp* is set to *true*;
        - 5> consider RSRP as the sorting quantity;
      - 4> else:
        - 5> consider RSRQ as the sorting quantity;
  - 2> determine the sorting quantity according to *reportQuantityUTRA-FDD* for UTRA-FDD cell, as below:
    - 3> if a single quantity is set to *true*:
      - 4> consider this quantity as the sorting quantity;
    - 3> else:
      - 4> consider RSCP as the sorting quantity.

## 5.5.6 Location measurement indication

### 5.5.6.1 General



Figure 5.5.5.1-1: Location measurement indication

The purpose of this procedure is to indicate to the network that the UE is going to start/stop location related measurements towards E-UTRA or NR (*eutra-RSTD*, *nr-RSTD*, *nr-UE-RxTxTimeDiff*, *nr-PRS-RSRP*) which require measurement gaps or start/stop detection of subframe and slot timing towards E-UTRA (*eutra-FineTimingDetection*) which requires measurement gaps. UE shall initiate this procedure only after successful AS security activation.

NOTE: It is a network decision to configure the measurement gap.

### 5.5.6.2 Initiation

The UE shall:

1> if and only if upper layers indicate to start performing location measurements towards E-UTRA or NR or start subframe and slot timing detection towards E-UTRA, and the UE requires measurement gaps for these operations while measurement gaps are either not configured or not sufficient:

2> initiate the procedure to indicate start;

NOTE 1: The UE verifies the measurement gap situation only upon receiving the indication from upper layers. If at this point in time sufficient gaps are available, the UE does not initiate the procedure. Unless it receives a new indication from upper layers, the UE is only allowed to further repeat the procedure in the same PCell once per frequency of the target RAT if the provided measurement gaps are insufficient.

1> if and only if upper layers indicate to stop performing location measurements towards E-UTRA or NR or stop subframe and slot timing detection towards E-UTRA:

2> initiate the procedure to indicate stop.

NOTE 2: The UE may initiate the procedure to indicate stop even if it did not previously initiate the procedure to indicate start.

### 5.5.6.3 Actions related to transmission of *LocationMeasurementIndication* message

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

1> if the procedure is initiated to indicate start of location related measurements:

2> if the procedure is initiated for RSTD measurements towards E-UTRA:

3> set the *measurementIndication* to the *eutra-RSTD* according to the information received from upper layers;

2> else if the procedure is initiated for positioning measurement towards NR:

3> set the *measurementIndication* to the *nr-PRS-Measurement* according to the information received from upper layers;

1> else if the procedure is initiated to indicate stop of location related measurements:

2> set the *measurementIndication* to the value *release*;

1> if the procedure is initiated to indicate start of subframe and slot timing detection towards E-UTRA:

2> set the *measurementIndication* to the value *eutra-FineTimingDetection*;

1> else if the procedure is initiated to indicate stop of subframe and slot timing detection towards E-UTRA:

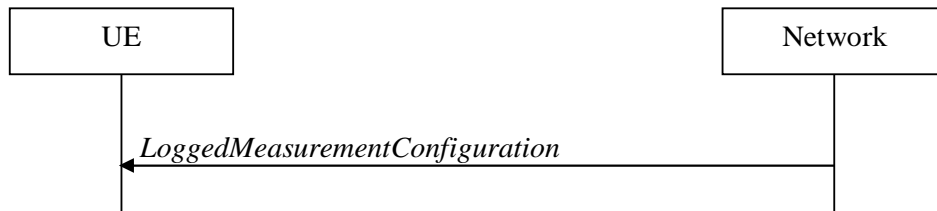
2> set the *measurementIndication* to the value *release*;

1> submit the *LocationMeasurementIndication* message to lower layers for transmission, upon which the procedure ends.

## 5.5a Logged Measurements

### 5.5a.1 Logged Measurement Configuration

#### 5.5a.1.1 General



**Figure 5.5a.1.1-1: Logged measurement configuration**

The purpose of this procedure is to configure the UE to perform logging of measurement results while in RRC\_IDLE and RRC\_INACTIVE. The procedure applies to logged measurements capable UEs that are in RRC\_CONNECTED.

NOTE: NG-RAN may retrieve stored logged measurement information by means of the UE information procedure.

#### 5.5a.1.2 Initiation

NG-RAN initiates the logged measurement configuration procedure to UE in RRC\_CONNECTED by sending the *LoggedMeasurementConfiguration* message.

#### 5.5a.1.3 Reception of the *LoggedMeasurementConfiguration* by the UE

Upon receiving the *LoggedMeasurementConfiguration* message the UE shall:

- 1> discard the logged measurement configuration as well as the logged measurement information as specified in 5.5a.2;
- 1> store the received *loggingDuration*, *reportType* and *areaConfiguration*, if included, in *VarLogMeasConfig*;
- 1> if the *LoggedMeasurementConfiguration* message includes *plmn-IdentityList*:
  - 2> set *plmn-IdentityList* in *VarLogMeasReport* to include the RPLMN as well as the PLMNs included in *plmn-IdentityList*;
- 1> else:
  - 2> set *plmn-IdentityList* in *VarLogMeasReport* to include the RPLMN;
- 1> store the received *absoluteTimeInfo*, *traceReference*, *traceRecordingSessionRef*, and *tce-Id* in *VarLogMeasReport*;
- 1> store the received *bt-NameList*, if included, in *VarLogMeasConfig*;
- 1> store the received *wlan-NameList*, if included, in *VarLogMeasConfig*;
- 1> store the received *sensor-NameList*, if included, in *VarLogMeasConfig*;
- 1> start timer T330 with the timer value set to the *loggingDuration*;

#### 5.5a.1.4 T330 expiry

Upon expiry of T330 the UE shall:

- 1> release *VarLogMeasConfig*;

The UE is allowed to discard stored logged measurements, i.e. to release *VarLogMeasReport*, 48 hours after T330 expiry.

### 5.5a.2 Release of Logged Measurement Configuration

#### 5.5a.2.1 General

The purpose of this procedure is to release the logged measurement configuration as well as the logged measurement information.

#### 5.5a.2.2 Initiation

The UE shall initiate the procedure upon receiving a logged measurement configuration in another RAT. The UE shall also initiate the procedure upon power off or detach.

The UE shall:

- 1> stop timer T330, if running;
- 1> if stored, discard the logged measurement configuration as well as the logged measurement information, i.e. release the UE variables *VarLogMeasConfig* and *VarLogMeasReport*.

### 5.5a.3 Measurements logging

#### 5.5a.3.1 General

This procedure specifies the logging of available measurements by a UE in RRC\_IDLE and RRC\_INACTIVE that has a logged measurement configuration. The actual process of logging within the UE, takes place in RRC\_IDLE state could continue in RRC\_INACTIVE state or vice versa.

#### 5.5a.3.2 Initiation

While T330 is running, the UE shall:

- 1> perform the logging in accordance with the following:
  - 2> if the *reportType* is set to *periodical* in the *VarLogMeasConfig*:
    - 3> if the UE is camping normally on an NR cell and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport* and, if the cell is part of the area indicated by *areaConfiguration* if configured in *VarLogMeasConfig*:
      - 4> perform the logging at regular time intervals, as defined by the *loggingInterval* in the *VarLogMeasConfig*;
  - 2> else if the *reportType* is set to *eventTriggered*, and *eventType* is set to *outOfCoverage*:
    - 3> perform the logging at regular time intervals as defined by the *loggingInterval* in *VarLogMeasConfig* only when the UE is in any cell selection state;
    - 3> perform the logging immediately upon transitioning from the any cell selection state to the camped normally state;
  - 2> else if the *reportType* is set to *eventTriggered* and *eventType* is set to *eventL1*:



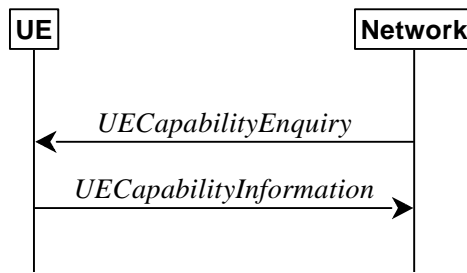
- 3> if the UE is camping normally on an NR cell and if the RPLMN is included in *plmn-IdentityList* stored in *VarLogMeasReport* and, if the cell is part of the area indicated by *areaConfiguration* if configured in *VarLogMeasConfig*;
  - 4> perform the logging at regular time intervals as defined by the *loggingInterval* in *VarLogMeasConfig* only when the conditions indicated by the *eventLI* are met;
- 2> when performing the logging:
- 3> set the *relativeTimeStamp* to indicate the elapsed time since the moment at which the logged measurement configuration was received;
  - 3> if detailed location information became available during the last logging interval, set the content of the *locationInfo* as in 5.3.3.7:
  - 3> if the UE is in any cell selection state (as specified in TS 38.304 [20]):
    - 4> set *anyCellSelectionDetected* to indicate the detection of no suitable or no acceptable cell found;
    - 4> set the *servCellIdentity* to indicate global cell identity of the last logged cell that the UE was camping on;
    - 4> set the *measResultServingCell* to include the quantities of the last logged cell the UE was camping on;
  - 3> else:
    - 4> set the *servCellIdentity* to indicate global cell identity of the cell the UE is camping on;
    - 4> set the *measResultServingCell* to include the quantities of the cell the UE is camping on;
    - 4> if available, set the *measResultNeighCells*, in order of decreasing ranking-criterion as used for cell reselection, to include neighbouring cell measurements that became available during the last logging interval for at most the following number of neighbouring cells: 6 intra-frequency and 3 inter-frequency neighbours per frequency as well as 3 inter-RAT neighbours, per frequency/ set of frequencies per RAT and according to the following:
      - 5> for each neighbour cell included, include the optional fields that are available;
- NOTE: The UE includes the latest results of the available measurements as used for cell reselection evaluation in RRC\_IDLE or RRC\_INACTIVE, which are performed in accordance with the performance requirements as specified in TS 38.133 [14].
- 2> when the memory reserved for the logged measurement information becomes full, stop timer T330 and perform the same actions as performed upon expiry of T330, as specified in 5.5a.1.4.

## 5.6 UE capabilities

### 5.6.1 UE capability transfer

#### 5.6.1.1 General

This clause describes how the UE compiles and transfers its UE capability information upon receiving a UECapabilityEnquiry from the network.



**Figure 5.6.1.1-1: UE capability transfer**

### 5.6.1.2 Initiation

The network initiates the procedure to a UE in RRC\_CONNECTED when it needs (additional) UE radio access capability information. The network should retrieve UE capabilities only after AS security activation. Network does not forward UE capabilities that were retrieved before AS security activation to the CN.

### 5.6.1.3 Reception of the *UECapabilityEnquiry* by the UE

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

- 1> if the *ue-CapabilityRAT-RequestList* contains a *UE-CapabilityRAT-Request* with *rat-Type* set to *nr*:
  - 2> include in the *ue-CapabilityRAT-ContainerList* a *UE-CapabilityRAT-Container* of the type *UE-NR-Capability* and with the *rat-Type* set to *nr*;
  - 2> include the *supportedBandCombinationList*, *featureSets* and *featureSetCombinations* as specified in clause 5.6.1.4;
- 1> if the *ue-CapabilityRAT-RequestList* contains a *UE-CapabilityRAT-Request* with *rat-Type* set to *eutra-nr*:
  - 2> if the UE supports (NG)EN-DC or NE-DC:
    - 3> include in the *ue-CapabilityRAT-ContainerList* a *UE-CapabilityRAT-Container* of the type *UE-MRDC-Capability* and with the *rat-Type* set to *eutra-nr*;
    - 3> include the *supportedBandCombinationList* and *featureSetCombinations* as specified in clause 5.6.1.4;
- 1> if the *ue-CapabilityRAT-RequestList* contains a *UE-CapabilityRAT-Request* with *rat-Type* set to *eutra*:
  - 2> if the UE supports E-UTRA:
    - 3> include in the *ue-CapabilityRAT-ContainerList* a *ue-CapabilityRAT-Container* of the type *UE-EUTRA-Capability* and with the *rat-Type* set to *eutra* as specified in TS 36.331 [10], clause 5.6.3.3, according to the *capabilityRequestFilter*, if received;
- 1> if the *ue-CapabilityRAT-RequestList* contains a *UE-CapabilityRAT-Request* with *rat-Type* set to *utra-fdd*:
  - 2> if the UE supports UTRA-FDD:
    - 3> include the UE radio access capabilities for UTRA-FDD within a *ue-CapabilityRAT-Container* and with the *rat-Type* set to *utra-fdd*;
- 1> if the RRC message segmentation is enabled based on the field *rrc-SegAllowed* received, and the encoded RRC message is larger than the maximum supported size of a PDCP SDU specified in TS 38.323 [5]:
  - 2> initiate the UL message segment transfer procedure as specified in clause 5.7.7;
- 1> else:
  - 2> submit the *UECapabilityInformation* message to lower layers for transmission, upon which the procedure ends.

#### 5.6.1.4 Setting band combinations, feature set combinations and feature sets supported by the UE

The UE invokes the procedures in this clause if the NR or E-UTRA network requests UE capabilities for *nr*, *eutra-nr* or *eutra*. This procedure is invoked once per requested *rat-Type* (see clause 5.6.1.3 for capability enquiry by the NR network; see TS 36.331 [10], clause 5.6.3.3 for capability enquiry by the E-UTRA network). The UE shall ensure that the feature set IDs are consistent across feature sets, feature set combinations and band combinations in all three UE capability containers that the network queries with the same fields with the same values, i.e. *UE-CapabilityRequestFilterNR*, *UE-CapabilityRequestFilterCommon* and fields in *UECapabilityEnquiry* message (i.e. *requestedFreqBandsNR-MRDC*, *requestedCapabilityNR*, *eutra-nr-only* flag, and *requestedCapabilityCommon*) as defined in TS 36.331, where applicable.

NOTE 1: Capability enquiry without *frequencyBandListFilter* is not supported.

NOTE 2: In EN-DC, the gNB needs the capabilities for RAT types *nr* and *eutra-nr* and it uses the *featureSets* in the *UE-NR-Capability* together with the *featureSetCombinations* in the *UE-MRDC-Capability* to determine the NR UE capabilities for the supported MRDC band combinations. Similarly, the eNB needs the capabilities for RAT types *eutra* and *eutra-nr* and it uses the *featureSetsEUTRA* in the *UE-EUTRA-Capability* together with the *featureSetCombinations* in the *UE-MRDC-Capability* to determine the E-UTRA UE capabilities for the supported MRDC band combinations. Hence, the IDs used in the *featureSets* must match the IDs referred to in *featureSetCombinations* across all three containers. The requirement on consistency implies that there are no undefined feature sets and feature set combinations.

NOTE 3: If the UE cannot include all feature sets and feature set combinations due to message size or list size constraints, it is up to UE implementation which feature sets and feature set combinations it prioritizes.

The UE shall:

1> compile a list of "candidate band combinations" according to the filter criteria in *capabilityRequestFilterCommon* (if included), only consisting of bands included in *frequencyBandListFilter*, and prioritized in the order of *frequencyBandListFilter* (i.e. first include band combinations containing the first-listed band, then include remaining band combinations containing the second-listed band, and so on), where for each band in the band combination, the parameters of the band do not exceed *maxBandwidthRequestedDL*, *maxBandwidthRequestedUL*, *maxCarriersRequestedDL*, *maxCarriersRequestedUL*, *ca-BandwidthClassDL-EUTRA* or *ca-BandwidthClassUL-EUTRA*, whichever are received;

1> for each band combination included in the list of "candidate band combinations":

2> if the network (E-UTRA) included the *eutra-nr-only* field, or

2> if the requested *rat-Type* is *eutra*:

3> remove the NR-only band combination from the list of "candidate band combinations";

NOTE 4: The (E-UTRA) network may request capabilities for *nr* but indicate with the *eutra-nr-only* flag that the UE shall not include any NR band combinations in the *UE-NR-Capability*. In this case the procedural text above removes all NR-only band combinations from the candidate list and thereby also avoids inclusion of corresponding feature set combinations and feature sets below.

2> if it is regarded as a fallback band combination with the same capabilities of another band combination included in the list of "candidate band combinations", and

2> if this fallback band combination is generated by releasing at least one SCell or uplink configuration of SCell according to TS 38.306 [26]:

3> remove the band combination from the list of "candidate band combinations";

NOTE 5: Even if the network requests (only) capabilities for *nr*, it may include E-UTRA band numbers in the *frequencyBandListFilter* to ensure that the UE includes all necessary feature sets needed for subsequently requested *eutra-nr* capabilities. At this point of the procedure the list of "candidate band combinations" contains all NR- and/or E-UTRA-NR band combinations that match the filter (*frequencyBandListFilter*) provided by the NW and that match the *eutra-nr-only* flag (if RAT-Type *nr* is requested by E-UTRA). In the following, this candidate list is used to derive the band combinations, feature set combinations and feature sets to be reported in the requested capability container.

- 1> if the requested *rat-Type* is *nr*:
  - 2> include into *supportedBandCombinationList* as many NR-only band combinations as possible from the list of "candidate band combinations", starting from the first entry;
  - 3> if *srs-SwitchingTimeRequest* is received:
    - 4> if SRS carrier switching is supported;
      - 5> include *srs-SwitchingTimesListNR* for each band combination;
    - 4> set *srs-SwitchingTimeRequested* to *true*;
  - 2> include, into *featureSetCombinations*, the feature set combinations referenced from the supported band combinations as included in *supportedBandCombinationList* according to the previous;
  - 2> compile a list of "candidate feature set combinations" referenced from the list of "candidate band combinations" excluding entries (rows in feature set combinations) for fallback band combinations with same or lower capabilities;
  - 2> if *uplinkTxSwitchRequest* is received:
    - 3> include into *supportedBandCombinationList-UplinkTxSwitch* as many NR-only band combinations that supported UL TX switching as possible from the list of "candidate band combinations", starting from the first entry;
    - 4> if *srs-SwitchingTimeRequest* is received:
      - 5> if SRS carrier switching is supported;
        - 6> include *srs-SwitchingTimesListNR* for each band combination;
      - 5> set *srs-SwitchingTimeRequested* to *true*;
    - 3> include, into *featureSetCombinations*, the feature set combinations referenced from the supported band combinations as included in *supportedBandCombinationList-UplinkTxSwitch* according to the previous;

NOTE 6: This list of "candidate feature set combinations" contains the feature set combinations used for NR-only as well as E-UTRA-NR band combinations. It is used to derive a list of NR feature sets referred to from the feature set combinations in the *UE-NR-Capability* and from the feature set combinations in a *UE-MRDC-Capability* container.

- 2> include into *featureSets* the feature sets referenced from the "candidate feature set combinations" excluding entries (feature sets per CC) for fallback band combinations with same or lower capabilities and may exclude the feature sets with the parameters that exceed any of *maxBandwidthRequestedDL*, *maxBandwidthRequestedUL*, *maxCarriersRequestedDL* or *maxCarriersRequestedUL*, whichever are received;
- 1> else, if the requested *rat-Type* is *eutra-nr*:
  - 2> include into *supportedBandCombinationList* and/or *supportedBandCombinationListNEDC-Only* as many E-UTRA-NR band combinations as possible from the list of "candidate band combinations", starting from the first entry;
  - 3> if *srs-SwitchingTimeRequest* is received:
    - 4> if SRS carrier switching is supported;
      - 5> include *srs-SwitchingTimesListNR* and *srs-SwitchingTimesListEUTRA* for each band combination;
    - 4> set *srs-SwitchingTimeRequested* to *true*;
  - 2> include, into *featureSetCombinations*, the feature set combinations referenced from the supported band combinations as included in *supportedBandCombinationList* according to the previous;
  - 2> if *uplinkTxSwitchRequest* is received:

- 3> include into *supportedBandCombinationList-UplinkTxSwitch* as many E-UTRA-NR band combinations that supported UL TX switching as possible from the list of "candidate band combinations", starting from the first entry;
  - 4> if *srs-SwitchingTimeRequest* is received:
    - 5> if SRS carrier switching is supported;
      - 6> include *srs-SwitchingTimesListNR* and *srs-SwitchingTimesListEUTRA* for each band combination;
      - 5> set *srs-SwitchingTimeRequested* to true;
    - 3> include, into *featureSetCombinations*, the feature set combinations referenced from the supported band combinations as included in *supportedBandCombinationList-UplinkTxSwitch* according to the previous;
  - 1> else (if the requested *rat-Type* is *eutra*):
    - 2> compile a list of "candidate feature set combinations" referenced from the list of "candidate band combinations" excluding entries (rows in feature set combinations) for fallback band combinations with same or lower capabilities;
- NOTE 7: This list of "candidate feature set combinations" contains the feature set combinations used for E-UTRA-NR band combinations. It is used to derive a list of E-UTRA feature sets referred to from the feature set combinations in a *UE-MRDC-Capability* container.
- 2> include into *featureSetsEUTRA* (in the *UE-EUTRA-Capability*) the feature sets referenced from the "candidate feature set combinations" excluding entries (feature sets per CC) for fallback band combinations with same or lower capabilities and may exclude the feature sets with the parameters that exceed *ca-BandwidthClassDL-EUTRA* or *ca-BandwidthClassUL-EUTRA*, whichever are received;
  - 1> include the received *frequencyBandListFilter* in the field *appliedFreqBandListFilter* of the requested UE capability, except if the requested *rat-Type* is *nr* and the network included the *eutra-nr-only* field;
  - 1> if the network included *ue-CapabilityEnquiryExt*:
    - 2> include the received *ue-CapabilityEnquiryExt* in the field *receivedFilters*;

### 5.6.1.5 Void

## 5.7 Other

### 5.7.1 DL information transfer

#### 5.7.1.1 General



Figure 5.7.1.1-1: DL information transfer

The purpose of this procedure is to transfer NAS dedicated information from NG-RAN to a UE in RRC\_CONNECTED.

### 5.7.1.2 Initiation

The network initiates the DL information transfer procedure whenever there is a need to transfer NAS dedicated information. The network initiates the DL information transfer procedure by sending the *DLInformationTransfer* message.

### 5.7.1.3 Reception of the *DLInformationTransfer* by the UE

Upon receiving *DLInformationTransfer* message, the UE shall:

- 1> if *dedicatedNAS-Message* is included:
  - 2> forward *dedicatedNAS-Message* to upper layers.
- 1> if *referenceTimeInfo* is included:
  - 2> calculate the reference time based on the *time*, *referenceSFN* and *timeInfoType* if it is included;
  - 2> calculate the uncertainty of the reference time based on the *uncertainty*, if *uncertainty* is included;
  - 2> inform upper layers of the reference time and, if *uncertainty* is included, of the uncertainty.

## 5.7.1a DL information transfer for MR-DC

### 5.7.1a.1 General



**Figure 5.7.1a.1-1: DL information transfer MR-DC**

The purpose of this procedure is to transfer RRC messages from the network to the UE over SRB3 (e.g. an NR or E-UTRA RRC connection reconfiguration, an RRC connection release, a *MobilityFromNRCommand*, or a *MobilityFromEUTRACommand* message) during fast MCG link recovery.

### 5.7.1a.2 Initiation

The network initiates this procedure whenever there is a need to transfer an RRC message during fast MCG link recovery.

### 5.7.1a.3 Actions related to reception of *DLInformationTransferMRDC* message

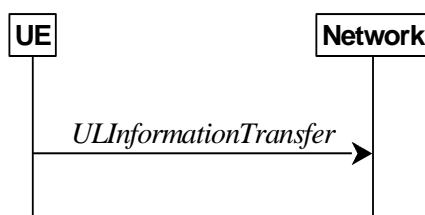
Upon receiving the *DLInformationTransferMRDC*, the UE shall:

- 1> if the *RRCReconfiguration* message is included in *dl-DCCH-MessageNR*:
  - 2> perform the RRC reconfiguration procedure according to 5.3.5.3;
- 1> else if the *RRCRelease* message is included in *dl-DCCH-MessageNR*:
  - 2> perform the RRC release procedure according to 5.3.8;
- 1> else if the *MobilityFromNRCommand* message is included in the *dl-DCCH-MessageNR*:
  - 2> perform the mobility from NR procedure according to 5.4.3.3;
- 1> else if the E-UTRA *RRCConnectionReconfiguration* message is included in *dl-DCCH-MessageEUTRA*:

- 2> perform the RRC connection reconfiguration procedure as specified in TS 36.331 [10], clause 5.3.5.3;
- 1> else if the E-UTRA *RRCConnectionRelease* message is included in *dl-DCCH-MessageEUTRA*:
  - 2> perform the RRC connection release as specified in TS 36.331 [10], clause 5.3.8;
- 1> else if the *MobilityFromEUTRACommand* message is included in the *dl-DCCH-MessageEUTRA*:
  - 2> perform the mobility from E-UTRA procedure as specified in TS 36.331 [10], clause 5.4.3.3;

## 5.7.2 UL information transfer

### 5.7.2.1 General



**Figure 5.7.2.1-1: UL information transfer**

The purpose of this procedure is to transfer NAS dedicated information from the UE to the network.

### 5.7.2.2 Initiation

A UE in RRC\_CONNECTED initiates the UL information transfer procedure whenever there is a need to transfer NAS dedicated information. The UE initiates the UL information transfer procedure by sending the *ULInformationTransfer* message.

### 5.7.2.3 Actions related to transmission of *ULInformationTransfer* message

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

- 1> if the upper layer provides NAS PDU:
  - 2> set the *dedicatedNAS-Message* to include the information received from upper layers
- 1> submit the *ULInformationTransfer* message to lower layers for transmission, upon which the procedure ends.

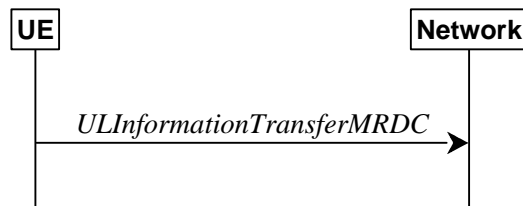
### 5.7.2.4 Failure to deliver *ULInformationTransfer* message

The UE shall:

- 1> if AS security is not started and radio link failure occurs before the successful delivery of *ULInformationTransfer* messages has been confirmed by lower layers; or
- 1> if PDCP re-establishment or release/addition (e.g due to key refresh upon PCell or PSCell change, or RRC connection re-establishment) occurs on an SRB on which *ULInformationTransfer* messages were submitted for transmission but successful delivery of these messages was not confirmed by lower layers:
  - 2> inform upper layers about the possible failure to deliver the information contained in the concerned *ULInformationTransfer* messages.

## 5.7.2a UL information transfer for MR-DC

### 5.7.2a.1 General



**Figure 5.7.2a.1-1: UL information transfer MR-DC**

The purpose of this procedure is to transfer MR-DC dedicated information from the UE to the network e.g. the NR or E-UTRA RRC *MeasurementReport*, *FailureInformation*, *UEAssistanceInformation*, *RRCReconfigurationComplete* or *MCGFailureInformation* message.

### 5.7.2a.2 Initiation

A UE in RRC\_CONNECTED initiates the UL information transfer for MR-DC procedure whenever there is a need to transfer MR-DC dedicated information. I.e. the procedure is not used during an RRC connection reconfiguration involving NR or E-UTRA connection reconfiguration, in which case the MR DC information is piggybacked to the *RRCReconfigurationComplete* message.

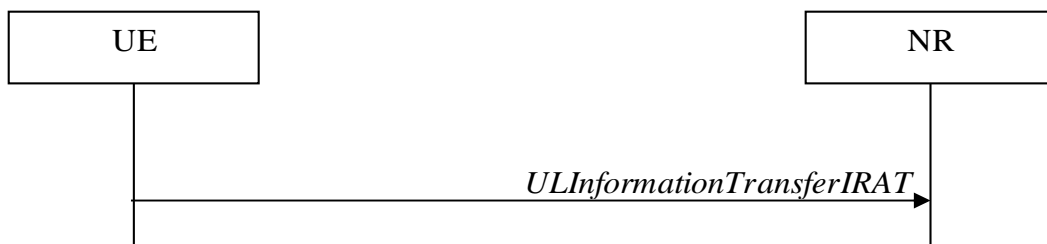
### 5.7.2a.3 Actions related to transmission of *ULInformationTransferMRDC* message

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

- 1> if there is a need to transfer MR-DC dedicated information related to NR:
  - 2> set the *ul-DCCH-MessageNR* to include the NR MR-DC dedicated information to be transferred (e.g., NR RRC *MeasurementReport*, *UEAssistanceInformation*, *FailureInformation*, *RRCReconfigurationComplete* or *MCGFailureInformation* message);
- 1> else if there is a need to transfer MR-DC dedicated information related to E-UTRA:
  - 2> set the *ul-DCCH-MessageEUTRA* to include the E-UTRA MR-DC dedicated information to be transferred (e.g., E-UTRA RRC *MeasurementReport*, or *MCGFailureInformation* message);
- 1> submit the *ULInformationTransferMRDC* message to lower layers for transmission, upon which the procedure ends.

## 5.7.2b UL transfer of IRAT information

### 5.7.2b.1 General



**Figure 5.7.2b.1-1: UL transfer of IRAT information**

The purpose of this procedure is to transfer from the UE to NR MCG dedicated information terminated at the NR MCG but specified by another RAT e.g. the E-UTRA *MeasurementReport* message, the E-UTRA *SidelinkUEInformation*



message or the E-UTRA *UEAssistanceInformation* message. The specific information transferred in this message is set in accordance with:

- the procedure specified in 5.6.10 of TS 36.331 [10] for E-UTRA *UEAssistanceInformation* message;
- the procedure specified in 5.10.2 of TS 36.331 [10] for E-UTRA *SidelinkUEInformation* message;
- the procedure specified in 5.5.5 of TS 36.331 [10] for E-UTRA *MeasurementReport* Message.

### 5.7.2b.2 Initiation

A UE in RRC\_CONNECTED initiates the UL information transfer procedure whenever there is a need to transfer dedicated inter-RAT information as specified in TS 36.331 [10].

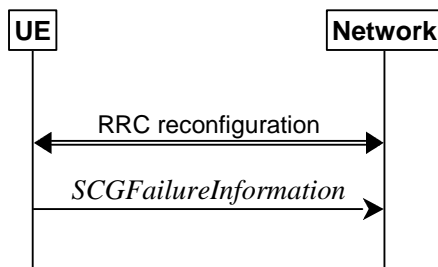
### 5.7.2b.3 Actions related to transmission of *ULInformationTransferIRAT* message

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

- 1> if there is a need to transfer dedicated LTE information related to V2X sidelink communications:
  - 2> set the *ul-DCCH-MessageEUTRA* to include the V2X sidelink communication information to be transferred (e.g. the E-UTRA RRC *MeasurementReport* message, the E-UTRA RRC *SidelinkUEInformation* message, or the E-UTRA RRC *UEAssistanceInformation* message);
- 1> submit the *ULInformationTransferIRAT* message to lower layers for transmission, upon which the procedure ends;

## 5.7.3 SCG failure information

### 5.7.3.1 General



**Figure 5.7.3.1-1: SCG failure information**

The purpose of this procedure is to inform E-UTRAN or NR MN about an SCG failure the UE has experienced i.e. SCG radio link failure, failure of SCG reconfiguration with sync, SCG configuration failure for RRC message on SRB3, SCG integrity check failure, and consistent uplink LBT failures on PSCell for operation with shared spectrum channel access.

### 5.7.3.2 Initiation

A UE initiates the procedure to report SCG failures when neither MCG nor SCG transmission is suspended and when one of the following conditions is met:

- 1> upon detecting radio link failure for the SCG, in accordance with subclause 5.3.10.3;
- 1> upon reconfiguration with sync failure of the SCG, in accordance with subclause 5.3.5.8.3;
- 1> upon SCG configuration failure, in accordance with subclause 5.3.5.8.2;
- 1> upon integrity check failure indication from SCG lower layers concerning SRB3.

Upon initiating the procedure, the UE shall:

- 1> suspend SCG transmission for all SRBs and DRBs;
- 1> reset SCG MAC;
- 1> stop T304 for the SCG, if running;
- 1> stop conditional reconfiguration evaluation for CPC, if configured;
- 1> if the UE is in (NG)EN-DC:
  - 2> initiate transmission of the *SCGFailureInformationNR* message as specified in TS 36.331 [10], clause 5.6.13a.
- 1> else:
  - 2> initiate transmission of the *SCGFailureInformation* message in accordance with 5.7.3.5.

### 5.7.3.3 Failure type determination for (NG)EN-DC

The UE shall set the SCG failure type as follows:

- 1> if the UE initiates transmission of the *SCGFailureInformationNR* message due to T310 expiry:
  - 2> set the *failureType* as *t310-Expiry*;
- 1> else if the UE initiates transmission of the *SCGFailureInformationNR* message due to T312 expiry:
  - 2> set the *failureType* as *other* and set the *failureType-v1610* as *t312-Expiry*;
- 1> else if the UE initiates transmission of the *SCGFailureInformationNR* message to provide reconfiguration with sync failure information for an SCG:
  - 2> set the *failureType* as *synchReconfigFailure-SCG*;
- 1> else if the UE initiates transmission of the *SCGFailureInformationNR* message to provide random access problem indication from SCG MAC:
  - 2> if the random access procedure was initiated for beam failure recovery:
    - 3> set the *failureType* as *other* and set the *failureType-v1610* as *beamFailureRecoveryFailure*;
  - 2> else:
    - 3> set the *failureType* as *randomAccessProblem*;
- 1> else if the UE initiates transmission of the *SCGFailureInformationNR* message to provide indication from SCG RLC that the maximum number of retransmissions has been reached:
  - 2> set the *failureType* as *rlc-MaxNumRetx*;
- 1> else if the UE initiates transmission of the *SCGFailureInformationNR* message due to SRB3 integrity check failure:
  - 2> set the *failureType* as *srb3-IntegrityFailure*;
- 1> else if the UE initiates transmission of the *SCGFailureInformationNR* message due to Reconfiguration failure of NR RRC reconfiguration message:
  - 2> set the *failureType* as *scg-reconfigFailure*.
- 1> else if the UE initiates transmission of the *SCGFailureInformationNR* message due to consistent uplink LBT failures:
  - 2> set the *failureType* as *other* and set the *failureType-v1610* as *scg-lbtFailure*;
- 1> else if connected as an IAB-node and the *SCGFailureInformationNR* is initiated due to the reception of a BH RLF indication on BAP entity from the SCG:

2> set the *failureType* as *other* and set *failureType-v1610* as *bh-RLF*.

### 5.7.3.4 Setting the contents of *MeasResultSCG-Failure*

The UE shall set the contents of the *MeasResultSCG-Failure* as follows:

- 1> for each *MeasObjectNR* configured on NR SCG for which a *measId* is configured and measurement results are available:
  - 2> include an entry in *measResultPerMOList*;
  - 2> if there is a *measId* configured with the *MeasObjectNR* and a *reportConfig* which has *rsType* set to *ssb*:
    - 3> set *ssbFrequency* to the value indicated by *ssbFrequency* as included in the *MeasObjectNR*;
  - 2> if there is a *measId* configured with the *MeasObjectNR* and a *reportConfig* which has *rsType* set to *csi-rs*:
    - 3> set *refFreqCSI-RS* to the value indicated by *refFreqCSI-RS* as included in the associated measurement object;
  - 2> if a serving cell is associated with the *MeasObjectNR*:
    - 3> set *measResultServingCell* to include the available quantities of the concerned cell and in accordance with the performance requirements in TS 38.133 [14];
  - 2> set the *measResultNeighCellList* to include the best measured cells, ordered such that the best cell is listed first, and based on measurements collected up to the moment the UE detected the failure, and set its fields as follows:
    - 3> ordering the cells with sorting as follows:
      - 4> based on SS/PBCH block if SS/PBCH block measurement results are available and otherwise based on CSI-RS;
      - 4> using RSRP if RSRP measurement results are available, otherwise using RSRQ if RSRQ measurement results are available, otherwise using SINR;
    - 3> for each neighbour cell included:
      - 4> include the optional fields that are available.

NOTE: The measured quantities are filtered by the L3 filter as configured in the mobility measurement configuration. The measurements are based on the time domain measurement resource restriction, if configured. Blacklisted cells are not required to be reported.

2> if available, set the *locationInfo* as in 5.3.3.7.:

### 5.7.3.5 Actions related to transmission of *SCGFailureInformation* message

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

- 1> if the UE initiates transmission of the *SCGFailureInformation* message due to T310 expiry:
  - 2> set the *failureType* as *t310-Expiry*;
- 1> else if the UE initiates transmission of the *SCGFailureInformation* message due to T312 expiry:
  - 2> set the *failureType* as *other* and set the *failureType-v1610* as *t312-Expiry*;
- 1> else if the UE initiates transmission of the *SCGFailureInformation* message to provide reconfiguration with sync failure information for an SCG:
  - 2> set the *failureType* as *synchReconfigFailure-SCG*;
- 1> else if the UE initiates transmission of the *SCGFailureInformation* message to provide random access problem indication from SCG MAC:

- 2> if the random access procedure was initiated for beam failure recovery:
  - 3> set the *failureType* as *other* and set the *failureType-v1610* as *beamFailureRecoveryFailure*;
- 2> else:
  - 3> set the *failureType* as *randomAccessProblem*;
- 1> else if the UE initiates transmission of the *SCGFailureInformation* message to provide indication from SCG RLC that the maximum number of retransmissions has been reached:
  - 2> set the *failureType* as *rlc-MaxNumRetx*;
- 1> else if the UE initiates transmission of the *SCGFailureInformation* message due to SRB3 IP check failure:
  - 2> set the *failureType* as *srb3-IntegrityFailure*;
- 1> else if the UE initiates transmission of the *SCGFailureInformation* message due to Reconfiguration failure of NR RRC reconfiguration message:
  - 2> set the *failureType* as *scg-reconfigFailure*.
- 1> else if the UE initiates transmission of the *SCGFailureInformation* message due to consistent uplink LBT failures:
  - 2> set the *failureType* as *other* and set the *failureType-v1610* as *scg-lbtFailure*;
- 1> else if connected as an IAB-node and the *SCGFailureInformation* is initiated due to the reception of a BH RLF indication on BAP entity from the SCG:
  - 2> set the *failureType* as *other* and set *failureType-v1610* as *bh-RLF*;
- 1> include and set *MeasResultSCG-Failure* in accordance with 5.7.3.4;
- 1> for each *MeasObjectNR* configured by a *MeasConfig* associated with the MCG, and for which measurement results are available:
  - 2> include an entry in *measResultFreqList*;
  - 2> if there is a *measId* configured with the *MeasObjectNR* and a *reportConfig* which has *rsType* set to *ssb*:
    - 3> set *ssbFrequency* in *measResultFreqList* to the value indicated by *ssbFrequency* as included in the *MeasObjectNR*;
  - 2> if there is a *measId* configured with the *MeasObjectNR* and a *reportConfig* which has *rsType* set to *csi-rs*:
    - 3> set *refFreqCSI-RS* in *measResultFreqList* to the value indicated by *refFreqCSI-RS* as included in the associated measurement object;
  - 2> if a serving cell is associated with the *MeasObjectNR*:
    - 3> set *measResultServingCell* in *measResultFreqList* to include the available quantities of the concerned cell and in accordance with the performance requirements in TS 38.133 [14];
  - 2> set the *measResultNeighCellList* in *measResultFreqList* to include the best measured cells, ordered such that the best cell is listed first, and based on measurements collected up to the moment the UE detected the failure, and set its fields as follows;
    - 3> ordering the cells with sorting as follows:
      - 4> based on SS/PBCH block if SS/PBCH block measurement results are available and otherwise based on CSI-RS;
      - 4> using RSRP if RSRP measurement results are available, otherwise using RSRQ if RSRQ measurement results are available, otherwise using SINR;
    - 3> for each neighbour cell included:

4> include the optional fields 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.

NOTE 2: Field *measResultSCG-Failure* is used to report available results for NR frequencies the UE is configured to measure by SCG RRC signalling.

1> if available, set the *locationInfo* as in 5.3.3.7.:

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

## 5.7.3a EUTRA SCG failure information

### 5.7.3a.1 General

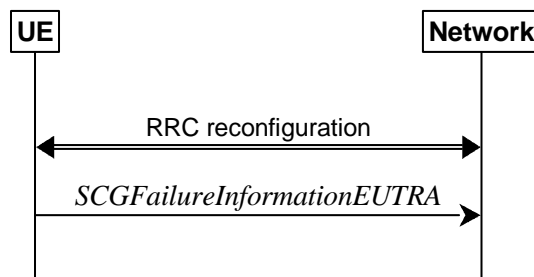


Figure 5.7.3a.1-1: EUTRA SCG failure information

The purpose of this procedure is to inform NR MN about an SCG failure on E-UTRA SN the UE has experienced (e.g. SCG radio link failure, SCG change failure), as specified in TS 36.331 [10] clause 5.6.13.2.

### 5.7.3a.2 Initiation

A UE initiates the procedure to report EUTRA SCG failures when neither NR MCG nor EUTRA SCG transmission is suspended and in accordance with TS 36.331 [10] clause 5.6.13.2. Actions the UE shall perform upon initiating the procedure, other than related to the transmission of the *SCGFailureInformationEUTRA* message are specified in TS 36.331 [10] clause 5.6.13.2.

### 5.7.3a.3 Actions related to transmission of *SCGFailureInformationEUTRA* message

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

- 1> include *failureType* within *failureReportSCG-EUTRA* and set it to indicate the SCG failure in accordance with TS 36.331 [10] clause 5.6.13.4;
- 1> include and set *measResultSCG-FailureMRDC* in accordance with TS 36.331 [10] clause 5.6.13.5;
- 1> for each EUTRA frequency the UE is configured to measure by *measConfig* for which measurement results are available:
  - 2> set the *measResultFreqListMRDC* to include the best measured cells, ordered such that the best cell is listed first using RSRP to order if RSRP measurement results are available for cells on this frequency, otherwise using RSRQ to order if RSRQ measurement results are available for cells on this frequency, otherwise using SINR to order, and based on measurements collected up to the moment the UE detected the failure, and for each cell that is included, include the optional fields that are available;

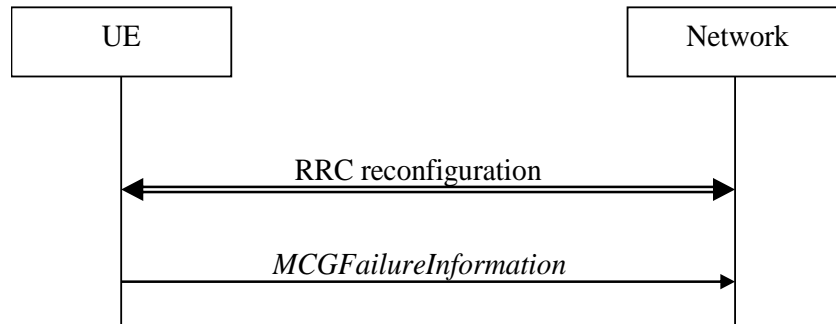
NOTE: Field *measResultSCG-FailureMRDC* is used to report available results for E-UTRAN frequencies the UE is configured to measure by E-UTRA RRC signalling.

1> if available, set the *locationInfo* as in 5.3.3.7.:

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

## 5.7.3b MCG failure information

### 5.7.3b.1 General



**Figure 5.7.3b.1-1: MCG failure information**

The purpose of this procedure is to inform the network about an MCG failure the UE has experienced i.e. MCG radio link failure. A UE in RRC\_CONNECTED, for which AS security has been activated with SRB2 and at least one DRB setup or, for IAB, SRB2, may initiate the fast MCG link recovery procedure in order to continue the RRC connection without re-establishment.

### 5.7.3b.2 Initiation

A UE configured with split SRB1 or SRB3 initiates the procedure to report MCG failures when neither MCG nor SCG transmission is suspended, *t316* is configured, and when the following condition is met:

- 1> upon detecting radio link failure of the MCG, in accordance with 5.3.10.3, while T316 is not running.

Upon initiating the procedure, the UE shall:

- 1> stop timer T310 for the PCell, if running;
- 1> stop timer T312 for the PCell, if running;
- 1> suspend MCG transmission for all SRBs and DRBs, except SRB0;
- 1> reset MCG MAC;
- 1> stop conditional reconfiguration evaluation for CHO, if configured;
- 1> stop conditional reconfiguration evaluation for CPC, if configured;
- 1> initiate transmission of the *MCGFailureInformation* message in accordance with 5.7.3b.4.

**NOTE:** The handling of any outstanding UL RRC messages during the initiation of the fast MCG link recovery is left to UE implementation.

### 5.7.3b.3 Failure type determination

The UE shall set the MCG failure type as follows:

- 1> if the UE initiates transmission of the *MCGFailureInformation* message due to T310 expiry:
  - 2> set the *failureType* as *t310-Expiry*;
- 1> else if the UE initiates transmission of the *MCGFailureInformation* message due to T312 expiry:
  - 2> set the *failureType* as *t312-Expiry*;
- 1> else if the UE initiates transmission of the *MCGFailureInformation* message to provide random access problem indication from MCG MAC:

- 2> if the random access procedure was initiated for beam failure recovery:
  - 3> set the *failureType* as *beamFailureRecoveryFailure*;
- 2> else:
  - 3> set the *failureType* as *randomAccessProblem*;
- 1> else if the UE initiates transmission of the *MCGFailureInformation* message to provide indication from MCG RLC that the maximum number of retransmissions has been reached:
  - 2> set the *failureType* as *rlc-MaxNumRetx*;
- 1> else if the UE initiates transmission of the *MCGFailureInformation* message due to consistent uplink LBT failures on the MCG:
  - 2> set the *failureType* as *lbt-Failure*;
- 1> else if connected as an IAB-node and the *MCGFailureInformation* message is initiated due to the reception of a BH RLF indication on BAP entity from the MCG:
  - 2> set the *failureType* as *bh-RLF*.

#### 5.7.3b.4 Actions related to transmission of *MCGFailureInformation* message

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

- 1> include and set *failureType* in accordance with 5.7.3b.3;
- 1> for each *MeasObjectNR* configured by a *measConfig* associated with the MCG, and for which measurement results are available:
  - 2> include an entry in *measResultFreqList*;
  - 2> if there is a *measId* configured with the *MeasObjectNR* and a *reportConfig* which has *rsType* set to *ssb*:
    - 3> set *ssbFrequency* in *measResultFreqList* to the value indicated by *ssbFrequency* as included in the *MeasObjectNR*;
  - 2> if there is a *measId* configured with the *MeasObjectNR* and a *reportConfig* which has *rsType* set to *csi-rs*:
    - 3> set *refFreqCSI-RS* in *measResultFreqList* to the value indicated by *refFreqCSI-RS* as included in the associated measurement object;
  - 2> if a serving cell is associated with the *MeasObjectNR*:
    - 3> set *measResultServingCell* in *measResultFreqList* to include the available quantities of the concerned cell and in accordance with the performance requirements in TS 38.133 [14];
  - 2> set the *measResultNeighCellList* in *measResultFreqList* to include the best measured cells, ordered such that the best cell is listed first, and based on measurements collected up to the moment the UE detected the failure, and set its fields as follows:
    - 3> ordering the cells with sorting as follows:
      - 4> based on SS/PBCH block if SS/PBCH block measurement results are available and otherwise based on CSI-RS;
      - 4> using RSRP if RSRP measurement results are available, otherwise using RSRQ if RSRQ measurement results are available, otherwise using SINR;
    - 3> for each neighbour cell included:
      - 4> include the optional fields that are available.
- 1> for each EUTRA frequency the UE is configured to measure by *measConfig* for which measurement results are available:

- 2> set the *measResultFreqListEUTRA* to include the best measured cells, ordered such that the best cell is listed first using RSRP to order the cells if RSRP measurement results are available for cells on this frequency, otherwise using RSRQ to order the cells if RSRQ measurement results are available for cells on this frequency, otherwise using SINR to order the cells, based on measurements collected up to the moment the UE detected the failure, and for each cell that is included, include the optional fields that are available;
  - 1> for each UTRA-FDD frequency the UE is configured to measure by *measConfig* for which measurement results are available:
    - 2> set the *measResultFreqListUTRA-FDD* to include the best measured cells, ordered such that the best cell is listed first using RSCP to order the cells if RSCP measurement results are available for cells on this frequency, otherwise using EcN0 to order the cells, based on measurements collected up to the moment the UE detected the failure, and for each cell that is included, include the optional fields that are available;
  - 1> if the UE is in NR-DC:
    - 2> include and set *measResultSCG* in accordance with 5.7.3.4;
  - 1> if the UE is in NE-DC:
    - 2> include and set *measResultSCG-EUTRA* in accordance with TS 36.331 [10] clause 5.6.13.5;
- 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.
- NOTE 2: Field *measResultSCG-Failure* is used to report available results for NR frequencies the UE is configured to measure by SCG RRC signalling.
- NOTE 3: Field *measResultSCG-EUTRA* is used to report available results for E-UTRAN frequencies the UE is configured to measure by E-UTRA RRC signalling.
- 1> if SRB1 is configured as split SRB and *pdcp-Duplication* is not configured:
    - 2> if the *primaryPath* for the PDCP entity of SRB1 refers to the MCG:
      - 3> set the *primaryPath* to refer to the SCG.

The UE shall:

- 1> start timer T316;
- 1> if SRB1 is configured as split SRB:
  - 2> submit the *MCGFailureInformation* message to lower layers for transmission via SRB1, upon which the procedure ends;
- 1> else (i.e. SRB3 configured):
  - 2> submit the *MCGFailureInformation* message to lower layers for transmission embedded in NR RRC message *ULInformationTransferMRDC* via SRB3 as specified in 5.7.2a.3.

### 5.7.3b.5 T316 expiry

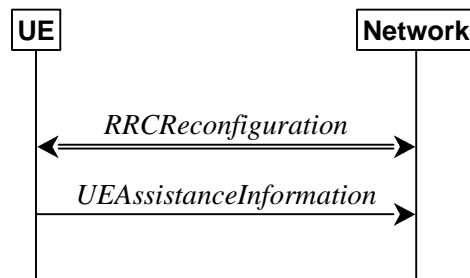
The UE shall:

- 1> if T316 expires:
  - 2> initiate the connection re-establishment procedure as specified in 5.3.7.



## 5.7.4 UE Assistance Information

### 5.7.4.1 General



**Figure 5.7.4.1-1: UE Assistance Information**

The purpose of this procedure is for the UE to inform the network of:

- its delay budget report carrying desired increment/decrement in the connected mode DRX cycle length, or;
- its overheating assistance information, or;
- its IDC assistance information, or;
- its preference on DRX parameters for power saving, or;
- its preference on the maximum aggregated bandwidth for power saving, or;
- its preference on the maximum number of secondary component carriers for power saving, or;
- its preference on the maximum number of MIMO layers for power saving, or;
- its preference on the minimum scheduling offset for cross-slot scheduling for power saving, or;
- assistance information to transition out of RRC\_CONNECTED state when the UE does not expect to send or receive data in the near future, or;
- configured grant assistance information for NR sidelink communication, or;
- its preference in being provisioned with reference time information.

### 5.7.4.2 Initiation

A UE capable of providing delay budget report in RRC\_CONNECTED may initiate the procedure in several cases, including upon being configured to provide delay budget report and upon change of delay budget preference.

A UE capable of providing overheating assistance information in RRC\_CONNECTED may initiate the procedure if it was configured to do so, upon detecting internal overheating, or upon detecting that it is no longer experiencing an overheating condition.

A UE capable of providing IDC assistance information in RRC\_CONNECTED may initiate the procedure if it was configured to do so, upon detecting IDC problem if the UE did not transmit an IDC assistance information since it was configured to provide IDC indications, or upon change of IDC problem information.

A UE capable of providing its preference on DRX parameters of a cell group for power saving in RRC\_CONNECTED may initiate the procedure in several cases, if it was configured to do so, including upon having a preference on DRX parameters and upon change of its preference on DRX parameters.

A UE capable of providing its preference on the maximum aggregated bandwidth of a cell group for power saving in RRC\_CONNECTED may initiate the procedure in several cases, if it was configured to do so, including upon having a maximum aggregated bandwidth preference and upon change of its maximum aggregated bandwidth preference.

A UE capable of providing its preference on the maximum number of secondary component carriers of a cell group for power saving in RRC\_CONNECTED may initiate the procedure in several cases, if it was configured to do so, including upon having a maximum number of secondary component carriers preference and upon change of its maximum number of secondary component carriers preference.

A UE capable of providing its preference on the maximum number of MIMO layers of a cell group for power saving in RRC\_CONNECTED may initiate the procedure in several cases, if it was configured to do so, including upon having a maximum number of MIMO layers preference and upon change of its maximum number of MIMO layers preference.

A UE capable of providing its preference on the minimum scheduling offset for cross-slot scheduling of a cell group for power saving in RRC\_CONNECTED may initiate the procedure in several cases, if it was configured to do so, including upon having a minimum scheduling offset preference and upon change of its minimum scheduling offset preference.

A UE capable of providing assistance information to transition out of RRC\_CONNECTED state may initiate the procedure if it was configured to do so, upon determining that it prefers to transition out of RRC\_CONNECTED state, or upon change of its preferred RRC state.

A UE capable of providing configured grant assistance information for NR sidelink communication in RRC\_CONNECTED may initiate the procedure in several cases, including upon being configured to provide traffic pattern information and upon change of traffic patterns.

A UE capable of providing an indication of its preference in being provisioned with reference time information may initiate the procedure upon being configured to provide this indication, or if it was configured to provide this indication and upon change of its preference.

Upon initiating the procedure, the UE shall:

1> if configured to provide delay budget report:

2> if the UE did not transmit a *UEAssistanceInformation* message with *delayBudgetReport* since it was configured to provide delay budget report; or

2> if the current delay budget is different from the one indicated in the last transmission of the *UEAssistanceInformation* message including *delayBudgetReport* and timer T342 is not running:

3> start or restart timer T342 with the timer value set to the *delayBudgetReportingProhibitTimer*;

3> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.7.4.3 to provide a delay budget report;

1> if configured to provide overheating assistance information:

2> if the overheating condition has been detected and T345 is not running; or

2> if the current overheating assistance information is different from the one indicated in the last transmission of the *UEAssistanceInformation* message including *overheatingAssistance* and timer T345 is not running:

3> start timer T345 with the timer value set to the *overheatingIndicationProhibitTimer*;

3> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.7.4.3 to provide overheating assistance information;

1> if configured to provide IDC assistance information:

2> if the UE did not transmit a *UEAssistanceInformation* message with *idc-Assistance* since it was configured to provide IDC assistance information:

3> if on one or more frequencies included in *candidateServingFreqListNR*, the UE is experiencing IDC problems that it cannot solve by itself; or

3> if on one or more supported UL CA combination comprising of carrier frequencies included in *candidateServingFreqListNR*, the UE is experiencing IDC problems that it cannot solve by itself:

4> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.7.4.3 to provide IDC assistance information;

- 2> else if the current IDC assistance information is different from the one indicated in the last transmission of the *UEAssistanceInformation* message:
- 3> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.7.4.3 to provide IDC assistance information;

NOTE 1: The term "IDC problems" refers to interference issues applicable across several subframes/slots where not necessarily all the subframes/slots are affected.

NOTE 2: For the frequencies on which a serving cell or serving cells is configured that is activated, IDC problems consist of interference issues that the UE cannot solve by itself, during either active data exchange or upcoming data activity which is expected in up to a few hundred milliseconds.  
For frequencies on which a SCell or SCells is configured that is deactivated, reporting IDC problems indicates an anticipation that the activation of the SCell or SCells would result in interference issues that the UE would not be able to solve by itself.  
For a non-serving frequency, reporting IDC problems indicates an anticipation that if the non-serving frequency or frequencies became a serving frequency or serving frequencies then this would result in interference issues that the UE would not be able to solve by itself.

- 1> if configured to provide its preference on DRX parameters of a cell group for power saving:
  - 2> if the UE has a preference on DRX parameters of the cell group and the UE did not transmit a *UEAssistanceInformation* message with *drx-Preference* for the cell group since it was configured to provide its preference on DRX parameters of the cell group for power saving; or
  - 2> if the current *drx-Preference* information for the cell group is different from the one indicated in the last transmission of the *UEAssistanceInformation* message including *drx-Preference* for the cell group and timer T346a associated with the cell group is not running:
    - 3> start the timer T346a with the timer value set to the *drx-PreferenceProhibitTimer* of the cell group;
    - 3> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.7.4.3 to provide the current *drx-Preference*;
- 1> if configured to provide its preference on the maximum aggregated bandwidth of a cell group for power saving:
  - 2> if the UE has a preference on the maximum aggregated bandwidth of the cell group and the UE did not transmit a *UEAssistanceInformation* message with *maxBW-Preference* for the cell group since it was configured to provide its preference on the maximum aggregated bandwidth of the cell group for power saving; or
  - 2> if the current *maxBW-Preference* information for the cell group is different from the one indicated in the last transmission of the *UEAssistanceInformation* message including *maxBW-Preference* for the cell group and timer T346b associated with the cell group is not running:
    - 3> start the timer T346b with the timer value set to the *maxBW-PreferenceProhibitTimer* of the cell group;
    - 3> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.7.4.3 to provide the current *maxBW-Preference*;
- 1> if configured to provide its preference on the maximum number of secondary component carriers of a cell group for power saving:
  - 2> if the UE has a preference on the maximum number of secondary component carriers of the cell group and the UE did not transmit a *UEAssistanceInformation* message with *maxCC-Preference* for the cell group since it was configured to provide its preference on the maximum number of secondary component carriers of the cell group for power saving; or
  - 2> if the current *maxCC-Preference* information for the cell group is different from the one indicated in the last transmission of the *UEAssistanceInformation* message including *maxCC-Preference* for the cell group and timer T346c associated with the cell group is not running:
    - 3> start the timer T346c with the timer value set to the *maxCC-PreferenceProhibitTimer* of the cell group;
    - 3> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.7.4.3 to provide the current *maxCC-Preference*;

- 1> if configured to provide its preference on the maximum number of MIMO layers of a cell group for power saving:
  - 2> if the UE has a preference on the maximum number of MIMO layers of the cell group and the UE did not transmit a *UEAssistanceInformation* message with *maxMIMO-LayerPreference* for the cell group since it was configured to provide its preference on the maximum number of MIMO layers of the cell group for power saving; or
  - 2> if the current *maxMIMO-LayerPreference* information for the cell group is different from the one indicated in the last transmission of the *UEAssistanceInformation* message including *maxMIMO-LayerPreference* for the cell group and timer T346d associated with the cell group is not running:
    - 3> start the timer T346d with the timer value set to the *maxMIMO-LayerPreferenceProhibitTimer* of the cell group;
    - 3> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.7.4.3 to provide the current *maxMIMO-LayerPreference*;
- 1> if configured to provide its preference on the minimum scheduling offset for cross-slot scheduling of a cell group for power saving:
  - 2> if the UE has a preference on the minimum scheduling offset for cross-slot scheduling of the cell group and the UE did not transmit a *UEAssistanceInformation* message with *minSchedulingOffsetPreference* for the cell group since it was configured to provide its preference on the minimum scheduling offset for cross-slot scheduling of the cell group for power saving; or
  - 2> if the current *minSchedulingOffsetPreference* information for the cell group is different from the one indicated in the last transmission of the *UEAssistanceInformation* message including *minSchedulingOffsetPreference* for the cell group and timer T346e associated with the cell group is not running:
    - 3> start the timer T346e with the timer value set to the *minSchedulingOffsetPreferenceProhibitTimer* of the cell group;
    - 3> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.7.4.3 to provide the current *minSchedulingOffsetPreference*;
- 1> if configured to provide its release preference and timer T346f is not running:
  - 2> if the UE determines that it would prefer to transition out of RRC\_CONNECTED state; or
  - 2> if the UE is configured with *connectedReporting* and the UE determines that it would prefer to revert an earlier indication to transition out of RRC\_CONNECTED state:
    - 3> start timer T346f with the timer value set to the *releasePreferenceProhibitTimer*;
    - 3> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.7.4.3 to provide the release preference;
- 1> if configured to provide configured grant assistance information for NR sidelink communication:
  - 2> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.7.4.3 to provide configured grant assistance information for NR sidelink communication;
- 1> if configured with *referenceTimePreferenceReporting* to provide preference in being provisioned with reference time information:
  - 2> if the UE did not transmit a *UEAssistanceInformation* message with *referenceTimeInfoPreference* since it was configured to provide preference; or
  - 2> if the UE's preference changed from the last time UE initiated transmission of the *UEAssistanceInformation* message including *referenceTimeInfoInterestPreference*:
    - 3> initiate transmission of the *UEAssistanceInformation* message in accordance with 5.7.4.3 to provide preference in being provisioned with reference time information.

### 5.7.4.3 Actions related to transmission of *UEAssistanceInformation* message

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

- 1> if transmission of the *UEAssistanceInformation* message is initiated to provide a delay budget report according to 5.7.4.2 or 5.3.5.3;
  - 2> set *delayBudgetReport* to *type1* according to a desired value;
- 1> if transmission of the *UEAssistanceInformation* message is initiated to provide overheating assistance information according to 5.7.4.2 or 5.3.5.3;
  - 2> if the UE experiences internal overheating:
    - 3> if the UE prefers to temporarily reduce the number of maximum secondary component carriers:
      - 4> include *reducedMaxCCs* in the *OverheatingAssistance* IE;
      - 4> set *reducedCCsDL* to the number of maximum SCells the UE prefers to be temporarily configured in downlink;
      - 4> set *reducedCCsUL* to the number of maximum SCells the UE prefers to be temporarily configured in uplink;
    - 3> if the UE prefers to temporarily reduce maximum aggregated bandwidth of FR1:
      - 4> include *reducedMaxBW-FR1* in the *OverheatingAssistance* IE;
      - 4> set *reducedBW-DL* to the maximum aggregated bandwidth the UE prefers to be temporarily configured across all downlink carriers of FR1;
      - 4> set *reducedBW-UL* to the maximum aggregated bandwidth the UE prefers to be temporarily configured across all uplink carriers of FR1;
    - 3> if the UE prefers to temporarily reduce maximum aggregated bandwidth of FR2:
      - 4> include *reducedMaxBW-FR2* in the *OverheatingAssistance* IE;
      - 4> set *reducedBW-DL* to the maximum aggregated bandwidth the UE prefers to be temporarily configured across all downlink carriers of FR2;
      - 4> set *reducedBW-UL* to the maximum aggregated bandwidth the UE prefers to be temporarily configured across all uplink carriers of FR2;
    - 3> if the UE prefers to temporarily reduce the number of maximum MIMO layers of each serving cell operating on FR1:
      - 4> include *reducedMaxMIMO-LayersFR1* in the *OverheatingAssistance* IE;
      - 4> set *reducedMIMO-LayersFR1-DL* to the number of maximum MIMO layers of each serving cell operating on FR1 the UE prefers to be temporarily configured in downlink;
      - 4> set *reducedMIMO-LayersFR1-UL* to the number of maximum MIMO layers of each serving cell operating on FR1 the UE prefers to be temporarily configured in uplink;
    - 3> if the UE prefers to temporarily reduce the number of maximum MIMO layers of each serving cell operating on FR2:
      - 4> include *reducedMaxMIMO-LayersFR2* in the *OverheatingAssistance* IE;
      - 4> set *reducedMIMO-LayersFR2-DL* to the number of maximum MIMO layers of each serving cell operating on FR2 the UE prefers to be temporarily configured in downlink;
      - 4> set *reducedMIMO-LayersFR2-UL* to the number of maximum MIMO layers of each serving cell operating on FR2 the UE prefers to be temporarily configured in uplink;
  - 2> else (if the UE no longer experiences an overheating condition):

- 3> do not include *reducedMaxCCs*, *reducedMaxBW-FR1*, *reducedMaxBW-FR2*, *reducedMaxMIMO-LayersFR1* and *reducedMaxMIMO-LayersFR2* in *OverheatingAssistance IE*;
- 1> if transmission of the *UEAssistanceInformation* message is initiated to provide IDC assistance information according to 5.7.4.2 or 5.3.5.3:
  - 2> if there is at least one carrier frequency included in *candidateServingFreqListNR*, the UE is experiencing IDC problems that it cannot solve by itself:
    - 3> include the field *affectedCarrierFreqList* with an entry for each affected carrier frequency included in *candidateServingFreqListNR*;
    - 3> for each carrier frequency included in the field *affectedCarrierFreqList*, include *interferenceDirection* and set it accordingly;
  - 2> if there is at least one supported UL CA combination comprising of carrier frequencies included in *candidateServingFreqListNR*, the UE is experiencing IDC problems that it cannot solve by itself:
    - 3> include *victimSystemType* for each UL CA combination included in *affectedCarrierFreqCombList*;
    - 3> if the UE sets *victimSystemType* to *wlan* or *bluetooth*:
      - 4> include *affectedCarrierFreqCombList* with an entry for each supported UL CA combination comprising of carrier frequencies included in *candidateServingFreqListNR*, that is affected by IDC problems;
    - 3> else:
      - 4> optionally include *affectedCarrierFreqCombList* with an entry for each supported UL CA combination comprising of carrier frequencies included in *candidateServingFreqListNR*, that is affected by IDC problems;

NOTE 1: When sending an *UEAssistanceInformation* message to inform the IDC problems, the UE includes all IDC assistance information (rather than providing e.g. the changed part(s) of the IDC assistance information).

NOTE 2: Upon not anymore experiencing a particular IDC problem that the UE previously reported, the UE provides an IDC indication with the modified contents of the *UEAssistanceInformation* message (e.g. by not including the IDC assistance information in the *idc-Assistance* field).

- 1> if transmission of the *UEAssistanceInformation* message is initiated to provide *drx-Preference* of a cell group for power saving according to 5.7.4.2 or 5.3.5.3:
  - 2> include *drx-Preference* in the *UEAssistanceInformation* message;
  - 2> if the UE has a preference on DRX parameters for the cell group:
    - 3> if the UE has a preference for the long DRX cycle:
      - 4> include *preferredDRX-LongCycle* in the *DRX-Preference IE* and set it to the preferred value;
    - 3> if the UE has a preference for the DRX inactivity timer:
      - 4> include *preferredDRX-InactivityTimer* in the *DRX-Preference IE* and set it to the preferred value;
    - 3> if the UE has a preference for the short DRX cycle:
      - 4> include *preferredDRX-ShortCycle* in the *DRX-Preference IE* and set it to the preferred value;
    - 3> if the UE has a preference for the short DRX timer:
      - 4> include *preferredDRX-ShortCycleTimer* in the *DRX-Preference IE* and set it to the preferred value;
  - 2> else (if the UE has no preference on DRX parameters for the cell group):
    - 3> do not include *preferredDRX-LongCycle*, *preferredDRX-InactivityTimer*, *preferredDRX-ShortCycle* and *preferredDRX-ShortCycleTimer* in the *DRX-Preference IE*;

- 1> if transmission of the *UEAssistanceInformation* message is initiated to provide *maxBW-Preference* of a cell group for power saving according to 5.7.4.2 or 5.3.5.3:
  - 2> include *maxBW-Preference* in the *UEAssistanceInformation* message;
  - 2> if the UE has a preference on the maximum aggregated bandwidth for the cell group:
    - 3> if the UE prefers to reduce the maximum aggregated bandwidth of FR1:
      - 4> include *reducedMaxBW-FR1* in the *MaxBW-Preference* IE;
      - 4> set *reducedBW-DL* to the maximum aggregated bandwidth the UE desires to have configured across all downlink carriers of FR1 in the cell group;
      - 4> set *reducedBW-UL* to the maximum aggregated bandwidth the UE desires to have configured across all uplink carriers of FR1 in the cell group;
    - 3> if the UE prefers to reduce the maximum aggregated bandwidth of FR2:
      - 4> include *reducedMaxBW-FR2* in the *MaxBW-Preference* IE;
      - 4> set *reducedBW-DL* to the maximum aggregated bandwidth the UE desires to have configured across all downlink carriers of FR2 in the cell group;
      - 4> set *reducedBW-UL* to the maximum aggregated bandwidth the UE desires to have configured across all uplink carriers of FR2 in the cell group;
  - 2> else (if the UE has no preference on the maximum aggregated bandwidth for the cell group):
    - 3> do not include *reducedMaxBW-FR1* and *reducedMaxBW-FR2* in the *MaxBW-Preference* IE;

- 1> if transmission of the *UEAssistanceInformation* message is initiated to provide *maxCC-Preference* of a cell group for power saving according to 5.7.4.2 or 5.3.5.3:
  - 2> include *maxCC-Preference* in the *UEAssistanceInformation* message;
  - 2> if the UE has a preference on the maximum number of secondary component carriers for the cell group:
    - 3> include *reducedMaxCCs* in the *MaxCC-Preference* IE;
    - 3> set *reducedCCsDL* to the number of maximum SCells the UE desires to have configured in downlink in the cell group;
    - 3> set *reducedCCsUL* to the number of maximum SCells the UE desires to have configured in uplink in the cell group;
  - 2> else (if the UE has no preference on the maximum number of secondary component carriers for the cell group):
    - 3> do not include *reducedMaxCCs* in the *MaxCC-Preference* IE;

NOTE 3: The UE can implicitly indicate a preference for NR SCG release by reporting the maximum aggregated bandwidth preference for power saving of the cell group, if configured, as zero for both FR1 and FR2, and by reporting the maximum number of secondary component carriers for power saving of the cell group, if configured, as zero for both uplink and downlink.

- 1> if transmission of the *UEAssistanceInformation* message is initiated to provide *maxMIMO-LayerPreference* of a cell group for power saving according to 5.7.4.2 or 5.3.5.3:
  - 2> include *maxMIMO-LayerPreference* in the *UEAssistanceInformation* message;
  - 2> if the UE has a preference on the maximum number of MIMO layers for the cell group:
    - 3> if the UE prefers to reduce the number of maximum MIMO layers of each serving cell operating on FR1:
      - 4> include *reducedMaxMIMO-LayersFR1* in the *MaxMIMO-LayerPreference* IE;

- 4> set *reducedMIMO-LayersFR1-DL* to the preferred maximum number of downlink MIMO layers of each BWP of each FR1 serving cell that the UE operates on in the cell group;
- 4> set *reducedMIMO-LayersFR1-UL* to the preferred maximum number of uplink MIMO layers of each FR1 serving cell that the UE operates on in the cell group;
- 3> if the UE prefers to reduce the number of maximum MIMO layers of each serving cell operating on FR2:
  - 4> include *reducedMaxMIMO-LayersFR2* in the *MaxMIMO-LayerPreference* IE;
  - 4> set *reducedMIMO-LayersFR2-DL* to the preferred maximum number of downlink MIMO layers of each BWP of each FR2 serving cell that the UE operates on in the cell group;
  - 4> set *reducedMIMO-LayersFR2-UL* to the preferred maximum number of uplink MIMO layers of each FR2 serving cell that the UE operates on in the cell group;
- 2> else (if the UE has no preference on the maximum number of MIMO layers for the cell group):
  - 3> do not include *reducedMaxMIMO-LayersFR1* and *reducedMaxMIMO-LayersFR2* in the *MaxMIMO-LayerPreference* IE;
- 1> if transmission of the *UEAssistanceInformation* message is initiated to provide *minSchedulingOffsetPreference* of a cell group for power saving according to 5.7.4.2 or 5.3.5.3:
  - 2> include *minSchedulingOffsetPreference* in the *UEAssistanceInformation* message;
  - 2> if the UE has a preference on the minimum scheduling offset for cross-slot scheduling for the cell group:
    - 3> if the UE has a preference for the value of  $K_0$  (TS 38.214 [19], clause 5.1.2.1) for cross-slot scheduling with 15 kHz SCS:
      - 4> include *preferredK0-SCS-15kHz* in the *MinSchedulingOffsetPreference* IE and set it to the desired value of  $K_0$ ;
    - 3> if the UE has a preference for the value of  $K_0$  for cross-slot scheduling with 30 kHz SCS:
      - 4> include *preferredK0-SCS-30kHz* in the *MinSchedulingOffsetPreference* IE and set it to the desired value of  $K_0$ ;
    - 3> if the UE has a preference for the value of  $K_0$  for cross-slot scheduling with 60 kHz SCS:
      - 4> include *preferredK0-SCS-60kHz* in the *MinSchedulingOffsetPreference* IE and set it to the desired value of  $K_0$ ;
    - 3> if the UE has a preference for the value of  $K_0$  for cross-slot scheduling with 120 kHz SCS:
      - 4> include *preferredK0-SCS-120kHz* in the *MinSchedulingOffsetPreference* IE and set it to the desired value of  $K_0$ ;
    - 3> if the UE has a preference for the value of  $K_2$  (TS 38.214 [19], clause 6.1.2.1) for cross-slot scheduling with 15 kHz SCS:
      - 4> include *preferredK2-SCS-15kHz* in the *MinSchedulingOffsetPreference* IE and set it to the desired value of  $K_2$ ;
    - 3> if the UE has a preference for the value of  $K_2$  for cross-slot scheduling with 30 kHz SCS:
      - 4> include *preferredK2-SCS-30kHz* in the *MinSchedulingOffsetPreference* IE and set it to the desired value of  $K_2$ ;
    - 3> if the UE has a preference for the value of  $K_2$  for cross-slot scheduling with 60 kHz SCS:
      - 4> include *preferredK2-SCS-60kHz* in the *MinSchedulingOffsetPreference* IE and set it to the desired value of  $K_2$ ;
    - 3> if the UE has a preference for the value of  $K_2$  for cross-slot scheduling with 120 kHz SCS:



- 4> include *preferredK2-SCS-120kHz* in the *MinSchedulingOffsetPreference* IE and set it to the desired value of  $K_2$ ;
- 2> else (if the UE has no preference on the minimum scheduling offset for cross-slot scheduling for the cell group):
  - 3> do not include *preferredK0* and *preferredK2* in the *MinSchedulingOffsetPreference* IE;
- 1> if transmission of the *UEAssistanceInformation* message is initiated to provide a release preference according to 5.7.4.2 or 5.3.5.3:
  - 2> include *releasePreference* in the *UEAssistanceInformation* message;
  - 2> set *preferredRRC-State* to the desired RRC state on transmission of the *UEAssistanceInformation* message;
- 1> if transmission of the *UEAssistanceInformation* message is initiated to provide an indication of preference in being provisioned with reference time information according to 5.7.4.2 or 5.3.5.3:
  - 2> if the UE has a preference in being provisioned with reference time information:
    - 3> set *referenceTimeInfoPreference* to *true*;
  - 2> else:
    - 3> set *referenceTimeInfoPreference* to *false*.

The UE shall set the contents of the *UEAssistanceInformation* message for configured grant assistance information for NR sidelink communication:

- 1> if configured to provide configured grant assistance information for NR sidelink communication:
  - 2> include the *sl-UE-AssistanceInformationNR*;

NOTE 4: It is up to UE implementation when and how to trigger configured grant assistance information for NR sidelink communication.

The UE shall:

- 1> if the procedure was triggered to provide configured grant assistance information for NR sidelink communication by an NR *RRCReconfiguration* message that was embedded within an E-UTRA *RRCConnectionReconfiguration*:
  - 2> submit the *UEAssistanceInformation* to lower layers via SRB1, embedded in E-UTRA RRC message *ULInformationTransferIRAT* as specified in TS 36.331 [10], clause 5.6.28;
- 1> else if the UE is in (NG)EN-DC:
  - 2> if SRB3 is configured:
    - 3> submit the *UEAssistanceInformation* message via SRB3 to lower layers for transmission;
  - 2> else:
    - 3> submit the *UEAssistanceInformation* message via the E-UTRA MCG embedded in E-UTRA RRC message *ULInformationTransferMRDC* as specified in TS 36.331 [10].
- 1> else if the UE is in NR-DC:
  - 2> if the UE assistance configuration that triggered this UE assistance information is associated with the SCG:
    - 3> if SRB3 is configured:
      - 4> submit the *UEAssistanceInformation* message via SRB3 to lower layers for transmission;
    - 3> else:
      - 4> submit the *UEAssistanceInformation* message via the NR MCG embedded in NR RRC message *ULInformationTransferMRDC* as specified in 5.7.2a.3;

2> else:

3> submit the *UEAssistanceInformation* message via SRB1 to lower layers for transmission;

1> else:

2> submit the *UEAssistanceInformation* message to lower layers for transmission.

### 5.7.4.3a Setting the contents of *OverheatingAssistance* IE

The UE shall set the contents of *OverheatingAssistance* IE if initiated to provide overheating assistance indication for SCG in (NG)EN-DC according to clause 5.6.10.3 as specified in TS 36.331 [10]:

1> if the UE prefers to temporarily reduce the number of maximum secondary component carriers for SCG:

2> include *reducedMaxCCs* in the *OverheatingAssistance* IE;

2> set *reducedCCsDL* to the number of maximum SCells of the SCG the UE prefers to be temporarily configured in downlink;

2> set *reducedCCsUL* to the number of maximum SCells of the SCG the UE prefers to be temporarily configured in uplink;

1> if the UE prefers to temporarily reduce maximum aggregated bandwidth of FR1 for SCG:

2> include *reducedMaxBW-FR1* in the *OverheatingAssistance* IE;

2> set *reducedBW-FR1-DL* to the maximum aggregated bandwidth the UE prefers to be temporarily configured across all downlink carriers of FR1 of the SCG;

2> set *reducedBW-FR1-UL* to the maximum aggregated bandwidth the UE prefers to be temporarily configured across all uplink carriers of FR1 of the SCG;

1> if the UE prefers to temporarily reduce maximum aggregated bandwidth of FR2 for SCG:

2> include *reducedMaxBW-FR2* in the *OverheatingAssistance* IE;

2> set *reducedBW-FR2-DL* to the maximum aggregated bandwidth the UE prefers to be temporarily configured across all downlink carriers of FR2 of the SCG;

2> set *reducedBW-FR2-UL* to the maximum aggregated bandwidth the UE prefers to be temporarily configured across all uplink carriers of FR2 of the SCG;

1> if the UE prefers to temporarily reduce the number of maximum MIMO layers of each serving cell operating on FR1 for SCG:

2> include *reducedMaxMIMO-LayersFR1* in the *OverheatingAssistance* IE;

2> set *reducedMIMO-LayersFR1-DL* to the number of maximum MIMO layers of each serving cell operating on FR1 of the SCG the UE prefers to be temporarily configured in downlink;

2> set *reducedMIMO-LayersFR1-UL* to the number of maximum MIMO layers of each serving cell operating on FR1 of the SCG the UE prefers to be temporarily configured in uplink;

1> if the UE prefers to temporarily reduce the number of maximum MIMO layers of each serving cell operating on FR2 for SCG:

2> include *reducedMaxMIMO-LayersFR2* in the *OverheatingAssistance* IE;

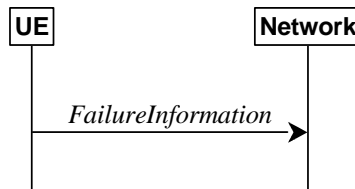
2> set *reducedMIMO-LayersFR2-DL* to the number of maximum MIMO layers of each serving cell operating on FR2 of the SCG the UE prefers to be temporarily configured in downlink;

2> set *reducedMIMO-LayersFR2-UL* to the number of maximum MIMO layers of each serving cell operating on FR2 of the SCG the UE prefers to be temporarily configured in uplink;

## 5.7.4a Void

## 5.7.5 Failure information

### 5.7.5.1 General



**Figure 5.7.5.1-1: Failure information**

The purpose of this procedure is to inform the network about a failure detected by the UE.

### 5.7.5.2 Initiation

A UE initiates the procedure when there is a need to inform the network about a failure detected by the UE. In particular, the UE initiates the procedure when the following condition is met:

- 1> upon detecting failure for an RLC bearer, in accordance with 5.3.10.3;
- 1> upon detecting DAPS handover failure, in accordance with 5.3.5.8.3;

Upon initiating the procedure, the UE shall:

- 1> initiate transmission of the *FailureInformation* message as specified in 5.7.5.3;

### 5.7.5.3 Actions related to transmission of *FailureInformation* message

The UE shall:

- 1> if initiated to provide RLC failure information, set *FailureInfoRLC-Bearer* as follows:
  - 2> set *logicalChannelIdentity* to the logical channel identity of the failing RLC bearer;
  - 2> set *cellGroupId* to the cell group identity of the failing RLC bearer;
  - 2> set the *failureType* as *rlc-failure*;
- 1> if initiated to provide DAPS failure information, set *FailureInfoDAPS* as follows:
  - 2> set the *failureType* as *daps-failure*;
- 1> if used to inform the network about a failure for an MCG RLC bearer or DAPS failure information:
  - 2> submit the *FailureInformation* message to lower layers for transmission via SRB1;
- 1> else if used to inform the network about a failure for an SCG RLC bearer:
  - 2> if SRB3 is configured;
    - 3> submit the *FailureInformation* message to lower layers for transmission via SRB3;
  - 2> else;
  - 3> if the UE is in (NG)EN-DC:
    - 4> submit the *FailureInformation* message via E-UTRA SRB1 embedded in E-UTRA RRC message *ULInformationTransferMRDC* as specified in TS 36.331 [10].

3> else if the UE is in NR-DC:

4> submit the *FailureInformation* message via SRB1 embedded in NR RRC message *ULInformationTransferMRDC* as specified in clause 5.7.2a.3.

## 5.7.6 DL message segment transfer

### 5.7.6.1 General



**Figure 5.7.6.1-1: DL message segment transfer**

The purpose of this procedure is to transfer segments of DL DCCH messages from the network to the UE.

NOTE: The segmentation of DL DCCH message is only applicable to *RRCReconfiguration* and *RRCResume* messages in this release.

### 5.7.6.2 Initiation

The network initiates the DL Dedicated Message Segment transfer procedure whenever the encoded RRC message PDU exceeds the maximum PDCP SDU size. The network initiates the DL Dedicated Message Segment transfer procedure by sending the *DL Dedicated Message Segment* message.

### 5.7.6.3 Reception of *DL Dedicated Message Segment* by the UE

Upon receiving *DL Dedicated Message Segment* message, the UE shall:

- 1> store the segment included in *rrc-MessageSegmentContainer*;
- 1> if all segments of the message have been received:
  - 2> assemble the message from the received segments and process the message according to 5.3.5.3 for the *RRCReconfiguration* message or 5.3.13.4 for the *RRCResume* message;
  - 2> discard all segments.

## 5.7.7 UL message segment transfer

### 5.7.7.1 General



**Figure 5.7.7.1-1: UL message segment transfer**

The purpose of this procedure is to transfer segments of UL DCCH messages from UE to a NG-RAN in RRC\_CONNECTED.

NOTE: The segmentation of UL DCCH message is only applicable to *UECapabilityInformation* in this release.

### 5.7.7.2 Initiation

A UE capable of UL RRC message segmentation in RRC\_CONNECTED will initiate the procedure when the following conditions are met:

- 1> if the RRC message segmentation is enabled based on the field *rrc-SegAllowed* received, and
- 1> if the encoded RRC message is larger than the maximum supported size of a PDCP SDU specified in TS 38.323 [5];

Upon initiating the procedure, the UE shall:

- 1> initiate transmission of the *ULDedicatedMessageSegment* message as specified in 5.7.7.3;

### 5.7.7.3 Actions related to transmission of *ULDedicatedMessageSegment* message

The UE shall segment the encoded RRC PDU based on the maximum supported size of a PDCP SDU specified in TS 38.323 [5]. UE shall minimize the number of segments and set the contents of the *ULDedicatedMessageSegment* messages as follows:

- 1> For each new UL DCCH message, set the *segmentNumber* to 0 for the first message segment and increment the *segmentNumber* for each subsequent RRC message segment;
- 1> set *rrc-MessageSegmentContainer* to include the segment of the UL DCCH message corresponding to the *segmentNumber*;
- 1> if the segment included in the *rrc-MessageSegmentContainer* is the last segment of the UL DCCH message:
  - 2> set the *rrc-MessageSegmentType* to *lastSegment*;
- 1> else:
  - 2> set the *rrc-MessageSegmentType* to *notLastSegment*;
- 1> submit all the *ULDedicatedMessageSegment* messages generated for the segmented RRC message to lower layers for transmission in ascending order based on the *segmentNumber*, upon which the procedure ends.

## 5.7.8 Idle/inactive Measurements

### 5.7.8.1 General

This procedure specifies the measurements to be performed and stored by a UE in RRC\_IDLE and RRC\_INACTIVE when it has an idle/inactive measurement configuration.

#### 5.7.8.1a Measurement configuration

The purpose of this procedure is to update the idle/inactive measurement configuration.

The UE initiates this procedure while T331 is running and one of the following conditions is met:

- 1> upon selecting a cell when entering RRC\_IDLE or RRC-INACTIVE from RRC\_CONNECTED; or
- 1> upon update of system information (*SIB4*, or *SIB11*), e.g. due to intra RAT cell (re)selection;

While in RRC\_IDLE or RRC\_INACTIVE, and T331 is running, the UE shall:

- 1> if *VarMeasIdleConfig* includes neither a *measIdleCarrierListEUTRA* nor a *measIdleCarrierListNR* received from the *RRCRelease* message:
  - 2> if the UE is capable of idle/inactive measurements for NE-DC:
    - 3> if the SIB11 includes the *measIdleConfigSIB* and contains *measIdleCarrierListEUTRA*:

- 4> store or replace the *measIdleCarrierListEUTRA* of *measIdleConfigSIB* of *SIB11* within *VarMeasIdleConfig*;
- 3> else:
  - 4> remove the *measIdleCarrierListEUTRA* in *VarMeasIdleConfig*, if stored;
- 2> if the UE is capable of idle/inactive measurements for CA or NR-DC:
  - 3> if *SIB11* includes the *measIdleConfigSIB* and contains *measIdleCarrierListNR*:
    - 4> store or replace the *measIdleCarrierListNR* of *measIdleConfigSIB* of *SIB11* within *VarMeasIdleConfig*;
  - 3> else:
    - 4> remove the *measIdleCarrierListNR* in *VarMeasIdleConfig*, if stored;
- 1> for each entry in the *measIdleCarrierListNR* within *VarMeasIdleConfig* that does not contain an *ssb-MeasConfig* received from the *RRCRelease* message:
  - 2> if there is an entry in *measIdleCarrierListNR* in *measIdleConfigSIB* of *SIB11* that has the same carrier frequency and subcarrier spacing as the entry in the *measIdleCarrierListNR* within *VarMeasIdleConfig* and that contains *ssb-MeasConfig*:
    - 3> delete the *ssb-MeasConfig* of the corresponding entry in the *measIdleCarrierListNR* within *VarMeasIdleConfig*;
    - 3> store the SSB measurement configuration from *SIB11* into *nrofSS-BlocksToAverage*, *absThreshSS-BlocksConsolidation*, *smtc*, *ssb-ToMeasure*, *deriveSSB-IndexFromCell*, and *ss-RSSI-Measurement* within *ssb-MeasConfig* of the corresponding entry in the *measIdleCarrierListNR* within *VarMeasIdleConfig*;
  - 2> else if there is an entry in *carrierFreqListNR* of *SIB4* with the same carrier frequency and subcarrier spacing as the entry in *measIdleCarrierListNR* within *VarMeasIdleConfig*:
    - 3> delete the *ssb-MeasConfig* of the corresponding entry in the *measIdleCarrierListNR* within *VarMeasIdleConfig*;
    - 3> store the SSB measurement configuration from *SIB4* into *nrofSS-BlocksToAverage*, *absThreshSS-BlocksConsolidation*, *smtc*, *ssb-ToMeasure*, *deriveSSB-IndexFromCell*, and *ss-RSSI-Measurement* within *ssb-MeasConfig* of the corresponding entry in the *measIdleCarrierListNR* within *VarMeasIdleConfig*;
  - 2> else:
    - 3> remove the *ssb-MeasConfig* of the corresponding entry in the *measIdleCarrierListNR* within *VarMeasIdleConfig*, if stored;
- 1> perform measurements according to 5.7.8.2a.

## 5.7.8.2 Void

### 5.7.8.2a Performing measurements

When performing measurements on NR carriers according to this clause, the UE shall derive the cell quality as specified in 5.5.3.3 and consider the beam quality to be the value of the measurement results of the concerned beam, where each result is averaged as described in TS 38.215 [9].

While in *RRC\_IDLE* or *RRC\_INACTIVE*, and *T331* is running, the UE shall:

- 1> perform the measurements in accordance with the following:
  - 2> if the *VarMeasIdleConfig* includes the *measIdleCarrierListEUTRA* and the *SIB1* contains *idleModeMeasurementsEUTRA*:
    - 3> for each entry in *measIdleCarrierListEUTRA* within *VarMeasIdleConfig*:

- 4> if UE supports NE-DC between the serving carrier and the carrier frequency indicated by *carrierFreqEUTRA* within the corresponding entry:
  - 5> perform measurements in the carrier frequency and bandwidth indicated by *carrierFreq* and *allowedMeasBandwidth* within the corresponding entry;
  - 5> if the *reportQuantitiesEUTRA* is set to *rsrq*:
    - 6> consider RSRQ as the sorting quantity;
  - 5> else:
    - 6> consider RSRP as the sorting quantity;
  - 5> if the *measCellListEUTRA* is included:
    - 6> consider cells identified by each entry within the *measCellListEUTRA* to be applicable for idle/inactive mode measurement reporting;
  - 5> else:
    - 6> consider up to *maxCellMeasIdle* strongest identified cells, according to the sorting quantity, to be applicable for idle/inactive measurement reporting;
  - 5> for all cells applicable for idle/inactive measurement reporting, derive measurement results for the measurement quantities indicated by *reportQuantitiesEUTRA*;
  - 5> store the derived measurement results as indicated by *reportQuantitiesEUTRA* within the *measReportIdleEUTRA* in *VarMeasIdleReport* in decreasing order of the sorting quantity, i.e. the best cell is included first, as follows:
    - 6> if *qualityThresholdEUTRA* is configured:
      - 7> include the measurement results from the cells applicable for idle/inactive measurement reporting whose RSRP/RSRQ measurement results are above the value(s) provided in *qualityThresholdEUTRA*;
    - 6> else:
      - 7> include the measurement results from all cells applicable for idle/inactive measurement reporting;
- 2> if the *VarMeasIdleConfig* includes the *measIdleCarrierListNR* and the SIB1 contains *idleModeMeasurementsNR*:
  - 3> for each entry in *measIdleCarrierListNR* within *VarMeasIdleConfig* that contains *ssb-MeasConfig*:
    - 4> if UE supports carrier aggregation or NR-DC between serving carrier and the carrier frequency and subcarrier spacing indicated by *carrierFreq* and *ssbSubCarrierSpacing* within the corresponding entry:
      - 5> perform measurements in the carrier frequency and subcarrier spacing indicated by *carrierFreq* and *ssbSubCarrierSpacing* within the corresponding entry;
      - 5> if the *reportQuantities* is set to *rsrq*:
        - 6> consider RSRQ as the cell sorting quantity;
      - 5> else:
        - 6> consider RSRP as the cell sorting quantity;
      - 5> if the *measCellListNR* is included:
        - 6> consider cells identified by each entry within the *measCellListNR* to be applicable for idle/inactive measurement reporting;

- 5> else:
  - 6> consider up to *maxCellMeasIdle* strongest identified cells, according to the sorting quantity, to be applicable for idle/inactive measurement reporting;
  - 5> for all cells applicable for idle/inactive measurement reporting and for the serving cell, derive cell measurement results for the measurement quantities indicated by *reportQuantities*;
  - 5> store the derived cell measurement results as indicated by *reportQuantities* for the serving cell within *measResultServingCell* in the *measReportIdleNR* in *VarMeasIdleReport*;
  - 5> store the derived cell measurement results as indicated by *reportQuantities* for cells applicable for idle/inactive measurement reporting within the *measReportIdleNR* in *VarMeasIdleReport* in decreasing order of the cell sorting quantity, i.e. the best cell is included first, as follows:
    - 6> if *qualityThreshold* is configured:
      - 7> include the measurement results from the cells applicable for idle/inactive measurement reporting whose RSRP/RSRQ measurement results are above the value(s) provided in *qualityThreshold*;
    - 6> else:
      - 7> include the measurement results from all cells applicable for idle/inactive measurement reporting;
  - 5> if *beamMeasConfigIdle* is included in the associated entry in *measIdleCarrierListNR*, for each cell in the measurement results:
    - 6> derive beam measurements based on SS/PBCH block for each measurement quantity indicated in *reportQuantityRS-IndexesNR*, as described in TS 38.215 [9];
    - 6> if the *reportQuantityRS-Indexes* is set to *rsrq*:
      - 7> consider RSRQ as the beam sorting quantity;
    - 6> else:
      - 7> consider RSRP as the beam sorting quantity;
    - 6> set *resultsSSB-Indexes* to include up to *maxNrofRS-IndexesToReport* SS/PBCH block indexes in order of decreasing beam sorting quantity as follows:
      - 7> include the index associated to the best beam for the sorting quantity and if *absThreshSS-BlocksConsolidation* is included, the remaining beams whose sorting quantity is above *absThreshSS-BlocksConsolidation*;
    - 6> if the *includeBeamMeasurements* is set to *true*:
      - 7> include the beam measurement results as indicated by *reportQuantityRS-Indexes*;

NOTE 1: The fields *s-NonIntraSearchP* and *s-NonIntraSearchQ* in *SIB2* do not affect the idle/inactive UE measurement procedures. How the UE performs idle/inactive measurements is up to UE implementation as long as the requirements in TS 38.133 [14] are met for measurement reporting.

NOTE 2: The UE is not required to perform idle/inactive measurements on a given carrier if the SSB configuration of that carrier provided via dedicated signaling is different from the SSB configuration broadcasted in the serving cell, if any.

NOTE 3: How the UE prioritizes which frequencies to measure or report (in case it is configured with more frequencies than it can measure or report) is left to UE implementation.

### 5.7.8.3 T331 expiry or stop

The UE shall:



1> if T331 expires or is stopped:

2> release the *VarMeasIdleConfig*.

NOTE: It is up to UE implementation whether to continue idle/inactive measurements according to SIB11 and SIB4 configurations after T331 has expired or stopped.

#### 5.7.8.4 Cell re-selection or cell selection while T331 is running

The UE shall:

1> if intra-RAT cell selection or reselection occurs while T331 is running:

2> if *validityAreaList* is configured in *VarMeasIdleConfig*:

3> if the serving frequency does not match with the *carrierFreq* of an entry in the *validityAreaList*; or

3> if the serving frequency matches with the *carrierFreq* of an entry in the *validityAreaList*, the *validityCellList* is included in that entry, and the physical cell identity of the serving cell does not match with any entry in *validityCellList*:

4> stop timer T331;

4> perform the actions as specified in 5.7.8.3, upon which the procedure ends.

1> else if inter-RAT cell selection or reselection occurs while T331 is running:

2> stop timer T331;

2> perform the actions as specified in 5.7.8.3;

### 5.7.9 Mobility history information

#### 5.7.9.1 General

This procedure specifies how the mobility history information is stored by the UE, covering RRC\_IDLE, RRC\_INACTIVE and RRC\_CONNECTED.

#### 5.7.9.2 Initiation

If the UE supports storage of mobility history information, the UE shall:

1> Upon change of suitable cell, consisting of PCell in RRC\_CONNECTED or serving cell in RRC\_INACTIVE (for NR cell) or in RRC\_IDLE (for NR or E-UTRA cell), to another NR or E-UTRA cell, or when entering any cell selection' state from 'camped normally' state in NR or LTE:

2> include an entry in variable *VarMobilityHistoryReport* possibly after removing the oldest entry, if necessary, according to following:

3> if the global cell identity of the previous PCell/serving cell is available:

4> include the global cell identity of that cell in the field *visitedCellId* of the entry;

3> else:

4> include the physical cell identity and carrier frequency of that cell in the field *visitedCellId* of the entry;

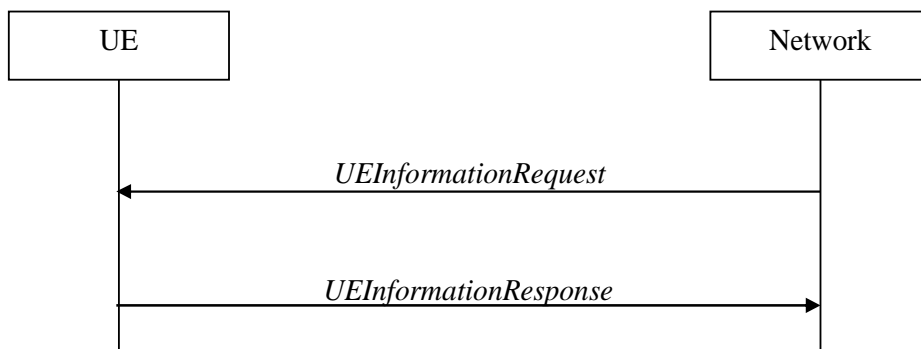
3> set the field *timeSpent* of the entry as the time spent in the previous PCell/serving cell;

1> upon entering camped normally state in NR (in RRC\_IDLE, RRC\_INACTIVE or RRC\_CONNECTED) or E-UTRA (in RRC\_IDLE or RRC\_CONNECTED) while previously in 'any cell selection' state or 'camped on any cell' state in NR or LTE:

- 2> include an entry in variable *VarMobilityHistoryReport* possibly after removing the oldest entry, if necessary, according to following:
- 3> set the field *timeSpent* of the entry as the time spent in 'any cell selection' state and/or 'camped on any cell' state in NR or LTE.

## 5.7.10 UE Information

### 5.7.10.1 General



**Figure 5.7.10.1-1: UE information procedure**

The UE information procedure is used by the network to request the UE to report information.

### 5.7.10.2 Initiation

The network initiates the procedure by sending the *UEInformationRequest* message. The network should initiate this procedure only after successful security activation.

### 5.7.10.3 Reception of the *UEInformationRequest* message

Upon receiving the *UEInformationRequest* message, the UE shall, only after successful security activation:

- 1> if the *idleModeMeasurementReq* is included in the *UEInformationRequest* and the UE has stored *VarMeasIdleReport* that contains measurement information concerning cells other than the PCell:
  - 2> set the *measResultIdleEUTRA* in the *UEInformationResponse* message to the value of *measReportIdleEUTRA* in the *VarMeasIdleReportEUTRA*, if available;
  - 2> set the *measResultIdleNR* in the *UEInformationResponse* message to the value of *measReportIdleNR* in the *VarMeasIdleReport*, if available;
  - 2> discard the *VarMeasIdleReport* upon successful delivery of the *UEInformationResponse* message confirmed by lower layers;
- 1> 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> if *ra-ReportReq* is set to *true* and the UE has random access related information available in *VarRA-Report* and if the RPLMN is included in *plmn-IdentityList* stored in *VarRA-Report*:
  - 2> set the *ra-Report* in the *UEInformationResponse* message to the value of *ra-Report* in *VarRA-Report*;
  - 2> discard the *ra-Report* from *VarRA-Report* upon successful delivery of the *UEInformationResponse* message confirmed by lower layers;
- 1> if *rlf-ReportReq* is set to *true*:
  - 2> if 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*:
    - 3> set *timeSinceFailure* in *VarRLF-Report* to the time that elapsed since the last radio link or handover failure in NR;
    - 3> set the *rlf-Report* in the *UEInformationResponse* message to the value of *rlf-Report* in *VarRLF-Report*;
    - 3> discard the *rlf-Report* from *VarRLF-Report* upon successful delivery of the *UEInformationResponse* message confirmed by lower layers;
  - 2> else if the UE is capable of cross-RAT RLF reporting as defined in TS 38.306 [26] and has radio link failure information or handover failure information available in *VarRLF-Report* of TS 36.331 [10] and if the RPLMN is included in *plmn-IdentityList* stored in *VarRLF-Report* of TS 36.331 [10]:
    - 3> set *timeSinceFailure* in *VarRLF-Report* of TS 36.331 [10] to the time that elapsed since the last radio link or handover failure in EUTRA;
    - 3> set the *measResult-RLF-Report-EUTRA* in the *rlf-Report* in the *UEInformationResponse* message to the value of *rlf-Report* in *VarRLF-Report* of TS 36.331 [10];
    - 3> discard the *rlf-Report* from *VarRLF-Report* of TS 36.331 [10] upon successful delivery of the *UEInformationResponse* message confirmed by lower layers;
- 1> if *connEstFailReportReq* is set to *true* and the UE has connection establishment failure or connection resume 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 or connection resume failure in NR;
  - 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> if the *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> if the *logMeasReport* is included in the *UEInformationResponse*:
  - 2> submit the *UEInformationResponse* message to lower layers for transmission via SRB2;
  - 2> discard the logged measurement entries included in the *logMeasInfoList* from *VarLogMeasReport* upon successful delivery of the *UEInformationResponse* message confirmed by lower layers;
- 1> else:
  - 2> submit the *UEInformationResponse* message to lower layers for transmission via SRB1.

#### 5.7.10.4 Actions upon successful completion of random-access procedure

Upon successfully performing 4 step random access procedure, the UE shall:

- 1> if the number of RA-Report stored in the RA-ReportList is less than *maxRAReport*:
- 2> if the number of PLMN entries in *plmn-IdentityList* stored in *VarRA-Report* is less than *maxPLMN*; or
- 2> if the number of PLMN entries in *plmn-IdentityList* stored in *VarRA-Report* is equal to *maxPLMN* and the list of EPLMNs is subset of or equal to the *plmn-IdentityList* stored in *VarRA-Report*:
- 3> append the following contents associated to the successfully completed random-access procedure as a new entry in the *VarRA-Report*:
  - 4> if the list of EPLMNs has been stored by the UE:
    - 5> if the RPLMN is included in *plmn-IdentityList* stored in *VarRA-Report*:
      - 6> set the *plmn-IdentityList* to include the list of EPLMNs stored by the UE (i.e. includes the RPLMN) without exceeding the limit of *maxPLMN*;
    - 5> else:
      - 6> clear the information included in *VarRA-Report*;
      - 6> set the *plmn-IdentityList* to the list of EPLMNs stored by the UE (i.e. includes the RPLMN);
  - 4> else:
    - 5> set the *plmn-Identity*, in *plmn-IdentityList*, to the PLMN selected by upper layers from the PLMN(s) included in the *plmn-IdentityList* in SIB1;
  - 4> set the *cellId* to the global cell identity and the tracking area code, if available, otherwise to the physical cell identity and carrier frequency of the cell in which the corresponding random-access preamble was transmitted;
  - 4> set the *raPurpose* to include the purpose of triggering the random-access procedure;
  - 4> set the *ra-InformationCommon-r16* as specified in subclause 5.7.10.5.

The UE may discard the random access report information, i.e. release the UE variable *VarRA-Report*, 48 hours after the last successful random access procedure related information is added to the *VarRA-Report*.

NOTE 1: The UE does not log the RA information in the RA report if the triggering event of the random access is consistent UL LBT on SpCell as specified in TS 38.321 [6].

### 5.7.10.5 RA information determination for RA report and RLF report

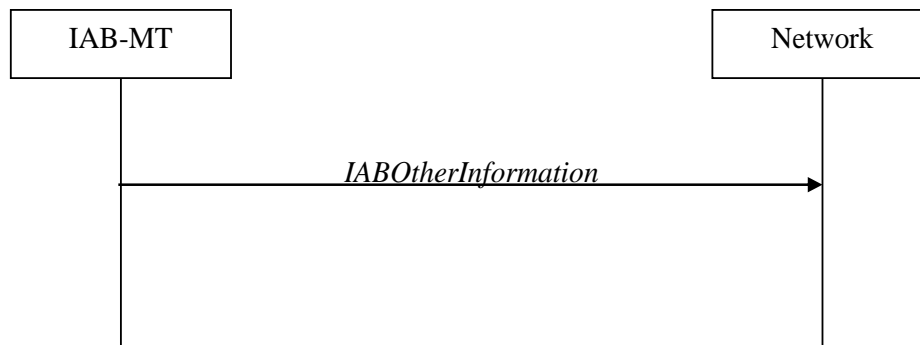
The UE shall set the content in *ra-InformationCommon-r16* as follows:

- 1> set the *absoluteFrequencyPointA* to indicate the absolute frequency of the reference resource block associated to the random-access resources used in the random-access procedure;
- 1> set the *locationAndBandwidth* and *subcarrierSpacing* associated to the UL BWP of the random-access resources used in the random-access procedure;
- 1> set the *msg1-FrequencyStart*, *msg1-FDM* and *msg1-SubcarrierSpacing* associated to the contention based random-access resources if used in the random-access procedure;
- 1> set the *msg1-FrequencyStartCFRA*, *msg1-FDMCFRA* and *msg1-SubcarrierSpacingCFRA* associated to the contention free random-access resources if used in the random-access procedure;
- 1> set the parameters associated to individual random-access attempt in the chronological order of attempts in the *perRAInfoList* as follows:
  - 2> if the random-access resource used is associated to a SS/PBCH block, set the associated random-access parameters for the successive random-access attempts associated to the same SS/PBCH block for one or more random-access attempts as follows:
    - 3> set the *ssb-Index* to include the SS/PBCH block index associated to the used random-access resource;
    - 3> set the *numberOfPreamblesSentOnSSB* to indicate the number of successive random-access attempts associated to the SS/PBCH block;
    - 3> for each random-access attempt performed on the random-access resource, include the following parameters in the chronological order of the random-access attempt:
      - 4> if the random-access attempt is performed on the contention based random-access resource and if *raPurpose* is not equal to 'requestForOtherSI', include *contentionDetected* as follows:
        - 5> if contention resolution was not successful as specified in TS 38.321 [6] for the transmitted preamble:
          - 6> set the *contentionDetected* to *true*;
        - 5> else:
          - 6> set the *contentionDetected* to *false*;
      - 4> if the random-access attempt is performed on the contention based random-access resource; or
      - 4> if the random-access attempt is performed on the contention free random-access resource and if the random-access procedure was initiated due to the PDCCH ordering:
        - 5> if the SS/PBCH block RSRP of the SS/PBCH block corresponding to the random-access resource used in the random-access attempt is above *rsrp-ThresholdSSB*:
          - 6> set the *dlRSRPAboveThreshold* to *true*;
        - 5> else:
          - 6> set the *dlRSRPAboveThreshold* to *false*;
  - 2> else if the random-access resource used is associated to a CSI-RS, set the associated random-access parameters for the successive random-access attempts associated to the same CSI-RS for one or more random-access attempts as follows:
    - 3> set the *csi-RS-Index* to include the CSI-RS index associated to the used random-access resource;
    - 3> set the *numberOfPreamblesSentOnCSI-RS* to indicate the number of successive random-access attempts associated to the CSI-RS.

NOTE 1: Void.

## 5.7.12 IAB Other Information

### 5.7.12.1 General



**Figure 5.7.12.1-1: IAB Other Information procedure**

The IAB Other Information procedure is used by IAB-MT to request the IAB-donor-CU to allocate IP address or inform the IAB-donor-CU of the IP address for the collocated IAB-DU.

### 5.7.12.2 Initiation

Upon initiation of the procedure, the IAB-MT shall:

- 1> initiate transmission of the *IABOtherInformation* message in accordance with 5.7.12.3;

### 5.7.12.3 Actions related to transmission of *IABOtherInformation* message

The IAB-MT shall set the contents of *IABOtherInformation* message as follows:

- 1> if the procedure is used to request IP addresses:
  - 2> if IPv4 addresses are requested:
    - 3> set the *iab-IPv4-AddressNumReq* to the number of IPv4 addresses requested per specific usage;
  - 2> if IPv6 addresses or IPv6 address prefixes are requested:
    - 3> if IPv6 addresses are requested:
      - 4> set the *iab-IPv6-AddressNumReq* to the number of IPv6 addresses requested per specific usage;
    - 3> else if IPv6 address prefix is requested:
      - 4> set the *iab-IPv6-AddressPrefixReq* to true per specific usage;
- 1> if the procedure is used to report IP addresses:
  - 2> if IPv4 addresses are reported:
    - 3> include *IPv4-Addresses* in *iab-IPv4-AddressReport*, and for each IP address included:
      - 4> if IPv4 addresses are used for F1-C traffic:
        - 5> include these addresses in *f1-C-Traffic-IP-Address*.
      - 4> if IPv4 addresses are used for F1-U traffic:
        - 5> include these addresses in *f1-U-Traffic-IP-Address*.
      - 4> if IPv4 address are used for non-F1 traffic:
        - 5> include these addresses in *non-f1-Traffic-IP-Address*.

- 4> if IPv4 addresses are used for all traffic:
  - 5> include these addresses in *all-Traffic-IAB-IP-Address*.
- 2> if IPv6 addresses or IPv6 address prefixes are reported:
  - 3> if IPv6 addresses are reported:
    - 4> include *iPv6-Addresses* in *iab-IPv6-AddressReport*, and for each IP address included:
      - 5> if IPv6 addresses are used for F1-C traffic:
        - 6> include these addresses in *f1-C-Traffic-IP-Address*.
      - 5> if IPv6 addresses are used for F1-U traffic:
        - 6> include these addresses in *f1-U-Traffic-IP-Address*.
      - 5> if IPv6 addresses are used for non-F1 traffic:
        - 6> include these addresses in *non-f1-Traffic-IP-Address*.
      - 5> if IPv6 addresses are used for all traffic:
        - 6> include these addresses in *all-Traffic-IAB-IP-Address*.
  - 3> else if IPv6 address prefixes are reported:
    - 4> include these *iPv6-Prefixes* in *iab-IPv6-PrefixReport*, and for each IP address prefix included:
      - 5> if this IPv6 address prefix is used for F1-C traffic:
        - 6> include this prefix in *f1-C-Traffic-IP-Address*.
      - 5> if this IPv6 address prefix is used for F1-U traffic:
        - 6> include this prefix in *f1-U-Traffic-IP-Address*.
      - 5> if this IPv6 address prefix is used for non-F1 traffic:
        - 6> include this prefix in *non-f1-Traffic-IP-Address*.
      - 5> if this IPv6 address prefix is used for all traffic:
        - 6> include this prefix in *all-Traffic-IAB-IP-Address*.
  - 1> submit the *IABOtherInformation* message to lower layers for transmission, upon which the procedure ends.

## 5.8 Sidelink

### 5.8.1 General

NR sidelink communication consists of unicast, groupcast and broadcast. For unicast, the PC5-RRC connection is a logical connection between a pair of a Source Layer-2 ID and a Destination Layer-2 ID in the AS. The PC5-RRC signalling, as specified in sub-clause 5.8.9, can be initiated after its corresponding PC5 unicast link establishment (TS 23.287 [55]). The PC5-RRC connection and the corresponding sidelink SRBs and sidelink DRB(s) are released when the PC5 unicast link is released as indicated by upper layers.

For each PC5-RRC connection of unicast, one sidelink SRB (i.e. SL-SRB0) is used to transmit the PC5-S message(s) before the PC5-S security has been established. One sidelink SRB (i.e. SL-SRB1) is used to transmit the PC5-S messages to establish the PC5-S security. One sidelink SRB (i.e. SL-SRB2) is used to transmit the PC5-S messages after the PC5-S security has been established, which is protected. One sidelink SRB (i.e. SL-SRB3) is used to transmit the PC5-RRC signalling, which is protected and only sent after the PC5-S security has been established.

For unicast of NR Sidelink communication, AS security comprises of integrity protection and ciphering of PC5 signaling (SL-SRB2 and SL-SRB3) and user data (SL-DRBs). The ciphering and integrity protection algorithms and parameters for a PC5 unicast link are exchanged by PC5-S messages in the upper layers as specified in TS 33.536 [60], and apply to the corresponding PC5-RRC connection in the AS. Once AS security is activated for a PC5 unicast link in the upper layers as specified in TS 33.536 [60], all messages on SL-SRB2 and SL-SRB3 and/or user data on SL-DRBs of the corresponding PC5-RRC connection are integrity protected and/or ciphered by the PDCP.

For unicast of NR Sidelink communication, if the change of the key is indicated by the upper layers as specified in TS 33.536 [60], UE re-establishes the PDCP entity of the SL-SRB1, SL-SRB2, SL-SRB3 and SL-DRBs on the corresponding PC5-RRC connection.

NOTE 1: In case the configurations for NR sidelink communication are acquired via the E-UTRA, the configurations for NR sidelink communication in *SIB12* and *sl-ConfigDedicatedNR* within *RRCReconfiguration* used in subclause 5.8 are provided by the configurations in *SystemInformationBlockType28* and *sl-ConfigDedicatedNR* within *RRCConnectionReconfiguration* as specified in TS 36.331 [10], respectively.

NOTE 2: In this release, there is one-to-one correspondence between the PC5-RRC connection and the PC5 unicast link as specified in TS 38.300[2].

NOTE3: All SL-DRBs related to the same PC5-RRC connection have the same activation/deactivation setting for ciphering and the same activation/deactivation setting for integrity protection as in TS 33.536 [60].

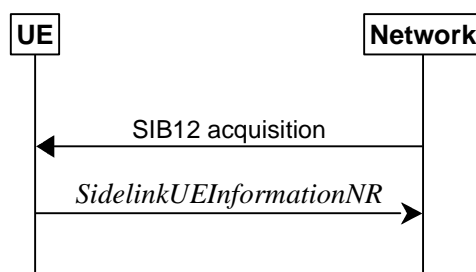
## 5.8.2 Conditions for NR sidelink communication operation

The UE shall perform NR sidelink communication operation only if the conditions defined in this clause are met, the :

- 1> if the UE's serving cell is suitable (RRC\_IDLE or RRC\_INACTIVE or RRC\_CONNECTED); and if either the selected cell on the frequency used for NR sidelink communication operation belongs to the registered or equivalent PLMN as specified in TS 24.587 [57] or the UE is out of coverage on the frequency used for NR sidelink communication operation as defined in TS 38.304 [20] and TS 36.304 [27]; or
- 1> if the UE's serving cell (RRC\_IDLE or RRC\_CONNECTED) fulfils the conditions to support NR sidelink communication in limited service state as specified in TS 23.287 [55]; and if either the serving cell is on the frequency used for NR sidelink communication operation or the UE is out of coverage on the frequency used for NR sidelink communication operation as defined in TS 38.304 [20] and TS 36.304 [27]; or
- 1> if the UE has no serving cell (RRC\_IDLE);

## 5.8.3 Sidelink UE information for NR sidelink communication

### 5.8.3.1 General



**Figure 5.8.3.1-1: Sidelink UE information for NR sidelink communication**

The purpose of this procedure is to inform the network that the UE:

- is interested or no longer interested to receive or transmit NR sidelink communication,
- is requesting assignment or release of transmission resource for NR sidelink communication,
- is reporting QoS parameters and QoS profile(s) related to NR sidelink communication,



- is reporting that a sidelink radio link failure or sidelink RRC reconfiguration failure has been detected,
- is reporting the sidelink UE capability information of the associated peer UE for unicast communication,
- is reporting the RLC mode information of the sidelink data radio bearer(s) received from the associated peer UE for unicast communication.

### 5.8.3.2 Initiation

A UE capable of NR sidelink communication that is in RRC\_CONNECTED may initiate the procedure to indicate it is (interested in) receiving or transmitting NR sidelink communication in several cases including upon successful connection establishment or resuming, upon change of interest, upon changing QoS profiles, upon receiving *UECapabilityInformationSidelink* from the associated peer UE, upon RLC mode information updated from the associated peer UE or upon change to a PCell providing *SIB12* including *sl-ConfigCommonNR*. A UE capable of NR sidelink communication may initiate the procedure to request assignment of dedicated sidelink DRB configuration and transmission resources for NR sidelink communication transmission. A UE capable of NR sidelink communication may initiate the procedure to report to the network that a sidelink radio link failure or sidelink RRC reconfiguration failure has been declared.

Upon initiating this procedure, the UE shall:

- 1> if *SIB12* including *sl-ConfigCommonNR* is provided by the PCell:
  - 2> ensure having a valid version of *SIB12* for the PCell;
  - 2> if configured by upper layers to receive NR sidelink communication on the frequency included in *sl-FreqInfoList* in *SIB12* of the PCell:
    - 3> if the UE did not transmit a *SidelinkUEInformationNR* message since last entering RRC\_CONNECTED state; or
    - 3> if since the last time the UE transmitted a *SidelinkUEInformationNR* message the UE connected to a PCell not providing *SIB12* including *sl-ConfigCommonNR*; or
    - 3> if the last transmission of the *SidelinkUEInformationNR* message did not include *sl-RxInterestedFreqList*; or if the frequency configured by upper layers to receive NR sidelink communication on has changed since the last transmission of the *SidelinkUEInformationNR* message:
      - 4> initiate transmission of the *SidelinkUEInformationNR* message to indicate the NR sidelink communication reception frequency of interest in accordance with 5.8.3.3;
  - 2> else:
    - 3> if the last transmission of the *SidelinkUEInformationNR* message included *sl-RxInterestedFreqList*:
      - 4> initiate transmission of the *SidelinkUEInformationNR* message to indicate it is no longer interested in NR sidelink communication reception in accordance with 5.8.3.3;
  - 2> if configured by upper layers to transmit NR sidelink communication on the frequency included in *sl-FreqInfoList* in *SIB12* of the PCell:
    - 3> if the UE did not transmit a *SidelinkUEInformationNR* message since last entering RRC\_CONNECTED state; or
    - 3> if since the last time the UE transmitted a *SidelinkUEInformationNR* message the UE connected to a PCell not providing *SIB12* including *sl-ConfigCommonNR*; or
    - 3> if the last transmission of the *SidelinkUEInformationNR* message did not include *sl-TxResourceReqList*; or if the information carried by the *sl-TxResourceReqList* has changed since the last transmission of the *SidelinkUEInformationNR* message:
      - 4> initiate transmission of the *SidelinkUEInformationNR* message to indicate the NR sidelink communication transmission resources required by the UE in accordance with 5.8.3.3;
  - 2> else:

- 3> if the last transmission of the *SidelinkUEInformationNR* message included *sl-TxResourceReqList*:
- 4> initiate transmission of the *SidelinkUEInformationNR* message to indicate it no longer requires NR sidelink communication transmission resources in accordance with 5.8.3.3.

### 5.8.3.3 Actions related to transmission of *SidelinkUEInformationNR* message

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

- 1> if the UE initiates the procedure to indicate it is (no more) interested to receive NR sidelink communication or to request (configuration/ release) of NR sidelink communication transmission resources or to report to the network that a sidelink radio link failure or sidelink RRC reconfiguration failure has been declared (i.e. UE includes all concerned information, irrespective of what triggered the procedure):
  - 2> if *SIB12* including *sl-ConfigCommonNR* is provided by the PCell:
    - 3> if configured by upper layers to receive NR sidelink communication:
      - 4> include *sl-RxInterestedFreqList* and set it to the frequency for NR sidelink communication reception;
    - 3> if configured by upper layers to transmit NR sidelink communication:
      - 4> include *sl-TxResourceReqList* and set its fields (if needed) as follows for each destination for which it requests network to assign NR sidelink communication resource:
        - 5> set *sl-DestinationIdentity* to the destination identity configured by upper layer for NR sidelink communication transmission;
        - 5> set *sl-CastType* to the cast type of the associated destination identity configured by the upper layer for the NR sidelink communication transmission;
        - 5> set *sl-RLC-ModeIndication* to include the RLC mode(s) and optionally QoS profile(s) of the sidelink QoS flow(s) of the associated RLC mode(s), if the associated bi-directional sidelink DRB has been established due to the configuration by *RRCReconfigurationSidelink*;
        - 5> set *sl-QoS-InfoList* to include QoS profile(s) of the sidelink QoS flow(s) of the associated destination configured by the upper layer for the NR sidelink communication transmission;
        - 5> set *sl-InterestedFreqList* to indicate the frequency of the associated destination for NR sidelink communication transmission;
        - 5> set *sl-TypeTxSyncList* to the current synchronization reference type used on the associated *sl-InterestedFreqList* for NR sidelink communication transmission.
        - 5> set *sl-CapabilityInformationSidelink* to include *UECapabilityInformationSidelink* message, if any, received from peer UE.
    - 4> include *sl-FailureList* and set its fields as follows for each destination for which it reports the NR sidelink communication failure:
      - 5> set *sl-DestinationIdentity* to the destination identity configured by upper layer for NR sidelink communication transmission;
      - 5> set *sl-Failure* as *rlf* for the associated destination for the NR sidelink communication transmission, if the sidelink RLF is detected as specified in sub-clause 5.8.9.3;
      - 5> set *sl-Failure* as *configFailure* for the associated destination for the NR sidelink communication transmission, if *RRCReconfigurationFailureSidelink* is received;
- 1> if the UE initiates the procedure while connected to an E-UTRA PCell:
  - 2> submit the *SidelinkUEInformationNR* to lower layers via SRB1, embedded in E-UTRA RRC message *ULInformationTransferIRAT* as specified in TS 36.331 [10], clause 5.6.28;
- 1> else:

2> submit the *SidelinkUEInformationNR* message to lower layers for transmission.

## 5.8.4 Void

## 5.8.5 Sidelink synchronisation information transmission for NR sidelink communication

### 5.8.5.1 General

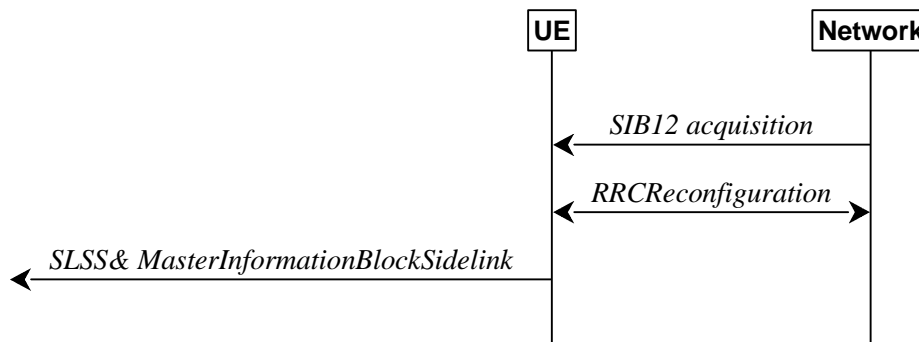


Figure 5.8.5.1-1: Synchronisation information transmission for NR sidelink communication, in (partial) coverage

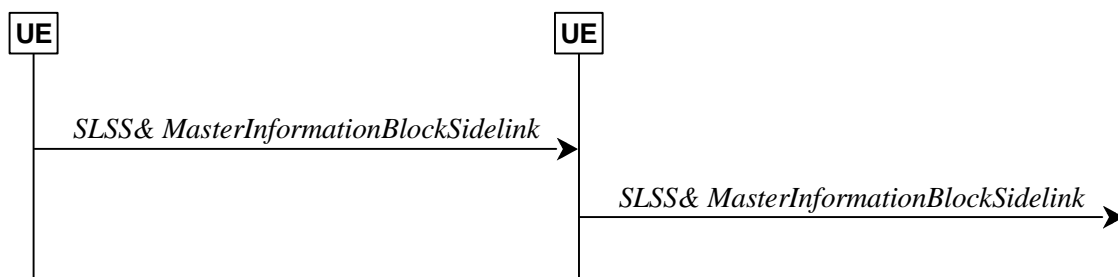


Figure 5.8.5.1-2: Synchronisation information transmission for NR sidelink communication, out of coverage

The purpose of this procedure is to provide synchronisation information to a UE.

### 5.8.5.2 Initiation

A UE capable of NR sidelink communication and SLSS/PSBCH transmission shall, when transmitting NR sidelink communication, and if the conditions for NR sidelink communication operation are met and when the following conditions are met:

- 1> if in coverage on the frequency used for NR sidelink communication, as defined in TS 38.304 [20]; and has selected GNSS or the cell as synchronization reference as defined in 5.8.6.3; or
- 1> if out of coverage on the frequency used for NR sidelink communication, and the frequency used to transmit NR sidelink communication is included in *sl-FreqInfoToAddModList* in *sl-ConfigDedicatedNR* within *RRCReconfiguration* message or included in *sl-FreqInfoList* within *SIB12*; and has selected GNSS or the cell as synchronization reference as defined in 5.8.6.3:
  - 2> if in *RRC\_CONNECTED*; and if *networkControlledSyncTx* is configured and set to *on*; or
  - 2> if *networkControlledSyncTx* is not configured; and for the concerned frequency *syncTxThreshIC* is configured; and the RSRP measurement of the reference cell, selected as defined in 5.8.6.3, for NR sidelink communication transmission is below the value of *syncTxThreshIC*:

- 3> transmit sidelink SSB on the frequency used for NR sidelink communication in accordance with 5.8.5.3 and TS 38.211 [16], including the transmission of SLSS as specified in 5.8.5.3 and transmission of *MasterInformationBlockSidelink* as specified in 5.8.9.4.3;

1> else:

- 2> for the frequency used for NR sidelink communication, if *syncTxThreshOoC* is included in *SidelinkPreconfigNR*; and the UE is not directly synchronized to GNSS, and the UE has no selected SyncRef UE or the PSBCH-RSRP measurement result of the selected SyncRef UE is below the value of *syncTxThreshOoC*; or
- 2> for the frequency used for NR sidelink communication, if the UE selects GNSS as the synchronization reference source:
  - 3> transmit sidelink SSB on the frequency used for NR sidelink communication in accordance with TS 38.211 [16], including the transmission of SLSS as specified in 5.8.5.3 and transmission of *MasterInformationBlockSidelink* as specified in 5.8.9.4.3;

### 5.8.5.3 Transmission of SLSS

The UE shall select the SLSSID and the slot in which to transmit SLSS as follows:

- 1> if triggered by NR sidelink communication and in coverage on the frequency used for NR sidelink communication, as defined in TS 38.304 [20]; or
- 1> if triggered by NR sidelink communication, and out of coverage on the frequency used for NR sidelink communication, and the concerned frequency is included in *sl-FreqInfoToAddModList* in *sl-ConfigDedicatedNR* within *RRCReconfiguration* message or included in *sl-FreqInfoList* within *SIB12*:
  - 2> if the UE has selected GNSS as synchronization reference in accordance with 5.8.6.2:
    - 3> select SLSSID 0;
    - 3> use *sl-SSB-TimeAllocation1* included in the entry of configured *sl-SyncConfigList* corresponding to the concerned frequency, that includes *txParameters* and *gnss-Sync*;
    - 3> select the slot(s) indicated by *sl-SSB-TimeAllocation1*;
  - 2> if the UE has selected a cell as synchronization reference in accordance with 5.8.6.2:
    - 3> select the SLSSID included in the entry of configured *sl-SyncConfigList* corresponding to the concerned frequency, that includes *txParameters* and does not include *gnss-Sync*;
    - 3> select the slot(s) indicated by *sl-SSB-TimeAllocation1*;
- 1> else if triggered by NR sidelink communication and the UE has GNSS as the synchronization reference:
  - 2> select SLSSID 0;
  - 2> if *sl-SSB-TimeAllocation3* is configured for the frequency used in *SidelinkPreconfigNR*:
    - 3> select the slot(s) indicated by *sl-SSB-TimeAllocation3*;
  - 2> else:
    - 3> select the slot(s) indicated by *sl-SSB-TimeAllocation1*;
- 1> else:
  - 2> select the synchronisation reference UE (i.e. SyncRef UE) as defined in 5.8.6;
  - 2> if the UE has a selected SyncRef UE and *inCoverage* in the *MasterInformationBlockSidelink* message received from this UE is set to *true*; or

- 2> if the UE has a selected SyncRef UE and *inCoverage* in the *MasterInformationBlockSidelink* message received from this UE is set to *false* while the SLSS from this UE is part of the set defined for out of coverage, see TS 38.211 [16]:
  - 3> select the same SLSSID as the SLSSID of the selected SyncRef UE;
  - 3> select the slot in which to transmit the SLSS according to the *sl-SSB-TimeAllocation1* or *sl-SSB-TimeAllocation2* included in the preconfigured sidelink parameters corresponding to the concerned frequency, such that the timing is different from the SLSS of the selected SyncRef UE;
- 2> else if the UE has a selected SyncRef UE and the SLSS from this UE was transmitted on the slot(s) indicated *sl-SSB-TimeAllocation3*, which is configured for the frequency used in *SidelinkPreconfigNR*:
  - 3> select SLSSID 337;
  - 3> select the slot(s) indicated by *sl-SSB-TimeAllocation2*;
- 2> else if the UE has a selected SyncRef UE:
  - 3> select the SLSSID from the set defined for out of coverage having an index that is 336 more than the index of the SLSSID of the selected SyncRef UE, see TS 38.211 [16];
  - 3> select the slot in which to transmit the SLSS according to *sl-SSB-TimeAllocation1* or *sl-SSB-TimeAllocation2* included in the preconfigured sidelink parameters corresponding to the concerned frequency, such that the timing is different from the SLSS of the selected SyncRef UE;
- 2> else (i.e. no SyncRef UE selected):
  - 3> if the UE has not randomly selected an SLSSID:
    - 4> randomly select, using a uniform distribution, an SLSSID from the set of sequences defined for out of coverage except SLSSID 336 and 337, see TS 38.211 [16];
    - 4> select the slot in which to transmit the SLSS according to the *sl-SSB-TimeAllocation1* or *sl-SSB-TimeAllocation2* (arbitrary selection between these) included in the preconfigured sidelink parameters in *SidelinkPreconfigNR* corresponding to the concerned frequency;

## 5.8.5a Sidelink synchronisation information transmission for V2X sidelink communication

### 5.8.5a.1 General

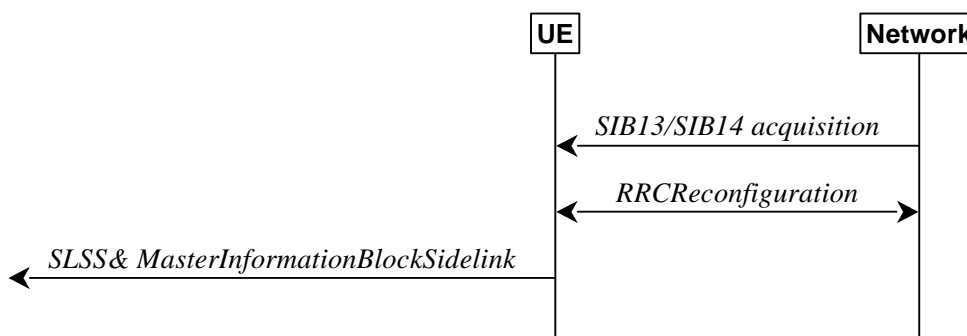
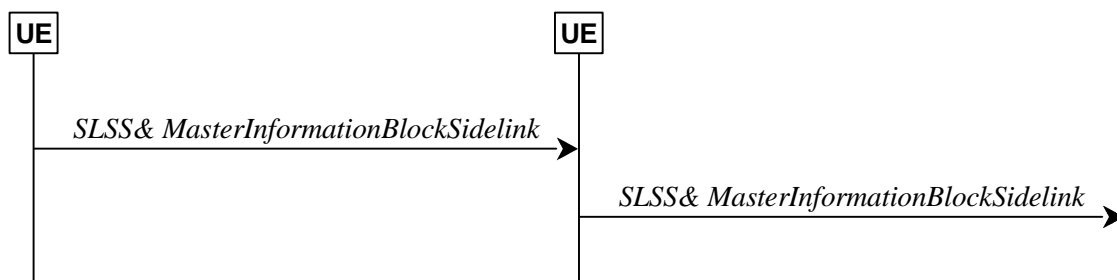


Figure 5.8.5a.1-1: Synchronisation information transmission for V2X sidelink communication, in (partial) coverage



**Figure 5.8.5a.1-2: Synchronisation information transmission for V2X sidelink communication, out of coverage**

The purpose of this procedure is to provide synchronisation information to a UE.

### 5.8.5a.2 Initiation

A UE capable of V2X sidelink communication initiates the transmission of SLSS and *MasterInformationBlock-SL-V2X* according to the conditions and the procedures specified for V2X sidelink communication in subclause 5.10.7 of TS 36.331 [10].

NOTE 1: When applying the procedure in this subclause, *SIB13* and *SIB14* correspond to *SystemInformationBlockType21* and *SystemInformationBlockType26* specified in TS 36.331 [10] respectively

## 5.8.6 Sidelink synchronisation reference

### 5.8.6.1 General

The purpose of this procedure is to select a synchronisation reference and used when transmitting NR sidelink communication.

### 5.8.6.2 Selection and reselection of synchronisation reference

The UE shall:

- 1> if the frequency used for NR sidelink communication is included in *sl-FreqInfoToAddModList* in *sl-ConfigDedicatedNR* within *RRCReconfiguration* message or included in *sl-ConfigCommonNR* within *SIB12*, and *sl-SyncPriority* is configured for the concerned frequency and set to *gnbEnb*:
  - 2> select a cell as the synchronization reference source as defined in 5.8.6.3:
- 1> else if the frequency used for NR sidelink communication is included in *sl-FreqInfoToAddModList* in *sl-ConfigDedicatedNR* within *RRCReconfiguration* message or included in *sl-ConfigCommonNR* within *SIB12*, and *sl-SyncPriority* for the concerned frequency is not configured or is set to *gnss*, and GNSS is reliable in accordance with TS 38.101-1 [15] and TS 38.133 [14]:
  - 2> select GNSS as the synchronization reference source;
- 1> else if the frequency used for NR sidelink communication is included in *PreconfigurationNR*, and *sl-SyncPriority* in *SidelinkPreconfigNR* is set to *gnss* and GNSS is reliable in accordance with TS 38.101-1 [15] and TS 38.133 [14]:
  - 2> select GNSS as the synchronization reference source;
- 1> else:
  - 2> perform a full search (i.e. covering all subframes and all possible SLSSIDs) to detect candidate SLSS, in accordance with TS 38.133 [14]
  - 2> when evaluating the one or more detected SLSSIDs, apply layer 3 filtering as specified in 5.5.3.2 using the preconfigured *sl-filterCoefficient*, before using the PSBCH-RSRP measurement results;

- 2> if the UE has selected a SyncRef UE:
  - 3> if the PSBCH-RSRP of the strongest candidate SyncRef UE exceeds the minimum requirement TS 38.133 [14] by *sl-SyncRefMinHyst* and the strongest candidate SyncRef UE belongs to the same priority group as the current SyncRef UE and the PSBCH-RSRP of the strongest candidate SyncRef UE exceeds the PSBCH-RSRP of the current SyncRef UE by *syncRefDiffHyst*; or
  - 3> if the PSBCH-RSRP of the candidate SyncRef UE exceeds the minimum requirement TS 38.133 [14] by *sl-SyncRefMinHyst* and the candidate SyncRef UE belongs to a higher priority group than the current SyncRef UE; or
  - 3> if GNSS becomes reliable in accordance with TS 38.101-1 [15] and TS 38.133 [14], and GNSS belongs to a higher priority group than the current SyncRef UE; or
  - 3> if a cell is detected and gNB/eNB (if *sl-NbAsSync* is set to *true*) belongs to a higher priority group than the current SyncRef UE; or
  - 3> if the PSBCH-RSRP of the current SyncRef UE is less than the minimum requirement defined in TS 38.133 [14]:
    - 4> consider no SyncRef UE to be selected;
- 2> if the UE has selected GNSS as the synchronization reference for NR sidelink communication:
  - 3> if the PSBCH-RSRP of the candidate SyncRef UE exceeds the minimum requirement defined in TS 38.133 [14] by *sl-SyncRefMinHyst* and the candidate SyncRef UE belongs to a higher priority group than GNSS; or
  - 3> if GNSS becomes not reliable in accordance with TS 38.101-1 [15] and TS 38.133 [14]:
    - 4> consider GNSS not to be selected;
- 2> if the UE has selected cell as the synchronization reference for NR sidelink communication:
  - 3> if the PSBCH-RSRP of the candidate SyncRef UE exceeds the minimum requirement defined in TS 38.133 [14] by *sl-SyncRefMinHyst* and the candidate SyncRef UE belongs to a higher priority group than gNB/eNB; or
  - 3> if the selected cell is not detected:
    - 4> consider the cell not to be selected;
- 2> if the UE has not selected any synchronization reference:
  - 3> if the UE detects one or more SLSSIDs for which the PSBCH-RSRP exceeds the minimum requirement defined in TS 38.133 [14] by *sl-SyncRefMinHyst* and for which the UE received the corresponding *MasterInformationBlockSidelink* message (candidate SyncRef UEs), or if the UE detects GNSS that is reliable in accordance with TS 38.101-1 [15] and TS 38.133 [14], or if the UE detects a cell, select a synchronization reference according to the following priority group order:
    - 4> if *sl-SyncPriority* corresponding to the concerned frequency is set to *gnbEnb*:
      - 5> UEs of which SLSSID is part of the set defined for in coverage, and *inCoverage*, included in the *MasterInformationBlockSidelink* message received from this UE, is set to *true*, starting with the UE with the highest PSBCH-RSRP result (priority group 1);
      - 5> UE of which SLSSID is part of the set defined for in coverage, and *inCoverage*, included in the *MasterInformationBlockSidelink* message received from this UE, is set to *false*, starting with the UE with the highest PSBCH-RSRP result (priority group 2);
      - 5> GNSS that is reliable in accordance with TS 38.101-1 [15] and TS 38.133 [14] (priority group 3);
      - 5> UEs of which SLSSID is 0, and *inCoverage*, included in the *MasterInformationBlockSidelink* message received from this UE, is set to *true*, or of which SLSSID is 0 and SLSS is transmitted on slot(s) indicated by *sl-SSB-TimeAllocation3*, starting with the UE with the highest PSBCH-RSRP result (priority group 4);

- 5> UEs of which SLSSID is 0 and SLSS is not transmitted on slot(s) indicated by *sl-SSB-TimeAllocation3*, and *inCoverage*, included in the *MasterInformationBlockSidelink* message received from this UE, is set to *false*, starting with the UE with the highest PSBCH-RSRP result (priority group 5);
- 5> UEs of which SLSSID is 337 and *inCoverage*, included in the *MasterInformationBlockSidelink* message received from this UE, is set to *false*, starting with the UE with the highest PSBCH-RSRP result (priority group 5);
- 5> Other UEs, starting with the UE with the highest PSBCH-RSRP result (priority group 6);
- 4> if *sl-SyncPriority* corresponding to the concerned frequency is set to *gnss*, and *sl-NbAsSync* is set to *true*:
  - 5> UEs of which SLSSID is 0, and *inCoverage*, included in the *MasterInformationBlockSidelink* message received from this UE, is set to *true*, or of which SLSSID is 0 and SLSS is transmitted on slot(s) indicated by *sl-SSB-TimeAllocation3*, starting with the UE with the highest PSBCH-RSRP result (priority group 1);
  - 5> UEs of which SLSSID is 0 and SLSS is not transmitted on slot(s) indicated by *sl-SSB-TimeAllocation3*, and *inCoverage*, included in the *MasterInformationBlockSidelink* message received from this UE, is set to *false*, starting with the UE with the highest PSBCH-RSRP result (priority group 2);
  - 5> UEs of which SLSSID is 337 and *inCoverage*, included in the *MasterInformationBlockSidelink* message received from this UE, is set to *false*, starting with the UE with the highest PSBCH-RSRP result (priority group 2);
  - 5> the cell detected by the UE as defined in 5.8.6.3 (priority group 3);
  - 5> UEs of which SLSSID is part of the set defined for in coverage, and *inCoverage*, included in the *MasterInformationBlockSidelink* message received from this UE, is set to *true*, starting with the UE with the highest PSBCH-RSRP result (priority group 4);
  - 5> UE of which SLSSID is part of the set defined for in coverage, and *inCoverage*, included in the *MasterInformationBlockSidelink* message received from this UE, is set to *false*, starting with the UE with the highest PSBCH-RSRP result (priority group 5);
  - 5> Other UEs, starting with the UE with the highest S-RSRP result (priority group 6);
- 4> if *sl-SyncPriority* corresponding to the concerned frequency is set to *gnss*, and *sl-NbAsSync* is set to *false*:
  - 5> UEs of which SLSSID is 0, and *inCoverage*, included in the *MasterInformationBlockSidelink* message received from this UE, is set to *true*, or of which SLSSID is 0 and SLSS is transmitted on slot(s) indicated by *sl-SSB-TimeAllocation3*, starting with the UE with the highest PSBCH-RSRP result (priority group 1);
  - 5> UEs of which SLSSID is 0 and SLSS is not transmitted on slot(s) indicated by *sl-SSB-TimeAllocation3*, and *inCoverage*, included in the *MasterInformationBlockSidelink* message received from this UE, is set to *false*, starting with the UE with the highest PSBCH-RSRP result (priority group 2);
  - 5> UEs of which SLSSID is 337 and *inCoverage*, included in the *MasterInformationBlockSidelink* message received from this UE, is set to *false*, starting with the UE with the highest PSBCH-RSRP result (priority group 2);
  - 5> Other UEs, starting with the UE with the highest PSBCH-RSRP result (priority group 3);

### 5.8.6.3 Sidelink communication transmission reference cell selection

A UE capable of NR sidelink communication that is configured by upper layers to transmit NR sidelink communication shall:



- 1> for the frequency used to transmit NR sidelink communication, select a cell to be used as reference for synchronization in accordance with the following:
  - 2> if the frequency concerns the primary frequency:
    - 3> use the PCell or the serving cell as reference;
  - 2> else if the frequency concerns a secondary frequency:
    - 3> use the concerned SCell as reference;
  - 2> else if the UE is in coverage of the concerned frequency:
    - 3> use the DL frequency paired with the one used to transmit NR sidelink communication as reference;
  - 2> else (i.e., out of coverage on the concerned frequency):
    - 3> use the PCell or the serving cell as reference, if needed;

### 5.8.7 Sidelink communication reception

A UE capable of NR sidelink communication that is configured by upper layers to receive NR sidelink communication shall:

- 1> if the conditions for NR sidelink communication operation as defined in 5.8.2 are met:
  - 2> if the frequency used for NR sidelink communication is included in *sl-FreqInfoToAddModList* in *RRCReconfiguration* message or *sl-FreqInfoList* included in *SIB12*:
    - 3> if the UE is configured with *sl-RxPool* included in *RRCReconfiguration* message with *reconfigwithSync* (i.e. handover):
      - 4> configure lower layers to monitor sidelink control information and the corresponding data using the pool of resources indicated by *sl-RxPool*;
    - 3> else if the cell chosen for NR sidelink communication transmission provides *SIB12*:
      - 4> configure lower layers to monitor sidelink control information and the corresponding data using the pool of resources indicated by *sl-RxPool* in *SIB12*;
  - 2> else:
    - 3> configure lower layers to monitor sidelink control information and the corresponding data using the pool of resources that were preconfigured by *sl-RxPool* in *SL-PreconfigurationNR*, as defined in sub-clause 9.3;

### 5.8.8 Sidelink communication transmission

A UE capable of NR sidelink communication that is configured by upper layers to transmit NR sidelink communication and has related data to be transmitted shall:

- 1> if the conditions for NR sidelink communication operation as defined in 5.8.2 are met:
  - 2> if the frequency used for NR sidelink communication is included in *sl-FreqInfoToAddModList* in *sl-ConfigDedicatedNR* within *RRCReconfiguration* message or included in *sl-ConfigCommonNR* within *SIB12*:
    - 3> if the UE is in *RRC\_CONNECTED* and uses the frequency included in *sl-ConfigDedicatedNR* within *RRCReconfiguration* message:
      - 4> if the UE is configured with *sl-ScheduledConfig*:
        - 5> if T310 for MCG or T311 is running; and if *sl-TxPoolExceptional* is included in *sl-FreqInfoList* for the concerned frequency in *SIB12* or included in *sl-ConfigDedicatedNR* in *RRCReconfiguration*; or

- 5> if T316 is running; and if *sl-TxPoolExceptional* is included in *sl-FreqInfoList* for the concerned frequency in *SIB12* or included in *sl-ConfigDedicatedNR* in *RRCReconfiguration*; or
- 5> if T301 is running and the cell on which the UE initiated RRC connection re-establishment provides *SIB12* including *sl-TxPoolExceptional* for the concerned frequency; or
- 5> if T304 for MCG is running and the UE is configured with *sl-TxPoolExceptional* included in *sl-ConfigDedicatedNR* for the concerned frequency in *RRCReconfiguration*:
  - 6> configure lower layers to perform the sidelink resource allocation mode 2 based on random selection using the pool of resources indicated by *sl-TxPoolExceptional* as defined in TS 38.321 [3];
- 5> else:
  - 6> configure lower layers to perform the sidelink resource allocation mode 1 for NR sidelink communication;
- 5> if T311 is running, configure the lower layers to release the resources indicated by *rrc-ConfiguredSidelinkGrant* (if any);
- 4> if the UE is configured with *sl-UE-SelectedConfig*:
  - 5> if a result of sensing on the resources configured in *sl-TxPoolSelectedNormal* for the concerned frequency included in *sl-ConfigDedicatedNR* within *RRCReconfiguration* is not available in accordance with TS 38.214 [19];
    - 6> if *sl-TxPoolExceptional* for the concerned frequency is included in *RRCReconfiguration*; or
    - 6> if the PCell provides *SIB12* including *sl-TxPoolExceptional* in *sl-FreqInfoList* for the concerned frequency:
      - 7> configure lower layers to perform the sidelink resource allocation mode 2 based on random selection using the pool of resources indicated by *sl-TxPoolExceptional* as defined in TS 38.321 [3];
  - 5> else, if the *sl-TxPoolSelectedNormal* for the concerned frequency is included in the *sl-ConfigDedicatedNR* within *RRCReconfiguration*:
    - 6> configure lower layers to perform the sidelink resource allocation mode 2 based on sensing (as defined in TS 38.321 [3] and TS 38.214 [19]) using the resource pools indicated by *sl-TxPoolSelectedNormal* for the concerned frequency;
- 3> else:
  - 4> if the cell chosen for NR sidelink communication transmission provides *SIB12*:
    - 5> if *SIB12* includes *sl-TxPoolSelectedNormal* for the concerned frequency, and a result of sensing on the resources configured in the *sl-TxPoolSelectedNormal* is available in accordance with TS 38.214 [19]
      - 6> configure lower layers to perform the sidelink resource allocation mode 2 based on sensing using the pool of resources indicated by *sl-TxPoolSelectedNormal* for the concerned frequency as defined in TS 38.321 [3];
    - 5> else if *SIB12* includes *sl-TxPoolExceptional* for the concerned frequency:
      - 6> from the moment the UE initiates RRC connection establishment or RRC connection resume, until receiving an *RRCReconfiguration* including *sl-ConfigDedicatedNR*, or receiving an *RRCRelease* or an *RRCReject*; or
      - 6> if a result of sensing on the resources configured in *sl-TxPoolSelectedNormal* for the concerned frequency in *SIB12* is not available in accordance with TS 38.214 [19];

7> configure lower layers to perform the sidelink resource allocation mode 2 based on random selection (as defined in TS 38.321 [3] and TS 38.214 [19]) using one of the resource pools indicated by *sl-TxPoolExceptional* for the concerned frequency;

2> else:

3> configure lower layers to perform the sidelink resource allocation mode 2 based on sensing (as defined in TS 38.321 [3] and TS 38.213 [13]) using the resource pool indicated by *sl-TxPoolSelectedNormal* in *SidelinkPreconfigNR* for the concerned frequency.

The UE capable of NR sidelink communication that is configured by upper layers to transmit NR sidelink communication shall perform sensing on all pools of resources which may be used for transmission of the sidelink control information and the corresponding data. The pools of resources are indicated by *SidelinkPreconfigNR*, *sl-TxPoolSelectedNormal* in *sl-ConfigDedicatedNR*, or *sl-TxPoolSelectedNormal* in *SIB12* for the concerned frequency, as configured above.

## 5.8.9 Sidelink RRC procedure

### 5.8.9.1 Sidelink RRC reconfiguration

#### 5.8.9.1.1 General

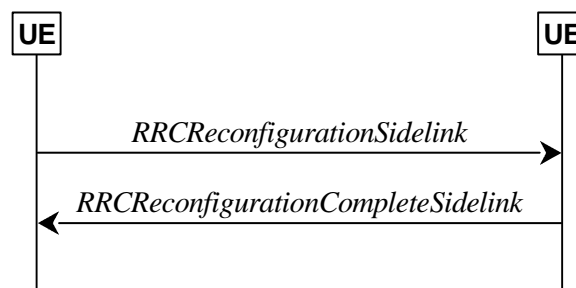


Figure 5.8.9.1.1-1: Sidelink RRC reconfiguration, successful

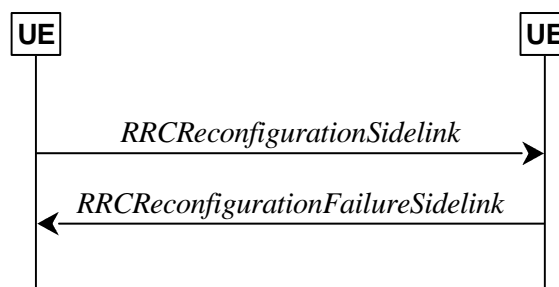


Figure 5.8.9.1.1-2: Sidelink RRC reconfiguration, failure

The purpose of this procedure is to modify a PC5-RRC connection, e.g. to establish/modify/release sidelink DRBs, to configure NR sidelink measurement and reporting, to configure sidelink CSI reference signal resources and CSI reporting latency bound.

The UE may initiate the sidelink RRC reconfiguration procedure and perform the operation in sub-clause 5.8.9.1.2 on the corresponding PC5-RRC connection in following cases:

- the release of sidelink DRBs associated with the peer UE, as specified in sub-clause 5.8.9.1a.1;
- the establishment of sidelink DRBs associated with the peer UE, as specified in sub-clause 5.8.9.1a.2;
- the modification for the parameters included in *SLRB-Config* of sidelink DRBs associated with the peer UE, as specified in sub-clause 5.8.9.1a.2;

- the configuration of the peer UE to perform NR sidelink measurement and report.
- the configuration of the sidelink CSI reference signal resources and CSI reporting latency bound.

In RRC\_CONNECTED, the UE applies the NR sidelink communications parameters provided in *RRCReconfiguration* (if any). In RRC\_IDLE or RRC\_INACTIVE, the UE applies the NR sidelink communications parameters provided in system information (if any). For other cases, UEs apply the NR sidelink communications parameters provided in *SidelinkPreconfigNR* (if any). When UE performs state transition between above three cases, the UE applies the NR sidelink communications parameters provided in the new state, after acquisition of the new configurations. Before acquisition of the new configurations, UE continues applying the NR sidelink communications parameters provided in the old state.

#### 5.8.9.1.2 Actions related to transmission of *RRCReconfigurationSidelink* message

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

- 1> for each sidelink DRB that is to be released, according to sub-clause 5.8.9.1a.1.1, due to configuration by *sl-ConfigDedicatedNR*, *SIB12*, *SidelinkPreconfigNR* or by upper layers:
  - 2> set the *SLRB-PC5-ConfigIndex* included in the *slrb-ConfigToReleaseList* corresponding to the sidelink DRB;
- 1> for each sidelink DRB that is to be established or modified, according to sub-clause 5.8.9.1a.2.1, due to receiving *sl-ConfigDedicatedNR*, *SIB12* or *SidelinkPreconfigNR*:
  - 2> set the *SLRB-Config* included in the *slrb-ConfigToAddModList*, according to the received *sl-RadioBearerConfig* and *sl-RLC-BearerConfig* corresponding to the sidelink DRB;
- 1> set the *sl-MeasConfig* according to the stored NR sidelink measurement configuration information of this destination;
- 1> start timer T400 for the destination associated with the sidelink DRB;
- 1> set the *sl-CSI-RS-Config*;
- 1> set the *sl-LatencyBoundCSI-Report*,

NOTE 1: How to set the parameters included in *sl-CSI-RS-Config* and *sl-LatencyBoundCSI-Report* is up to UE implementation.

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

#### 5.8.9.1.3 Reception of an *RRCReconfigurationSidelink* by the UE

The UE shall perform the following actions upon reception of the *RRCReconfigurationSidelink*:

- 1> if the *RRCReconfigurationSidelink* includes the *sl-ResetConfig*:
  - 2> perform the sidelink reset configuration procedure as specified in 5.8.9.1.10;
- 1> if the *RRCReconfigurationSidelink* includes the *slrb-ConfigToReleaseList*:
  - 2> for each *SLRB-PC5-ConfigIndex* value included in the *slrb-ConfigToReleaseList* that is part of the current UE sidelink configuration;
  - 3> perform the sidelink DRB release procedure, according to sub-clause 5.8.9.1a.1;
- 1> if the *RRCReconfigurationSidelink* includes the *slrb-ConfigToAddModList*:
  - 2> for each *slrb-PC5-ConfigIndex* value included in the *slrb-ConfigToAddModList* that is not part of the current UE sidelink configuration:
    - 3> if *sl-MappedQoS-FlowsToAddList* is included:
      - 4> apply the *SL-PQFI* included in *sl-MappedQoS-FlowsToAddList*;
    - 3> perform the sidelink DRB addition procedure, according to sub-clause 5.8.9.1a.2;

- 2> for each *slrb-PC5-ConfigIndex* value included in the *slrb-ConfigToAddModList* that is part of the current UE sidelink configuration:
  - 3> if *sl-MappedQoS-FlowsToAddList* is included:
    - 4> add the *SL-PQFI* included in *sl-MappedQoS-FlowsToAddList* to the corresponding sidelink DRB;
  - 3> if *sl-MappedQoS-FlowsToReleaseList* is included:
    - 4> remove the *SL-PQFI* included in *sl-MappedQoS-FlowsToReleaseList* from the corresponding sidelink DRB;
  - 3> if the sidelink DRB release conditions as described in sub-clause 5.8.9.1a.1.1 are met:
    - 4> perform the sidelink DRB release procedure according to sub-clause 5.8.9.1a.1.2;
  - 3> else if the sidelink DRB modification conditions as described in sub-clause 5.8.9.1a.2.1 are met:
    - 4> perform the sidelink DRB modification procedure according to sub-clause 5.8.9.1a.2.2;
- 1> if the *RRCReconfigurationSidelink* message includes the *sl-MeasConfig*:
  - 2> perform the sidelink measurement configuration procedure as specified in 5.8.10;
- 1> if the *RRCReconfigurationSidelink* message includes the *sl-CSI-RS-Config*:
  - 2> apply the sidelink CSI-RS configuration;
- 1> if the *RRCReconfigurationSidelink* message includes the *sl-LatencyBoundCSI-Report*:
  - 2> apply the configured sidelink CSI report latency bound;
- 1> if the UE is unable to comply with (part of) the configuration included in the *RRCReconfigurationSidelink* (i.e. sidelink RRC reconfiguration failure):
  - 2> continue using the configuration used prior to the reception of the *RRCReconfigurationSidelink* message;
  - 2> set the content of the *RRCReconfigurationFailureSidelink* message;
  - 3> submit the *RRCReconfigurationFailureSidelink* message to lower layers for transmission;
- 1> else:
  - 2> set the content of the *RRCReconfigurationCompleteSidelink* message;
  - 3> submit the *RRCReconfigurationCompleteSidelink* message to lower layers for transmission;

NOTE 1: When the same logical channel is configured with different RLC mode by another UE, the UE handles the case as sidelink RRC reconfiguration failure.

5.8.9.1.4      Void

5.8.9.1.5      Void

5.8.9.1.6      Void

5.8.9.1.7      Void

5.8.9.1.8      Reception of an *RRCReconfigurationFailureSidelink* by the UE

The UE shall perform the following actions upon reception of the *RRCReconfigurationFailureSidelink*:

- 1> stop timer T400, if running;
- 1> continue using the configuration used prior to corresponding *RRCReconfigurationSidelink* message;

1> if UE is in RRC\_CONNECTED:

- 2> perform the sidelink UE information for NR sidelink communication procedure, as specified in 5.8.3.3 or sub-clause 5.10.15 in TS 36.331 [10];

#### 5.8.9.1.9 Reception of an *RRCReconfigurationCompleteSidelink* by the UE

The UE shall perform the following actions upon reception of the *RRCReconfigurationCompleteSidelink*:

- 1> stop timer T400, if running;
- 1> consider the configurations in the corresponding *RRCReconfigurationSidelink* message to be applied.

#### 5.8.9.1.10 Sidelink reset configuration

The UE shall:

- 1> release/clear all current sidelink radio configuration of this destination;
- 1> release the sidelink DRBs of this destination, in according to sub-clause 5.8.9.1a.1;
- 1> reset the sidelink specific MAC of this destination.

### 5.8.9.1a Sidelink radio bearer management

#### 5.8.9.1a.1 Sidelink DRB release

##### 5.8.9.1a.1.1 Sidelink DRB release conditions

For NR sidelink communication, a sidelink DRB release is initiated in the following cases:

- 1> for groupcast, broadcast and unicast, if *slrb-Uu-ConfigIndex* (if any) of the sidelink DRB is included in *sl-RadioBearerToReleaseList* in *sl-ConfigDedicatedNR*; or
- 1> for groupcast and broadcast, if no sidelink QoS flow with data indicated by upper layers is mapped to the sidelink DRB for transmission, which is (re)configured by receiving *SIB12* or *SidelinkPreconfigNR*; or
- 1> for unicast, if no sidelink QoS flow with data indicated by upper layers is mapped to the sidelink DRB for transmission, which is (re)configured by receiving *SIB12* or *SidelinkPreconfigNR*, and if no sidelink QoS flow mapped to the sidelink DRB, which is (re)configured by receiving *RRCReconfigurationSidelink*, has data; or
- 1> for unicast, if *SLRB-PC5-ConfigIndex* (if any) of the sidelink DRB is included in *slrb-ConfigToReleaseList* in *RRCReconfigurationSidelink*;

For NR sidelink communication, a sidelink DRB release is also initiated when the corresponding PC5-RRC connection is released due to sidelink RLF being detected.

##### 5.8.9.1a.1.2 Sidelink DRB release operations

For each sidelink DRB, whose sidelink DRB release conditions are met as in sub-clause 5.8.9.1a.1.1, the UE capable of NR sidelink communication that is configured by upper layers to perform NR sidelink communication shall:

- 1> for groupcast and broadcast, or
- 1> for unicast, after receiving *RRCReconfigurationSidelink* message (in case the release is due to the configuration by *RRCReconfigurationSidelink*), or after receiving the *RRCReconfigurationCompleteSidelink* message (in case the release is due to the configuration by *sl-ConfigDedicatedNR*, *SIB12*, *SidelinkPreconfigNR* or indicated by upper layers):
  - 2> release the PDCP entity for NR sidelink communication associated with the sidelink DRB;
  - 2> if SDAP entity for NR sidelink communication associated with this sidelink DRB is configured:

- 3> indicate the release of the sidelink DRB to the SDAP entity associated with this sidelink DRB (TS 37.324 [24], clause 5.3.3);
- 2> release SDAP entities for NR sidelink communication, if any, that have no associated sidelink DRB as specified in TS 37.324 [24] clause 5.1.2;
- 1> for groupcast and broadcast, or
  - 1> for unicast, after receiving the *RRCReconfigurationCompleteSidelink* message (in case the release is due to the configuration by *sl-ConfigDedicatedNR*):
    - 2> for each *sl-RLC-BearerConfigIndex* included in the received *sl-RLC-BearerToReleaseList* that is part of the current UE sidelink configuration:
      - 3> release the RLC entity and the corresponding logical channel for NR sidelink communication, associated with the *sl-RLC-BearerConfigIndex*.
    - 1> for unicast, after receiving *RRCReconfigurationSidelink* message (in case the release is due to the configuration by *RRCReconfigurationSidelink*), or after receiving the *RRCReconfigurationCompleteSidelink* message (in case the release is due to the configuration by *SIB12*, *SidelinkPreconfigNR* or indicated by upper layers):
      - 2> release the RLC entity and the corresponding logical channel for NR sidelink communication associated with the sidelink DRB;
      - 2> perform the sidelink UE information procedure in sub-clause 5.8.3 for unicast if needed.

#### 5.8.9.1a.2 Sidelink DRB addition/modification

##### 5.8.9.1a.2.1 Sidelink DRB addition/modification conditions

For NR sidelink communication, a sidelink DRB addition is initiated only in the following cases:

- 1> if any sidelink QoS flow is (re)configured by *sl-ConfigDedicatedNR*, *SIB12*, *SidelinkPreconfigNR* and is to be mapped to one sidelink DRB, which is not established; or
- 1> if any sidelink QoS flow is (re)configured by *RRCReconfigurationSidelink* and is to be mapped to a sidelink DRB, which is not established;

For NR sidelink communication, a sidelink DRB modification is initiated only in the following cases:

- 1> if any of the sidelink DRB related parameters is changed by *sl-ConfigDedicatedNR*, *SIB12*, *SidelinkPreconfigNR* or *RRCReconfigurationSidelink* for one sidelink DRB, which is established;

##### 5.8.9.1a.2.2 Sidelink DRB addition/modification operations

For the sidelink DRB, whose sidelink DRB addition conditions are met as in sub-clause 5.8.9.1a.2.1, the UE capable of NR sidelink communication that is configured by upper layers to perform NR sidelink communication shall:

- 1> for groupcast and broadcast, or
  - 1> for unicast, after receiving *RRCReconfigurationSidelink* message (in case the addition is due to the configuration by *RRCReconfigurationSidelink*), or after receiving the *RRCReconfigurationCompleteSidelink* message (in case the addition is due to the configuration by *sl-ConfigDedicatedNR*, *SIB12*, *SidelinkPreconfigNR* or indicated by upper layers):
    - 2> if an SDAP entity for NR sidelink communication associated with the destination and the cast type of the sidelink DRB does not exist:
      - 3> establish an SDAP entity for NR sidelink communication as specified in TS 37.324 [24] clause 5.1.1;
      - 3> configure the SDAP entity in accordance with the *sl-SDAP-ConfigPC5* received in the *RRCReconfigurationSidelink* or *sl-SDAP-Config* received in *sl-ConfigDedicatedNR*, *SIB12*, *SidelinkPreconfigNR*, associated with the sidelink DRB;

- 2> establish a PDCP entity for NR sidelink communication and configure it in accordance with the *sl-PDCP-ConfigPC5* received in the *RRCReconfigurationSidelink* or *sl-PDCP-Config* received in *sl-ConfigDedicatedNR*, *SIB12*, *SidelinkPreconfigNR*, associated with the sidelink DRB;
- 2> establish a RLC entity for NR sidelink communication and configure it in accordance with the *sl-RLC-ConfigPC5* received in the *RRCReconfigurationSidelink* or *sl-RLC-Config* received in *sl-ConfigDedicatedNR*, *SIB12*, *SidelinkPreconfigNR*, associated with sidelink DRB;
- 2> if the *RRCReconfigurationSidelink* is received:
  - 3> configure the MAC entity with a logical channel in accordance with the *sl-MAC-LogicalChannelConfigPC5* received in the *RRCReconfigurationSidelink* associated with the sidelink DRB, and perform the sidelink UE information procedure in sub-clause 5.8.3 for unicast if need;
- 2> else:
  - 3> configure the MAC entity with a logical channel associated with the sidelink DRB, by assigning a new logical channel identity, in accordance with the *sl-MAC-LogicalChannelConfig* received in the *sl-ConfigDedicatedNR*, *SIB12*, *SidelinkPreconfigNR*.

NOTE 1: When a sidelink DRB addition is due to the configuration by *RRCReconfigurationSidelink*, it is up to UE implementation to select the sidelink DRB configuration as necessary transmitting parameters for the sidelink DRB, from the received *sl-ConfigDedicatedNR* (if in *RRC\_CONNECTED*), *SIB12* (if in *RRC\_IDLE/INACTIVE*), *SidelinkPreconfigNR* (if out of coverage) with the same RLC mode as the one configured in *RRCReconfigurationSidelink*.

For the sidelink DRB, whose sidelink DRB modification conditions are met as in sub-clause 5.8.9.1a.2.1, the UE capable of NR sidelink communication that is configured by upper layers to perform NR sidelink communication shall:

- 1> for groupcast and broadcast, or
  - 1> for unicast, after receiving *RRCReconfigurationSidelink* message (in case the modification is due to the configuration by *RRCReconfigurationSidelink*), or after receiving the *RRCReconfigurationCompleteSidelink* message (in case the modification is due to the configuration by *sl-ConfigDedicatedNR*, *SIB12* or *SidelinkPreconfigNR*):
    - 2> reconfigure the SDAP entity of the sidelink DRB, in accordance with the *sl-SDAP-ConfigPC5* received in the *RRCReconfigurationSidelink* or *sl-SDAP-Config* received in *sl-ConfigDedicatedNR*, *SIB12*, *SidelinkPreconfigNR*, if included;
    - 2> reconfigure the PDCP entity of the sidelink DRB, in accordance with the *sl-PDCP-ConfigPC5* received in the *RRCReconfigurationSidelink* or *sl-PDCP-Config* received in *sl-ConfigDedicatedNR*, *SIB12*, *SidelinkPreconfigNR*, if included;
    - 2> reconfigure the RLC entity of the sidelink DRB, in accordance with the *sl-RLC-ConfigPC5* received in the *RRCReconfigurationSidelink* or *sl-RLC-Config* received in *sl-ConfigDedicatedNR*, *SIB12*, *SidelinkPreconfigNR*, if included;
    - 2> reconfigure the logical channel of the sidelink DRB, in accordance with the *sl-MAC-LogicalChannelConfigPC5* received in the *RRCReconfigurationSidelink* or *sl-MAC-LogicalChannelConfig* received in *sl-ConfigDedicatedNR*, *SIB12*, *SidelinkPreconfigNR*, if included.

### 5.8.9.1a.3 Sidelink SRB release

The UE shall:

- 1> if a PC5-RRC connection release for a specific destination is requested by upper layers; or
- 1> if the sidelink radio link failure is detected for a specific destination:
  - 2> release the PDCP entity, RLC entity and the logical channel of the sidelink SRB for PC5-RRC message of the specific destination;
  - 2> consider the PC5-RRC connection is released for the destination.



- 1> if PC5-S transmission for a specific destination is terminated in upper layers:
  - 2> release the PDCP entity, RLC entity and the logical channel of the sidelink SRB(s) for PC5-S message of the specific destination;

#### 5.8.9.1a.4 Sidelink SRB addition

The UE shall:

- 1> if transmission of PC5-S message for a specific destination is requested by upper layers for sidelink SRB:
  - 2> establish PDCP entity, RLC entity and the logical channel of a sidelink SRB for PC5-S message, as specified in sub-clause 9.1.1.4;
- 1> if a PC5-RRC connection establishment for a specific destination is indicated by upper layers:
  - 2> establish PDCP entity, RLC entity and the logical channel of a sidelink SRB for PC5-RRC message of the specific destination, as specified in sub-clause 9.1.1.4;
  - 2> consider the PC5-RRC connection is established for the destination.

### 5.8.9.2 Sidelink UE capability transfer

#### 5.8.9.2.1 General

This clause describes how the UE compiles and transfers its sidelink UE capability information for unicast to the initiating UE.

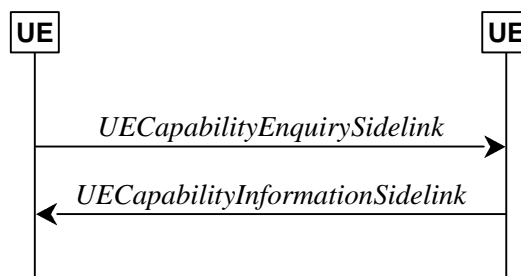


Figure 5.8.9.2.1-1: Sidelink UE capability transfer

#### 5.8.9.2.2 Initiation

The UE may initiate the sidelink UE capability transfer procedure upon indication from upper layer when it needs (additional) UE radio access capability information.

#### 5.8.9.2.3 Actions related to transmission of the *UECapabilityEnquirySidelink* by the UE

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

- 1> include in UE radio access capabilities for sidelink within *ue-CapabilityInformationSidelink*, if needed;

NOTE: It is up to initiating UE to decide whether *ue-CapabilityInformationSidelink* should be included.

- 1> set *frequencyBandListFilterSidelink* to include frequency bands for which the peer UE is requested to provide supported bands and band combinations;
- 1> submit the *UECapabilityEnquirySidelink* message to lower layers for transmission.

#### 5.8.9.2.4 Actions related to reception of the *UECapabilityEnquirySidelink* by the UE

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

- 1> include UE radio access capabilities for sidelink within *ue-CapabilityInformationSidelink*;
- 1> compile a list of "candidate band combinations" only consisting of bands included in *frequencyBandListFilter*, and prioritized in the order of *frequencyBandListFilterSidelink* (i.e. first include band combinations containing the first-listed band, then include remaining band combinations containing the second-listed band, and so on).
- 1> include into *supportedBandCombinationListSidelinkNR* as many band combinations as possible from the list of "candidate band combinations", starting from the first entry;
- 1> include the received *frequencyBandListFilter* in the field *appliedFreqBandListFilter* of the requested UE capability;
- 1> submit the *UECapabilityInformationSidelink* message to lower layers for transmission.

### 5.8.9.3 Sidelink radio link failure related actions

The UE shall:

- 1> upon indication from sidelink RLC entity that the maximum number of retransmissions for a specific destination has been reached; or
- 1> upon T400 expiry for a specific destination; or
- 1> upon indication from sidelink MAC entity that the maximum number of consecutive HARQ DTX for a specific destination has been reached; or
- 1> upon integrity check failure indication from sidelink PDCP entity concerning SL-SRB2 or SL-SRB3 for a specific destination:
  - 2> consider sidelink radio link failure to be detected for this destination;
  - 2> release the DRBs of this destination, in according to sub-clause 5.8.9.1a.1;
  - 2> release the SRBs of this destination, in according to sub-clause 5.8.9.1a.3;
  - 2> discard the NR sidelink communication related configuration of this destination;
  - 2> reset the sidelink specific MAC of this destination;
  - 2> consider the PC5-RRC connection is released for the destination;
  - 2> indicate the release of the PC5-RRC connection to the upper layers for this destination (i.e. PC5 is unavailable);
  - 2> if UE is in RRC\_CONNECTED:
    - 3> perform the sidelink UE information for NR sidelink communication procedure, as specified in 5.8.3.3;

NOTE: It is up to UE implementation on whether and how to indicate to upper layers to maintain the keep-alive procedure [55].

### 5.8.9.4 Sidelink common control information

#### 5.8.9.4.1 General

The sidelink common control information is carried by *MasterInformationBlockSidelink*. The sidelink common control information may change at any transmission, i.e. neither a modification period nor a change notification mechanism is used.

A UE configured to receive or transmit NR sidelink communication shall:

- 1> if the UE has a selected SyncRef UE, as specified in 5.8.6:
  - 2> ensure having a valid version of the *MasterInformationBlockSidelink* message of that SyncRef UE;

#### 5.8.9.4.2 Actions related to reception of *MasterInformationBlockSidelink* message

Upon receiving *MasterInformationBlockSidelink*, the UE shall:

- 1> apply the values included in the received *MasterInformationBlockSidelink* message.

#### 5.8.9.4.3 Transmission of *MasterInformationBlockSidelink* message

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

- 1> if in coverage on the frequency used for the NR sidelink communication as defined in TS 38.304 [20].

- 2> set *inCoverage* to *true*;

- 2> if *tdd-UL-DL-ConfigurationCommon* is included in the received *SIB1*:

- 3> set *sl-TDD-Config* to the value representing the same meaning as that is included in *tdd-UL-DL-ConfigurationCommon*;

- 2> else:

- 3> set *sl-TDD-Config* to *none*;

- 2> if *syncInfoReserved* is included in an entry of configured *sl-SyncConfigList* corresponding to the concerned frequency from the received *SIB12*:

- 3> set *reservedBits* to the value of *syncInfoReserved* in the received *SIB12*;

- 2> else:

- 3> set all bits in *reservedBits* to 0;

- 1> else if out of coverage on the frequency used for NR sidelink communication as defined in TS 38.304 [20]; and the concerned frequency is included in *sl-FreqInfoToAddModList* in *RRCReconfiguration* or in *sl-FreqInfoList* within *SIB12*, or the UE selects GNSS timing as the synchronization reference source:

- 2> set *inCoverage* to *true*;

- 2> set *sl-TDD-Config* and *reservedBits* to the value of the corresponding field included in the preconfigured sidelink parameters (i.e. *sl-PreconfigGeneral* in *SidelinkPreconfigNR* defined in 9.3);

- 1> else if out of coverage on the frequency used for NR sidelink communication as defined in TS 38.304 [20]; and the UE selects GNSS as the synchronization reference and *sl-SSB-TimeAllocation3* is not configured for the frequency used in *SidelinkPreconfigNR*:

- 2> set *inCoverage* to *true*;

- 2> set *sl-TDD-Config* and *reservedBits* to the value of the corresponding field included in the preconfigured sidelink parameters (i.e. *sl-PreconfigGeneral* in *SidelinkPreconfigNR* defined in 9.3);

- 1> else if the UE has a selected SyncRef UE (as defined in 5.8.6):

- 2> set *inCoverage* to *false*;

- 2> set *sl-TDD-Config* and *reservedBits* to the value of the corresponding field included in the received *MasterInformationBlockSidelink*;

- 1> else:

- 2> set *inCoverage* to *false*;

- 2> set *sl-TDD-Config* and *reservedBits* to the value of the corresponding field included in the preconfigured sidelink parameters (i.e. *sl-PreconfigGeneral* in *SidelinkPreconfigNR* defined in 9.3);

- 1> set *directFrameNumber* and *slotIndex* according to the slot used to transmit the SLSS, as specified in 5.8.5.3;

- 1> submit the *MasterInformationBlockSidelink* to lower layers for transmission upon which the procedure ends;

## 5.8.10 Sidelink measurement

### 5.8.10.1 Introduction

The UE may configure the associated peer UE to perform NR sidelink measurement and report on the corresponding PC5-RRC connection in accordance with the NR sidelink measurement configuration for unicast by *RRCReconfigurationSidelink* message.

The NR sidelink measurement configuration includes the following parameters for a PC5-RRC connection:

1. **NR sidelink measurement objects:** Object(s) on which the associated peer UE shall perform the NR sidelink measurements.
  - For NR sidelink measurement, a NR sidelink measurement object indicates the NR sidelink frequency of reference signals to be measured.
2. **NR sidelink reporting configurations:** NR sidelink measurement reporting configuration(s) where there can be one or multiple NR sidelink reporting configurations per NR sidelink measurement object. Each NR sidelink reporting configuration consists of the following:
  - Reporting criterion: The criterion that triggers the UE to send a NR sidelink measurement report. This can either be periodical or a single event description.
  - RS type: The RS that the UE uses for NR sidelink measurement results. In this release, only DMRS is supported for NR sidelink measurement.
  - Reporting format: The quantities that the UE includes in the measurement report. In this release, only RSRP measurement is supported.
3. **NR sidelink measurement identities:** A list of NR sidelink measurement identities where each NR sidelink measurement identity links one NR sidelink measurement object with one NR sidelink reporting configuration. By configuring multiple NR sidelink measurement identities, it is possible to link more than one NR sidelink measurement object to the same NR sidelink reporting configuration, as well as to link more than one NR sidelink reporting configuration to the same NR sidelink measurement object. The NR sidelink measurement identity is also included in the NR sidelink measurement report that triggered the reporting, serving as a reference to the network.
4. **NR sidelink quantity configurations:** The NR sidelink quantity configuration defines the NR sidelink measurement filtering configuration used for all event evaluation and related reporting, and for periodical reporting of that NR sidelink measurement. In each configuration, different filter coefficients can be configured for different NR sidelink measurement quantities.

Both UEs of the PC5-RRC connection maintains a NR sidelink measurement object list, a NR sidelink reporting configuration list, and a NR sidelink measurement identities list according to signalling and procedures in this specification.

### 5.8.10.2 Sidelink measurement configuration

#### 5.8.10.2.1 General

The UE shall:

- 1> if the received *sl-MeasConfig* includes the *sl-MeasObjectToRemoveList* in the *RRCReconfigurationSidelink*:
  - 2> perform the sidelink measurement object removal procedure as specified in 5.8.10.2.4;
- 1> if the received *sl-MeasConfig* includes the *sl-MeasObjectToAddModList* in the *RRCReconfigurationSidelink*:
  - 2> perform the sidelink measurement object addition/modification procedure as specified in 5.8.10.2.5;
- 1> if the received *sl-MeasConfig* includes the *sl-ReportConfigToRemoveList* in the *RRCReconfigurationSidelink*:
  - 2> perform the sidelink reporting configuration removal procedure as specified in 5.8.10.2.6;

- 1> if the received *sl-MeasConfig* includes the *sl-ReportConfigToAddModList* in the *RRCReconfigurationSidelink*:
  - 2> perform the sidelink reporting configuration addition/modification procedure as specified in 5.8.10.2.7;
- 1> if the received *sl-MeasConfig* includes the *sl-QuantityConfig* in the *RRCReconfigurationSidelink*:
  - 2> perform the sidelink quantity configuration procedure as specified in 5.8.10.2.8;
- 1> if the received *sl-MeasConfig* includes the *sl-MeasIdToRemoveList* in the *RRCReconfigurationSidelink*:
  - 2> perform the sidelink measurement identity removal procedure as specified in 5.8.10.2.2;
- 1> if the received *sl-MeasConfig* includes the *sl-MeasIdToAddModList* in the *RRCReconfigurationSidelink*:
  - 2> perform the sidelink measurement identity addition/modification procedure as specified in 5.8.10.2.3;

#### 5.8.10.2.2 Sidelink measurement identity removal

The UE shall:

- 1> for each *sl-MeasId* included in the received *sl-MeasIdToRemoveList* that is part of the current UE configuration in *VarMeasConfigSL*:
  - 2> remove the entry with the matching *sl-MeasId* from the *sl-MeasIdList* within the *VarMeasConfigSL*;
  - 2> remove the NR sidelink measurement reporting entry for this *sl-MeasId* from the *VarMeasReportListSL*, if included;
  - 2> stop the periodical reporting timer and reset the associated information (e.g. *sl-TimeToTrigger*) for this *sl-MeasId*.

NOTE: The UE does not consider the message as erroneous if the *sl-MeasIdToRemoveList* includes any *sl-MeasId* value that is not part of the current UE configuration.

#### 5.8.10.2.3 Sidelink measurement identity addition/modification

The UE shall:

- 1> for each *sl-MeasId* included in the received *sl-MeasIdToAddModList*:
  - 2> if an entry with the matching *sl-MeasId* exists in the *sl-MeasIdList* within the *VarMeasConfigSL*:
    - 3> replace the entry with the value received for this *sl-MeasId*;
  - 2> else:
    - 3> add a new entry for this *sl-MeasId* within the *VarMeasConfigSL*;
  - 2> remove the measurement reporting entry for this *sl-MeasId* from the *VarMeasReportListSL*, if included;
  - 2> stop the periodical reporting timer and reset the associated information (e.g. *sl-TimeToTrigger*) for this *sl-MeasId*;

#### 5.8.10.2.4 Sidelink measurement object removal

The UE shall:

- 1> for each *sl-MeasObjectId* included in the received *sl-MeasObjectToRemoveList* that is part of *sl-MeasObjectList* in *VarMeasConfigSL*:
  - 2> remove the entry with the matching *sl-MeasObjectId* from the *sl-MeasObjectList* within the *VarMeasConfigSL*;
  - 2> remove all *sl-MeasId* associated with this *sl-MeasObjectId* from the *sl-MeasIdList* within the *VarMeasConfigSL*, if any;

- 2> if a *sl-MeasId* is removed from the *sl-MeasIdList*:
  - 3> remove the measurement reporting entry for this *sl-MeasId* from the *VarMeasReportListSL*, if included;
  - 3> stop the periodical reporting timer and reset the associated information (e.g. *sl-TimeToTrigger*) for this *sl-MeasId*.

NOTE: The UE does not consider the message as erroneous if the *sl-MeasObjectToRemoveList* includes any *sl-MeasObjectId* value that is not part of the current UE configuration.

#### 5.8.10.2.5 Sidelink measurement object addition/modification

The UE shall:

- 1> for each *sl-MeasObjectId* included in the received *sl-MeasObjectToAddModList*:
  - 2> if an entry with the matching *sl-MeasObjectId* exists in the *sl-MeasObjectList* within the *VarMeasConfigSL*, for this entry:
    - 3> reconfigure the entry with the value received for this *sl-MeasObject*;
  - 2> else:
    - 3> add a new entry for the received *sl-MeasObject* to the *sl-MeasObjectList* within *VarMeasConfigSL*.

#### 5.8.10.2.6 Sidelink reporting configuration removal

The UE shall:

- 1> for each *sl-ReportConfigId* included in the received *sl-ReportConfigToRemoveList* that is part of the current UE configuration in *VarMeasConfigSL*:
  - 2> remove the entry with the matching *sl-ReportConfigId* from the *sl-ReportConfigList* within the *VarMeasConfigSL*;
  - 2> remove all *sl-MeasId* associated with the *sl-ReportConfigId* from the *sl-MeasIdList* within the *VarMeasConfigSL*, if any;
  - 2> if a *sl-MeasId* is removed from the *sl-MeasIdList*:
    - 3> remove the measurement reporting entry for this *sl-MeasId* from the *VarMeasReportListSL*, if included;
    - 3> stop the periodical reporting timer and reset the associated information (e.g. *sl-TimeToTrigger*) for this *sl-MeasId*.

NOTE: The UE does not consider the message as erroneous if the *sl-ReportConfigToRemoveList* includes any *sl-ReportConfigId* value that is not part of the current UE configuration.

#### 5.8.10.2.7 Sidelink reporting configuration addition/modification

The UE shall:

- 1> for each *sl-ReportConfigId* included in the received *sl-ReportConfigToAddModList*:
  - 2> if an entry with the matching *sl-ReportConfigId* exists in the *sl-ReportConfigList* within the *VarMeasConfigSL*, for this entry:
    - 3> reconfigure the entry with the value received for this *sl-ReportConfig*;
    - 3> for each *sl-MeasId* associated with this *sl-ReportConfigId* included in the *sl-MeasIdList* within the *VarMeasConfigSL*, if any:
      - 4> remove the measurement reporting entry for this *sl-MeasId* from the *VarMeasReportListSL*, if included;

4> stop the periodical reporting timer and reset the associated information (e.g. *sl-TimeToTrigger*) for this *sl-MeasId*;

2> else:

3> add a new entry for the received *sl-ReportConfig* to the *sl-ReportConfigList* within the *VarMeasConfigSL*.

### 5.8.10.2.8 Sidelink quantity configuration

The UE shall:

1> for each received *sl-QuantityConfig*:

2> set the corresponding parameter(s) in *sl-QuantityConfig* within *VarMeasConfigSL* to the value of the received *sl-QuantityConfig* parameter(s);

1> for each *sl-MeasId* included in the *sl-MeasIdList* within *VarMeasConfigSL*:

2> remove the measurement reporting entry for this *sl-MeasId* from the *VarMeasReportListSL*, if included;

2> stop the periodical reporting timer and reset the associated information (e.g. *sl-TimeToTrigger*) for this *sl-MeasId*.

### 5.8.10.3 Performing NR sidelink measurements

#### 5.8.10.3.1 General

A UE shall derive NR sidelink measurement results by measuring one or multiple DMRS associated per PC5-RRC connection as configured by the peer UE associated, as described in 5.8.10.3.2. For all NR sidelink measurement results the UE applies the layer 3 filtering as specified in sub-clause 5.5.3.2, before using the measured results for evaluation of reporting criteria and measurement reporting. In this release, only NR sidelink RSRP can be configured as trigger quantity and reporting quantity.

The UE shall:

1> for each *sl-MeasId* included in the *sl-MeasIdList* within *VarMeasConfigSL*:

2> if the *sl-MeasObject* is associated to NR sidelink and the *sl-RS-Type* is set to *dmrs*:

3> derive the layer 3 filtered NR sidelink measurement result based on DMRS for the trigger quantity and each measurement quantity indicated in *sl-ReportQuantity* using parameters from the associated *sl-MeasObject*, as described in 5.8.10.3.2.

2> perform the evaluation of reporting criteria as specified in 5.8.10.4.

#### 5.8.10.3.2 Derivation of NR sidelink measurement results

The UE may be configured by the peer UE associated to derive NR sidelink RSRP measurement results per PC5-RRC connection associated to the NR sidelink measurement objects based on parameters configured in the *sl-MeasObject* and in the *sl-ReportConfig*.

The UE shall:

1> for each NR sidelink measurement quantity to be derived based on NR sidelink DMRS:

2> derive the corresponding measurement of NR sidelink frequency indicated quantity based on DMRS as described in TS 38.215 [9] in the concerned *sl-MeasObject*;

2> apply layer 3 filtering as described in 5.5.3.2;

## 5.8.10.4 Sidelink measurement report triggering

### 5.8.10.4.1 General

The UE shall:

- 1> for each *sl-MeasId* included in the *sl-MeasIdList* within *VarMeasConfigSL*:
  - 2> if the *sl-ReportType* is set to *sl-EventTriggered* and if the entry condition applicable for this event, i.e. the event corresponding with the *sl-EventId* of the corresponding *sl-ReportConfig* within *VarMeasConfigSL*, is fulfilled for NR sidelink frequency for all NR sidelink measurements after layer 3 filtering taken during *sl-TimeToTrigger* defined for this event within the *VarMeasConfigSL*, while the *VarMeasReportListSL* does not include a NR sidelink measurement reporting entry for this *sl-MeasId* (a first NR sidelink frequency triggers the event):
    - 3> include a NR sidelink measurement reporting entry within the *VarMeasReportListSL* for this *sl-MeasId*;
    - 3> set the *sl-NumberOfReportsSent* defined within the *VarMeasReportListSL* for this *sl-MeasId* to 0;
    - 3> include the concerned NR sidelink frequency in the *sl-FrequencyTriggeredList* defined within the *VarMeasReportListSL* for this *sl-MeasId*;
    - 3> initiate the NR sidelink measurement reporting procedure, as specified in 5.8.10.5;
  - 2> else if the *sl-ReportType* is set to *sl-EventTriggered* and if the entry condition applicable for this event, i.e. the event corresponding with the *sl-EventId* of the corresponding *sl-ReportConfig* within *VarMeasConfigSL*, is fulfilled for NR sidelink frequency not included in the *sl-FrequencyTriggeredList* for all NR sidelink measurements after layer 3 filtering taken during *sl-TimeToTrigger* defined for this event within the *VarMeasConfigSL* (a subsequent NR sidelink frequency triggers the event):
    - 3> set the *sl-NumberOfReportsSent* defined within the *VarMeasReportListSL* for this *sl-MeasId* to 0;
    - 3> include the concerned NR sidelink frequency in the *sl-FrequencyTriggeredList* defined within the *VarMeasReportListSL* for this *sl-MeasId*;
    - 3> initiate the NR sidelink measurement reporting procedure, as specified in 5.8.10.5;
  - 2> else if the *sl-ReportType* is set to *sl-EventTriggered* and if the leaving condition applicable for this event is fulfilled for NR sidelink frequency included in the *sl-FrequencyTriggeredList* defined within the *VarMeasReportListSL* for this *sl-MeasId* for all NR sidelink measurements after layer 3 filtering taken during *sl-TimeToTrigger* defined within the *VarMeasConfigSL* for this event:
    - 3> remove the concerned NR sidelink frequency in the *sl-FrequencyTriggeredList* defined within the *VarMeasReportListSL* for this *sl-MeasId*;
    - 3> if *sl-ReportOnLeave* is set to *true* for the corresponding reporting configuration:
      - 4> initiate the NR sidelink measurement reporting procedure, as specified in 5.8.10.5;
    - 3> if the *sl-FrequencyTriggeredList* defined within the *VarMeasReportListSL* for this *sl-MeasId* is empty:
      - 4> remove the NR sidelink measurement reporting entry within the *VarMeasReportListSL* for this *sl-MeasId*;
      - 4> stop the periodical reporting timer for this *sl-MeasId*, if running;
  - 2> if *sl-ReportType* is set to *sl-Periodical* and if a (first) NR sidelink measurement result is available:
    - 3> include a NR sidelink measurement reporting entry within the *VarMeasReportListSL* for this *sl-MeasId*;
    - 3> set the *sl-NumberOfReportsSent* defined within the *VarMeasReportListSL* for this *sl-MeasId* to 0;
    - 3> initiate the NR sidelink measurement reporting procedure, as specified in 5.8.10.5, immediately after the quantity to be reported becomes available for the NR sidelink frequency;
  - 2> upon expiry of the periodical reporting timer for this *sl-MeasId*:



3> initiate the NR sidelink measurement reporting procedure, as specified in 5.8.10.5.

#### 5.8.10.4.2 Event S1 (Serving becomes better than threshold)

The UE shall:

- 1> consider the entering condition for this event to be satisfied when condition S1-1, as specified below, is fulfilled;
- 1> consider the leaving condition for this event to be satisfied when condition S1-2, as specified below, is fulfilled;
- 1> for this NR sidelink measurement, consider the NR sidelink frequency corresponding to the associated *sl-MeasObject* associated with this event.

Inequality S1-1 (Entering condition)

$$Ms - Hys > Thresh$$

Inequality S1-2 (Leaving condition)

$$Ms + Hys < Thresh$$

The variables in the formula are defined as follows:

***Ms*** is the NR sidelink measurement result of the NR sidelink frequency, not taking into account any offsets.

***Hys*** is the hysteresis parameter for this event (i.e. *sl-Hysteresis* as defined within *sl-ReportConfig* for this event).

***Thresh*** is the threshold parameter for this event (i.e. *s1-Threshold* as defined within *sl-ReportConfig* for this event).

***Ms*** is expressed in dBm in case of RSRP.

***Hys*** is expressed in dB.

***Thresh*** is expressed in the same unit as ***Ms***.

#### 5.8.10.4.3 Event S2 (Serving becomes worse than threshold)

The UE shall:

- 1> consider the entering condition for this event to be satisfied when condition S2-1, as specified below, is fulfilled;
- 1> consider the leaving condition for this event to be satisfied when condition S2-2, as specified below, is fulfilled;
- 1> for this NR sidelink measurement, consider the NR sidelink frequency indicated by the *sl-MeasObject* associated to this event.

Inequality S2-1 (Entering condition)

$$Ms + Hys < Thresh$$

Inequality S2-2 (Leaving condition)

$$Ms - Hys > Thresh$$

The variables in the formula are defined as follows:

***Ms*** is the NR sidelink measurement result of the NR sidelink frequency, not taking into account any offsets.

***Hys*** is the hysteresis parameter for this event (i.e. *sl-Hysteresis* as defined within *sl-ReportConfig* for this event).

***Thresh*** is the threshold parameter for this event (i.e. *s2-Threshold* as defined within *sl-ReportConfig* for this event).

***Ms*** is expressed in dBm in case of RSRP.

***Hys*** is expressed in dB.

***Thresh*** is expressed in the same unit as ***Ms***.

## 5.8.10.5 Sidelink measurement reporting

### 5.8.10.5.1 General



**Figure 5.8.10.5.1-1: NR sidelink measurement reporting**

The purpose of this procedure is to transfer measurement results from the UE to the peer UE associated.

For the *sl-MeasId* for which the NR sidelink measurement reporting procedure was triggered, the UE shall set the *sl-MeasResults* within the *MeasurementReportSidelink* message as follows:

- 1> set the *sl-MeasId* to the measurement identity that triggered the NR sidelink measurement reporting;
- 1> if the *sl-ReportConfig* associated with the *sl-MeasId* that triggered the NR sidelink measurement reporting is set to *sl-EventTriggered* or *sl-Periodical*:
  - 2> set *sl-ResultDMRS* within *sl-MeasResult* to include the NR sidelink DMRS based quantity indicated in the *sl-ReportQuantity* within the concerned *sl-ReportConfig*;
- 1> increment the *sl-NumberOfReportsSent* as defined within the *VarMeasReportListSSL* for this *sl-MeasId* by 1;
- 1> stop the periodical reporting timer, if running;
- 1> if the *sl-NumberOfReportsSent* as defined within the *VarMeasReportListSL* for this *sl-MeasId* is less than the *sl-ReportAmount* as defined within the corresponding *sl-ReportConfig* for this *sl-MeasId*:
  - 2> start the periodical reporting timer with the value of *sl-ReportInterval* as defined within the corresponding *sl-ReportConfig* for this *sl-MeasId*;
- 1> else:
  - 2> if the *sl-ReportType* is set to *sl-Periodical*:
    - 3> remove the entry within the *VarMeasReportListSL* for this *sl-MeasId*;
    - 3> remove this *sl-MeasId* from the *sl-MeasIdList* within *VarMeasConfigSL*;
- 1> submit the *MeasurementReportSidelink* message to lower layers for transmission, upon which the procedure ends.

## 5.8.11 Zone identity calculation

The UE shall determine an identity of the zone (i.e. *Zone\_id*) in which it is located using the following formulae, if *sl-ZoneConfig* is configured:

$$x_1 = \text{Floor}(x / L) \text{ Mod } 64;$$

$$y_1 = \text{Floor}(y / L) \text{ Mod } 64;$$

$$\text{Zone\_id} = y_1 * 64 + x_1.$$

The parameters in the formulae are defined as follows:

**L** is the value of *sl-ZoneLength* included in *sl-ZoneConfig*;

**x** is the geodesic distance in longitude between UE's current location and geographical coordinates (0, 0) according to WGS84 model [58] and it is expressed in meters;

$y$  is the geodesic distance in latitude between UE's current location and geographical coordinates (0, 0) according to WGS84 model [58] and it is expressed in meters.

NOTE: How the calculated  $zone\_id$  is used is specified in TS 38.321 [3].

## 5.8.12 DFN derivation from GNSS

When the UE selects GNSS as the synchronization reference source, the DFN, the subframe number within a frame and slot number within a frame used for NR sidelink communication are derived from the current UTC time, by the following formulae:

$$DFN = \text{Floor}(0.1 * (T_{current} - T_{ref} - \text{OffsetDFN})) \bmod 1024$$

$$\text{SubframeNumber} = \text{Floor}(T_{current} - T_{ref} - \text{OffsetDFN}) \bmod 10$$

$$\text{SlotNumber} = \text{Floor}((T_{current} - T_{ref} - \text{OffsetDFN}) * 2^\mu) \bmod (10 * 2^\mu)$$

Where:

**$T_{current}$**  is the current UTC time that obtained from GNSS. This value is expressed in milliseconds;

**$T_{ref}$**  is the reference UTC time 00:00:00 on Gregorian calendar date 1 January, 1900 (midnight between Thursday, December 31, 1899 and Friday, January 1, 1900). This value is expressed in milliseconds;

**$\text{OffsetDFN}$**  is the value  $sl\text{-OffsetDFN}$  if configured, otherwise it is zero. This value is expressed in milliseconds.

$\mu=0/1/2/3$  corresponding to the 15/30/60/120 kHz of SCS for SL, respectively.

NOTE 1: In case of leap second change event, how UE obtains the scheduled time of leap second change to adjust  $T_{current}$  correspondingly is left to UE implementation. How UE handles the sudden discontinuity of DFN is left to UE implementation.

NOTE 2: Void.

---

## 6 Protocol data units, formats and parameters (ASN.1)

### 6.1 General

#### 6.1.1 Introduction

The contents of each RRC message is specified in sub-clause 6.2 using ASN.1 to specify the message syntax and using tables when needed to provide further detailed information about the fields specified in the message syntax. The syntax of the information elements that are defined as stand-alone abstract types is further specified in a similar manner in sub-clause 6.3.

Usage of the text "Network always configures the UE with a value for this field" in the field description indicates that the network has to provide a value for the field in this or in a previous message based on delta configuration (for an optional field with Need M). It does not imply a mandatory presence of the field.

#### 6.1.2 Need codes and conditions for optional downlink fields

The need for fields to be present in a message or an abstract type, i.e., the ASN.1 fields that are specified as OPTIONAL in the abstract notation (ASN.1), is specified by means of comment text tags attached to the OPTIONAL statement in the abstract syntax. All comment text tags are available for use in the downlink direction only. The meaning of each tag is specified in table 6.1.2-1.

If conditions are used, a conditional presence table is provided for the message or information element specifying the need of the field for each condition case. The table also specifies whether UE maintains or releases the value in case the field is absent. The conditions clarify what the UE may expect regarding the setting of the message by the network. Violation of conditions is regarded as invalid network behaviour, which the UE is not required to cope with. Hence the general error handling defined in 10.4 does not apply in case a field is absent although it is mandatory according to the CondC or CondM condition.

For guidelines on the use of need codes and conditions, see Annex A.6 and A.7.

**Table 6.1.2-1: Meaning of abbreviations used to specify the need for fields to be present**

<b>Abbreviation</b>	<b>Meaning</b>
Cond conditionTag	Conditionally present Presence of the field is specified in a tabular form following the ASN.1 segment.
CondC conditionTag	Configuration condition Presence of the field is conditional to other configuration settings.
CondM conditionTag	Message condition Presence of the field is conditional to other fields included in the message.
Need S	<i>Specified</i> Used for (configuration) fields, whose field description or procedure <b>specifies</b> the UE behavior performed upon receiving a message with the field absent (and not if field description or procedure specifies the UE behavior when field is not configured).
Need M	<i>Maintain</i> Used for (configuration) fields that are stored by the UE i.e. not one-shot. Upon receiving a message with the field absent, the UE maintains the current value.
Need N	<i>No action</i> (one-shot configuration that is not maintained) Used for (configuration) fields that are not stored and whose presence causes a one-time action by the UE. Upon receiving message with the field absent, the UE takes no action.
Need R	<i>Release</i> Used for (configuration) fields that are stored by the UE i.e. not one-shot. Upon receiving a message with the field absent, the UE releases the current value.

NOTE: In this version of the specification, the condition tags CondC and CondM are not used.

Any field with Need M or Need N in system information shall be interpreted as Need R.

The need code used within a CondX definition only applies for the case (part of the condition) where it is defined: A condition may have different need codes for different parts of the condition. In particular, the CondX definition may contain the following "otherwise the field is absent" parts:

- "Otherwise, the field is absent": The field is not relevant or should not be configured when this part of the condition applies. In particular, the UE behaviour is not defined when the field is configured via another part of the condition and is reconfigured to this part of the condition. A need code is not provided when the transition from another part of the condition to this part of the condition is not supported, when the field clearly is a one-shot or there is no difference whether UE maintains or releases the value (e.g., in case the field is mandatory present according to the other part of the condition).
- "Otherwise, the field is absent, Need R": The field is released if absent when this part of the condition applies. This handles UE behaviour in case the field is configured via another part of the condition and this part of the condition applies (which means that network can assume UE releases the field if this part of the condition is valid).
- "Otherwise, the field is absent, Need M": The UE retains the field if it was already configured when this part of the condition applies. This means the network cannot release the field, but UE retains the previously configured value.

Use of different Need codes in different parts of a condition should be avoided.

For downlink messages, the need codes, conditions and ASN.1 defaults specified for a particular (child) field only apply in case the (parent) field including the particular field is present. Thus, if the parent is absent the UE shall not release the field unless the absence of the parent field implies that.

For (parent) fields without need codes in downlink messages, if the parent field is absent, UE shall follow the need codes of the child fields. Thus, if parent field is absent, the need code of each child field is followed (i.e. Need R child fields are released, Need M child fields are not modified and the actions for Need S child fields depend on the specified conditions of each field). Examples of (parent) fields in downlink messages without need codes where this rule applies are:

- *nonCriticalExtension* fields at the end of a message using empty SEQUENCE extension mechanism,
- groups of non-critical extensions using double brackets (referred to as extension groups), and
- non-critical extensions at the end of a message or at the end of a structure, contained in a BIT STRING or OCTET STRING (referred to as parent extension fields).

The handling of need codes as specified in the previous is illustrated by means of an example, as shown in the following ASN.1.

```
-- /example/ ASN1START

RRCMessage-IEs ::=
  field1          SEQUENCE {
    field1        InformationElement1    OPTIONAL, -- Need M
    field2        InformationElement2    OPTIONAL, -- Need R
    nonCriticalExtension RRCMessage-v1570-IEs OPTIONAL
  }

RRCMessage-1570-IEs ::=
  field3          SEQUENCE {
    field3        InformationElement3    OPTIONAL, -- Need M
    nonCriticalExtension RRCMessage-v1640-IEs OPTIONAL
  }

RRCMessage-v1640-IEs ::=
  field4          SEQUENCE {
    field4        InformationElement4    OPTIONAL, -- Need R
    nonCriticalExtension SEQUENCE {}    OPTIONAL
  }

InformationElement1 ::=
  field11         SEQUENCE {
    field11       InformationElement11   OPTIONAL, -- Need M
    field12       InformationElement12   OPTIONAL, -- Need R
    ...,
    [[
    field13       InformationElement13   OPTIONAL, -- Need R
    field14       InformationElement14   OPTIONAL, -- Need M
    ]]
  ]

InformationElement2 ::=
  field21         SEQUENCE {
    field21       InformationElement11   OPTIONAL, -- Need M
    ...
  }

-- ASN1STOP
```

The handling of need codes as specified in the previous implies that:

- if *field1* in *RRCMessage-IEs* is absent, UE does not modify any child fields configured within *field1* (regardless of their need codes);

- if *field2* in *RRCMessage-IEs* is absent, UE releases the *field2* (and also its child field *field21*);
- if *field1* or *field2* in *RRCMessage-IEs* is present, UE retains or releases their child fields according to the child field presence conditions;
- if *field1* in *RRCMessage-IEs* is present but the extension group containing *field13* and *field14* is absent, the UE releases *field13* but does not modify *field14*;
- if *nonCriticalExtension* defined by IE *RRCMessage-v1570-IEs* is absent, the UE does not modify *field3* but releases *field4*;

## 6.1.3 General rules

In the ASN.1 of this specification, the first bit of a bit string refers to the leftmost bit, unless stated otherwise.

Upon reception of a list not using ToAddModList and ToReleaseList structure, the UE shall delete all entries of the list currently in the UE configuration before applying the received list and shall consider each entry as newly created. This applies also to lists whose size is extended (i.e. with a second list structure in the ASN.1 comprising additional entries). This implies that Need M should not be used for fields in the entries of these lists; if used, UE will handle such fields equivalent to a Need R.

## 6.2 RRC messages

### 6.2.1 General message structure

#### – *NR-RRC-Definitions*

This ASN.1 segment is the start of the NR RRC PDU definitions.

```
-- ASN1START
-- TAG-NR-RRC-DEFINITIONS-START

NR-RRC-Definitions DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

-- TAG-NR-RRC-DEFINITIONS-STOP
-- ASN1STOP
```

#### – *BCCH-BCH-Message*

The *BCCH-BCH-Message* class is the set of RRC messages that may be sent from the network to the UE via BCH on the BCCH logical channel.

```
-- ASN1START
-- TAG-BCCH-BCH-MESSAGE-START

BCCH-BCH-Message ::=
    message SEQUENCE {
        BCCH-BCH-MessageType
```

```

}
BCCH-BCH-MessageType ::=          CHOICE {
    mib                          MIB,
    messageClassExtension        SEQUENCE {}
}
-- TAG-BCCH-BCH-MESSAGE-STOP
-- ASN1STOP

```

### – *BCCH-DL-SCH-Message*

The *BCCH-DL-SCH-Message* class is the set of RRC messages that may be sent from the network to the UE via DL-SCH on the BCCH logical channel.

```

-- ASN1START
-- TAG-BCCH-DL-SCH-MESSAGE-START

BCCH-DL-SCH-Message ::=          SEQUENCE {
    message                      BCCH-DL-SCH-MessageType
}

BCCH-DL-SCH-MessageType ::=     CHOICE {
    c1                           CHOICE {
        systemInformation        SystemInformation,
        systemInformationBlockType1 SIB1
    },
    messageClassExtension        SEQUENCE {}
}

-- TAG-BCCH-DL-SCH-MESSAGE-STOP
-- ASN1STOP

```

### – *DL-CCCH-Message*

The *DL-CCCH-Message* class is the set of RRC messages that may be sent from the Network to the UE on the downlink CCCH logical channel.

```

-- ASN1START
-- TAG-DL-CCCH-MESSAGE-START

DL-CCCH-Message ::=             SEQUENCE {
    message                      DL-CCCH-MessageType
}

DL-CCCH-MessageType ::=        CHOICE {
    c1                           CHOICE {
        rrcReject                RRCReject,
        rrcSetup                 RRCSetup,
        spare2                   NULL,
        spare1                   NULL
    }
}

```



```

    },
    messageClassExtension      SEQUENCE {}
}

-- TAG-DL-CCCH-MESSAGE-STOP
-- ASN1STOP

```

## — DL-DCCH-Message

The *DL-DCCH-Message* class is the set of RRC messages that may be sent from the network to the UE on the downlink DCCH logical channel.

```

-- ASN1START
-- TAG-DL-DCCH-MESSAGE-START

DL-DCCH-Message ::=
    message              SEQUENCE {
}

DL-DCCH-MessageType ::=
    c1                   CHOICE {
        rrcReconfiguration      RRCReconfiguration,
        rrcResume                RRCResume,
        rrcRelease                RRCRelease,
        rrcReestablishment        RRCReestablishment,
        securityModeCommand        SecurityModeCommand,
        dlInformationTransfer        DLInformationTransfer,
        ueCapabilityEnquiry        UECapabilityEnquiry,
        counterCheck                CounterCheck,
        mobilityFromNRCommand        MobilityFromNRCommand,
        dlDedicatedMessageSegment-r16 DLDedicatedMessageSegment-r16,
        ueInformationRequest-r16        UEInformationRequest-r16,
        dlInformationTransferMRDC-r16    DLInformationTransferMRDC-r16,
        loggedMeasurementConfiguration-r16 LoggedMeasurementConfiguration-r16,
        spare3 NULL, spare2 NULL, spare1 NULL
    },
    messageClassExtension SEQUENCE {}
}

-- TAG-DL-DCCH-MESSAGE-STOP
-- ASN1STOP

```

## — PCCH-Message

The *PCCH-Message* class is the set of RRC messages that may be sent from the Network to the UE on the PCCH logical channel.

```

-- ASN1START
-- TAG-PCCH-PCH-MESSAGE-START

PCCH-Message ::=
    SEQUENCE {

```

```

    message                PCCH-MessageType
  }
PCCH-MessageType ::=
  c1                      CHOICE {
    paging                 CHOICE {
      spare1 NULL
    },
    paging                 Paging,
    messageClassExtension SEQUENCE {}
  }
-- TAG-PCCH-PCH-MESSAGE-STOP
-- ASN1STOP

```

### – *UL-CCCH-Message*

The *UL-CCCH-Message* class is the set of 48-bits RRC messages that may be sent from the UE to the Network on the uplink CCCH logical channel.

```

-- ASN1START
-- TAG-UL-CCCH-MESSAGE-START

UL-CCCH-Message ::=
  message                UL-CCCH-MessageType
}

UL-CCCH-MessageType ::=
  c1                      CHOICE {
    rrcSetupRequest        RRCSetupRequest,
    rrcResumeRequest       RRCResumeRequest,
    rrcReestablishmentRequest RRCReestablishmentRequest,
    rrcSystemInfoRequest   RRCSystemInfoRequest
  },
  messageClassExtension SEQUENCE {}
}

-- TAG-UL-CCCH-MESSAGE-STOP
-- ASN1STOP

```

### – *UL-CCCH1-Message*

The *UL-CCCH1-Message* class is the set of 64-bits RRC messages that may be sent from the UE to the Network on the uplink CCCH1 logical channel.

```

-- ASN1START
-- TAG-UL-CCCH1-MESSAGE-START

UL-CCCH1-Message ::=
  message                UL-CCCH1-MessageType
}

```

```

}
UL-CCCH1-MessageType ::=
  CHOICE {
    c1
      rrcResumeRequest1
      spare3 NULL,
      spare2 NULL,
      spare1 NULL
    },
    messageClassExtension SEQUENCE {}
  }
-- TAG-UL-CCCH1-MESSAGE-STOP
-- ASN1STOP

```

## – *UL-DCCH-Message*

The *UL-DCCH-Message* class is the set of RRC messages that may be sent from the UE to the network on the uplink DCCH logical channel.

```

-- ASN1START
-- TAG-UL-DCCH-MESSAGE-START

UL-DCCH-Message ::=
  SEQUENCE {
    message UL-DCCH-MessageType
  }

UL-DCCH-MessageType ::=
  CHOICE {
    c1
      measurementReport MeasurementReport,
      rrcReconfigurationComplete RRCReconfigurationComplete,
      rrcSetupComplete RRCSetupComplete,
      rrcReestablishmentComplete RRCReestablishmentComplete,
      rrcResumeComplete RRCResumeComplete,
      securityModeComplete SecurityModeComplete,
      securityModeFailure SecurityModeFailure,
      ulInformationTransfer ULInformationTransfer,
      locationMeasurementIndication LocationMeasurementIndication,
      ueCapabilityInformation UECapabilityInformation,
      counterCheckResponse CounterCheckResponse,
      ueAssistanceInformation UEAssistanceInformation,
      failureInformation FailureInformation,
      ulInformationTransferMRDC ULInformationTransferMRDC,
      scgFailureInformation SCGFailureInformation,
      scgFailureInformationEUTRA SCGFailureInformationEUTRA
    },
    messageClassExtension
      CHOICE {
        c2
          ulDedicatedMessageSegment-r16 ULDedicatedMessageSegment-r16,
          dedicatedSIBRequest-r16 DedicatedSIBRequest-r16,
          mcgFailureInformation-r16 MCGFailureInformation-r16,
          ueInformationResponse-r16 UEInformationResponse-r16,

```

```
    sidelinkUEInformationNR-r16      SidelinkUEInformationNR-r16,  
    ulInformationTransferIRAT-r16    ULInformationTransferIRAT-r16,  
    iabOtherInformation-r16         IABOtherInformation-r16,  
    spare9 NULL, spare8 NULL, spare7 NULL, spare6 NULL,  
    spare5 NULL, spare4 NULL, spare3 NULL, spare2 NULL, spare1 NULL  
  },  
  messageClassExtensionFuture-r16  SEQUENCE {}  
}  
}  
  
-- TAG-UL-DCCH-MESSAGE-STOP  
-- ASN1STOP
```

## 6.2.2 Message definitions

### – CounterCheck

The *CounterCheck* message is used by the network to indicate the current COUNT MSB values associated to each DRB and to request the UE to compare these to its COUNT MSB values and to report the comparison results to the network.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: Network to UE

### **CounterCheck message**

```
-- ASN1START
-- TAG-COUNTERCHECK-START

CounterCheck ::=
    rrc-TransactionIdentifier      SEQUENCE {
    criticalExtensions              RRC-TransactionIdentifier,
    counterCheck                   CHOICE {
    criticalExtensionsFuture        CounterCheck-IEs,
                                   SEQUENCE {}
    }
}

CounterCheck-IEs ::=
    drb-CountMSB-InfoList          SEQUENCE {
    lateNonCriticalExtension        DRB-CountMSB-InfoList,
    nonCriticalExtension            OCTET STRING OPTIONAL,
                                   SEQUENCE {} OPTIONAL
}

DRB-CountMSB-InfoList ::=
    SEQUENCE (SIZE (1..maxDRB)) OF DRB-CountMSB-Info

DRB-CountMSB-Info ::=
    drb-Identity                   SEQUENCE {
    countMSB-Uplink                 DRB-Identity,
    countMSB-Downlink              INTEGER(0..33554431),
    countMSB-Downlink              INTEGER(0..33554431)
}

-- TAG-COUNTERCHECK-STOP
-- ASN1STOP
```

**CounterCheck-IEs field descriptions****drb-CountMSB-InfoList**

Indicates the MSBs of the COUNT values of the DRBs.

**DRB-CountMSB-Info field descriptions****countMSB-Downlink**

Indicates the value of 25 MSBs from RX\_NEXT – 1 (specified in TS 38.323 [5]) associated to this DRB.

**countMSB-Uplink**

Indicates the value of 25 MSBs from TX\_NEXT – 1 (specified in TS 38.323 [5]) associated to this DRB.

– **CounterCheckResponse**The *CounterCheckResponse* message is used by the UE to respond to a *CounterCheck* message.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

**CounterCheckResponse message**

```

-- ASN1START
-- TAG-COUNTERCHECKRESPONSE-START

CounterCheckResponse ::= SEQUENCE {
    rrc-TransactionIdentifier RRC-TransactionIdentifier,
    criticalExtensions CHOICE {
        counterCheckResponse CounterCheckResponse-IEs,
        criticalExtensionsFuture SEQUENCE {}
    }
}

CounterCheckResponse-IEs ::= SEQUENCE {
    drb-CountInfoList DRB-CountInfoList,
    lateNonCriticalExtension OCTET STRING OPTIONAL,
    nonCriticalExtension SEQUENCE {} OPTIONAL
}

DRB-CountInfoList ::= SEQUENCE (SIZE (0..maxDRB)) OF DRB-CountInfo

DRB-CountInfo ::= SEQUENCE {
    drb-Identity DRB-Identity,
    count-Uplink INTEGER (0..4294967295),

```

```

    count-Downlink                INTEGER (0..4294967295)
}
-- TAG-COUNTERCHECKRESPONSE-STOP
-- ASN1STOP

```

<i>CounterCheckResponse-IEs</i> field descriptions
--

<b><i>drb-CountInfoList</i></b>
---------------------------------

Indicates the COUNT values of the DRBs.
---

<i>DRB-CountInfo</i> field descriptions
---

<b><i>count-Downlink</i></b>
------------------------------

Indicates the value of RX_NEXT – 1 (specified in TS 38.323 [5]) associated to this DRB.
---

<b><i>count-Uplink</i></b>
----------------------------

Indicates the value of TX_NEXT – 1 (specified in TS 38.323 [5]) associated to this DRB.
---

## – *DedicatedSIBRequest*

The *DedicatedSIBRequest* message is used to request SIB(s) required by the UE in RRC\_CONNECTED as specified in clause 5.2.2.3.5.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

### *DedicatedSIBRequest* message

```

-- ASN1START
-- TAG-DEDICATEDSIBREQUEST-START

DedicatedSIBRequest-r16 ::= SEQUENCE {
    criticalExtensions          CHOICE {
        dedicatedSIBRequest-r16  DedicatedSIBRequest-r16-IEs,
        criticalExtensionsFuture  SEQUENCE {}
    }
}

DedicatedSIBRequest-r16-IEs ::= SEQUENCE {
    onDemandSIB-RequestList-r16 SEQUENCE {

        requestedSIB-List-r16      SEQUENCE (SIZE (1..maxOnDemandSIB-r16)) OF SIB-ReqInfo-r16      OPTIONAL,
        requestedPosSIB-List-r16   SEQUENCE (SIZE (1..maxOnDemandPosSIB-r16)) OF PosSIB-ReqInfo-r16   OPTIONAL
    } OPTIONAL,

```

```

    lateNonCriticalExtension      OCTET STRING      OPTIONAL,
    nonCriticalExtension          SEQUENCE {}        OPTIONAL
}

SIB-ReqInfo-r16 ::=
    ENUMERATED { sib12, sib13, sib14, spare5, spare4, spare3, spare2, spare1 }

PosSIB-ReqInfo-r16 ::=
    SEQUENCE {
        gnss-id-r16                GNSS-ID-r16        OPTIONAL,
        sbas-id-r16                SBAS-ID-r16        OPTIONAL,
        posSibType-r16            ENUMERATED { posSibType1-1, posSibType1-2, posSibType1-3, posSibType1-4, posSibType1-5, posSibType1-6,
        posSibType1-7, posSibType1-8, 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, posSibType2-20,
        posSibType2-21, posSibType2-22, posSibType2-23, posSibType3-1, posSibType4-1,
        posSibType5-1, posSibType6-1, posSibType6-2, posSibType6-3,... }
    }

-- TAG-DEDICATEDSIBREQUEST-STOP
-- ASN1STOP

```

#### **DedicatedSIBRequest field descriptions**

##### ***requestedSIB-List***

Contains a list of SIB(s) the UE requests while in RRC\_CONNECTED.

##### ***requestedPosSIB-List***

Contains a list of posSIB(s) the UE requests while in RRC\_CONNECTED.

#### **PosSIB-ReqInfo field descriptions**

##### ***gnss-id***

The presence of this field indicates that the request positioning SIB type is for a specific GNSS. Indicates a specific GNSS (see also TS 37.355 [49]).

##### ***sbas-id***

The presence of this field indicates that the request positioning SIB type is for a specific SBAS. Indicates a specific SBAS (see also TS 37.355 [49]).

## – ***DL DedicatedMessageSegment***

The *DL DedicatedMessageSegment* message is used to transfer one segment of the *RRCResume* or *RRCReconfiguration* messages.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: Network to UE



***DLDedicatedMessageSegment message***

```

-- ASN1START
-- TAG-DLDEDICATEDMESSAGESEGMENT-START

DLDedicatedMessageSegment-r16 ::= SEQUENCE {
    criticalExtensions          CHOICE {
        dlDedicatedMessageSegment-r16
        criticalExtensionsFuture
    }
}

DLDedicatedMessageSegment-r16-IEs ::= SEQUENCE {
    segmentNumber-r16          INTEGER(0..4),
    rrc-MessageSegmentContainer-r16 OCTET STRING,
    rrc-MessageSegmentType-r16 ENUMERATED {notLastSegment, lastSegment},
    lateNonCriticalExtension    OCTET STRING OPTIONAL,
    nonCriticalExtension        SEQUENCE {} OPTIONAL
}

-- TAG-DLDEDICATEDMESSAGESEGMENT-STOP
-- ASN1STOP

```

***DLDedicatedMessageSegment field descriptions******segmentNumber***

Identifies the sequence number of a segment within the encoded DL DCCH message. The network transmits the segments with continuously increasing *segmentNumber* order so that the UE's RRC layer may expect to obtain them from lower layers in the correct order. Hence, the UE is not required to perform segment re-ordering on RRC level.

***rrc-MessageSegmentContainer***

Includes a segment of the encoded DL DCCH message. The size of the included segment in this container should be small enough so the resulting encoded RRC message PDU is less than or equal to the PDCP SDU size limit.

***rrc-MessageSegmentType***

Indicates whether the included DL DCCH message segment is the last segment of the message or not.

– ***DLInformationTransfer***

The *DLInformationTransfer* message is used for the downlink transfer of NAS dedicated information and timing information for the 5G internal system clock.

Signalling radio bearer: SRB2 or SRB1 (only if SRB2 not established yet. If SRB2 is suspended, the network does not send this message until SRB2 is resumed.)

RLC-SAP: AM

Logical channel: DCCH

Direction: Network to UE

***DLInformationTransfer*** message

```

-- ASN1START
-- TAG-DLINFORMATIONTRANSFER-START

DLInformationTransfer ::= SEQUENCE {
    rrc-TransactionIdentifier RRC-TransactionIdentifier,
    criticalExtensions CHOICE {
        dlInformationTransfer DLInformationTransfer-IEs,
        criticalExtensionsFuture SEQUENCE {}
    }
}

DLInformationTransfer-IEs ::= SEQUENCE {
    dedicatedNAS-Message DedicatedNAS-Message OPTIONAL, -- Need N
    lateNonCriticalExtension OCTET STRING OPTIONAL,
    nonCriticalExtension DLInformationTransfer-v1610-IEs OPTIONAL
}

DLInformationTransfer-v1610-IEs ::= SEQUENCE {
    referenceTimeInfo-r16 ReferenceTimeInfo-r16 OPTIONAL, -- Need R
    nonCriticalExtension SEQUENCE {} OPTIONAL
}

-- TAG-DLINFORMATIONTRANSFER-STOP
-- ASN1STOP

```

– ***DLInformationTransferMRDC***

The *DLInformationTransferMRDC* message is used for the downlink transfer of RRC messages during fast MCG link recovery.

Signalling radio bearer: SRB3

RLC-SAP: AM

Logical channel: DCCH

Direction: Network to UE

***DLInformationTransferMRDC*** message

```

-- ASN1START
-- TAG-DLINFORMATIONTRANSFERMRDC-START

DLInformationTransferMRDC-r16 ::= SEQUENCE {
    criticalExtensions CHOICE {
        c1 CHOICE {
            dlInformationTransferMRDC-r16 DLInformationTransferMRDC-r16-IEs,
            spare3 NULL, spare2 NULL, spare1 NULL
        },

```

```

        criticalExtensionsFuture          SEQUENCE {}
    }
}

DLInformationTransferMRDC-r16-IEs ::= SEQUENCE {
    dl-DCCH-MessageNR-r16                OCTET STRING          OPTIONAL, -- Need N
    dl-DCCH-MessageEUTRA-r16            OCTET STRING          OPTIONAL, -- Need N
    lateNonCriticalExtension             OCTET STRING          OPTIONAL,
    nonCriticalExtension                  SEQUENCE {}           OPTIONAL
}

-- TAG-DLINFORMATIONTRANSFERMRDC-STOP
-- ASN1STOP

```

#### ***DLInformationTransferMRDC* field descriptions**

##### ***dl-DCCH-MessageNR***

Includes the *DL-DCCH-Message*. In this version of the specification, the field is only used to transfer the NR *RRCReconfiguration*, *RRCRelease*, and *MobilityFromNRCommand* messages.

##### ***dl-DCCH-MessageEUTRA***

Includes the *DL-DCCH-Message*. In this version of the specification, the field is only used to transfer the E-UTRA *RRCConnectionReconfiguration*, *RRCConnectionRelease*, and *MobilityFromEUTRACCommand* messages as specified in TS 36.331 [10].

## – *FailureInformation*

The *FailureInformation* message is used to inform the network about a failure detected by the UE.

Signalling radio bearer: SRB1 or SRB3

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to network

#### ***FailureInformation* message**

```

-- ASN1START
-- TAG-FAILUREINFORMATION-START

FailureInformation ::= SEQUENCE {
    criticalExtensions          CHOICE {
        failureInformation      FailureInformation-IEs,
        criticalExtensionsFuture SEQUENCE {}
    }
}

```

```

FailureInformation-IEs ::= SEQUENCE {
    failureInfoRLC-Bearer      FailureInfoRLC-Bearer      OPTIONAL,
    lateNonCriticalExtension   OCTET STRING          OPTIONAL,
    nonCriticalExtension       FailureInformation-v1610-IEs OPTIONAL
}

FailureInfoRLC-Bearer ::= SEQUENCE {
    cellGroupId      CellGroupId,
    logicalChannelIdentity LogicalChannelIdentity,
    failureType      ENUMERATED {rlc-failure, spare3, spare2, spare1}
}

FailureInformation-v1610-IEs ::= SEQUENCE {
    failureInfoDAPS-r16      FailureInfoDAPS-r16      OPTIONAL,
    nonCriticalExtension     SEQUENCE {}              OPTIONAL
}

FailureInfoDAPS-r16 ::= SEQUENCE {
    failureType-r16          ENUMERATED {daps-failure, spare3, spare2, spare1}
}

-- TAG-FAILUREINFORMATION-STOP
-- ASN1STOP

```

### – *IABOtherInformation*

The *IABOtherInformation* message is used by IAB-MT to request the network to allocate IP addresses for the collocated IAB-DU or inform the network about IP addresses allocated to the collocated IAB-DU.

Signalling radio bearer: SRB1 or SRB3

RLC-SAP: AM

Logical channel: DCCH

Direction: IAB-MT to Network

### *IABOtherInformation* message

```

-- ASN1START
-- TAG-IABOTHERINFORMATION-START

IABOtherInformation-r16 ::= SEQUENCE {
    rrc-TransactionIdentifier RRC-TransactionIdentifier,
    criticalExtensions        CHOICE {
        iabOtherInformation-r16 IABOtherInformation-r16-IEs,
        criticalExtensionsFuture SEQUENCE {}
    }
}

```

```

IABOtherInformation-r16-IEs ::= SEQUENCE {
  ip-InfoType-r16 CHOICE {
    iab-IP-Request-r16 SEQUENCE {
      iab-IPv4-AddressNumReq-r16 IAB-IP-AddressNumReq-r16 OPTIONAL,
      iab-IPv6-AddressReq-r16 CHOICE {
        iab-IPv6-AddressNumReq-r16 IAB-IP-AddressNumReq-r16,
        iab-IPv6-AddressPrefixReq-r16 IAB-IP-AddressPrefixReq-r16,
        ...
      }
    } OPTIONAL
  },
  iab-IP-Report-r16 SEQUENCE {
    iab-IPv4-AddressReport-r16 IAB-IP-AddressAndTraffic-r16 OPTIONAL,
    iab-IPv6-Report-r16 CHOICE {
      iab-IPv6-AddressReport-r16 IAB-IP-AddressAndTraffic-r16,
      iab-IPv6-PrefixReport-r16 IAB-IP-PrefixAndTraffic-r16,
      ...
    } OPTIONAL
  },
  ...
},
lateNonCriticalExtension OCTET STRING OPTIONAL,
nonCriticalExtension SEQUENCE {} OPTIONAL
}

IAB-IP-AddressNumReq-r16 ::= SEQUENCE {
  all-Traffic-NumReq-r16 INTEGER (1..8) OPTIONAL,
  fl-C-Traffic-NumReq-r16 INTEGER (1..8) OPTIONAL,
  fl-U-Traffic-NumReq-r16 INTEGER (1..8) OPTIONAL,
  non-Fl-Traffic-NumReq-r16 INTEGER (1..8) OPTIONAL,
  ...
}

IAB-IP-AddressPrefixReq-r16 ::= SEQUENCE {
  all-Traffic-PrefixReq-r16 ENUMERATED {true} OPTIONAL,
  fl-C-Traffic-PrefixReq-r16 ENUMERATED {true} OPTIONAL,
  fl-U-Traffic-PrefixReq-r16 ENUMERATED {true} OPTIONAL,
  non-Fl-Traffic-PrefixReq-r16 ENUMERATED {true} OPTIONAL,
  ...
}

IAB-IP-AddressAndTraffic-r16 ::= SEQUENCE {
  all-Traffic-IAB-IP-Address-r16 SEQUENCE (SIZE(1..8)) OF IAB-IP-Address-r16 OPTIONAL,
  fl-C-Traffic-IP-Address-r16 SEQUENCE (SIZE(1..8)) OF IAB-IP-Address-r16 OPTIONAL,
  fl-U-Traffic-IP-Address-r16 SEQUENCE (SIZE(1..8)) OF IAB-IP-Address-r16 OPTIONAL,
  non-Fl-Traffic-IP-Address-r16 SEQUENCE (SIZE(1..8)) OF IAB-IP-Address-r16 OPTIONAL
}

IAB-IP-PrefixAndTraffic-r16 ::= SEQUENCE {
  all-Traffic-IAB-IP-Address-r16 IAB-IP-Address-r16 OPTIONAL,
  fl-C-Traffic-IP-Address-r16 IAB-IP-Address-r16 OPTIONAL,
  fl-U-Traffic-IP-Address-r16 IAB-IP-Address-r16 OPTIONAL,
  non-Fl-Traffic-IP-Address-r16 IAB-IP-Address-r16 OPTIONAL
}

```

-- TAG-IABOTHERINFORMATION-STOP  
 -- ASN1STOP

<b><i>IABOtherInformation-IEs</i> field descriptions</b>
<b><i>all-Traffic-PrefixReq</i></b> This field is used to request the IPv6 address prefix for all traffic. The length of allocated IPv6 prefix is fixed to 64.
<b><i>all-Traffic-NumReq</i></b> This field is used to request the numbers of IP address for all traffic.
<b><i>IAB-IP-AddressAndTraffic</i></b> This field is used to report to IAB-donor-CU the IP addresses per specific usage assigned by OAM for IAB-DU.
<b><i>IAB-IP-PrefixAndTraffic</i></b> This field is used to report to IAB-donor-CU the IPv6 prefixes per specific usage assigned by OAM for IAB-DU.
<b><i>iab-IPv4-AddressNumReq</i></b> This field is used to request the numbers of IPv4 address per specific usage. The specific usages include F1-C traffic, F1-U traffic, non-F1 traffic and all traffic.
<b><i>iab-IPv6-AddressNumReq</i></b> This field is used to request the numbers of the IPv6 address per specific usage. The specific usages include F1-C traffic, F1-U traffic, non-F1 traffic and all traffic.
<b><i>iab-IPv6-AddressPrefixReq</i></b> This field is used to request the the prefix of IPv6 address per specific usage. The specific usages include F1-C traffic, F1-U traffic, non-F1 traffic and all traffic.
<b><i>f1-C-Traffic-PrefixReq</i></b> This field is used to request the IPv6 address prefix for F1-C traffic. The length of allocated IPv6 prefix is fixed to 64.
<b><i>f1-C-Traffic-NumReq</i></b> This field is used to request the numbers of IP address for F1-C traffic.
<b><i>f1-U-Traffic-PrefixReq</i></b> This field is used to request the IPv6 address prefix for F1-U traffic. The length of allocated IPv6 prefix is fixed to 64.
<b><i>f1-U-Traffic-NumReq</i></b> This field is used to request the numbers of IP address for F1-U traffic.
<b><i>non-F1-Traffic-PrefixReq</i></b> This field is used to request the IPv6 address prefix for non-F1 traffic. The length of allocated IPv6 prefix is fixed to 64.
<b><i>non-F1-Traffic-NumReq</i></b> This field is used to request the numbers of IP address for non-F1 traffic.

– *LocationMeasurementIndication*

The *LocationMeasurementIndication* message is used to indicate that the UE is going to either start or stop location related measurement which requires measurement gaps.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

***LocationMeasurementIndication message***

```

-- ASN1START
-- TAG-LOCATIONMEASUREMENTINDICATION-START

LocationMeasurementIndication ::= SEQUENCE {
    criticalExtensions CHOICE {
        locationMeasurementIndication LocationMeasurementIndication-IEs,
        criticalExtensionsFuture SEQUENCE {}
    }
}

LocationMeasurementIndication-IEs ::= SEQUENCE {
    measurementIndication SetupRelease {LocationMeasurementInfo},
    lateNonCriticalExtension OCTET STRING OPTIONAL,
    nonCriticalExtension SEQUENCE{} OPTIONAL
}

-- TAG-LOCATIONMEASUREMENTINDICATION-STOP
-- ASN1STOP

```

***LoggedMeasurementConfiguration***

The *LoggedMeasurementConfiguration* message is used to perform logging of measurement results while in RRC\_IDLE or RRC\_INACTIVE. It is used to transfer the logged measurement configuration for network performance optimisation.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: Network to UE

***LoggedMeasurementConfiguration message***

```

-- ASN1START
-- TAG-LOGGEDMEASUREMENTCONFIGURATION-START

LoggedMeasurementConfiguration-r16 ::= SEQUENCE {
    criticalExtensions CHOICE {
        loggedMeasurementConfiguration-r16 LoggedMeasurementConfiguration-r16-IEs,
        criticalExtensionsFuture SEQUENCE {}
    }
}

LoggedMeasurementConfiguration-r16-IEs ::= SEQUENCE {
    traceReference-r16 TraceReference-r16,
    traceRecordingSessionRef-r16 OCTET STRING (SIZE (2)),
}

```

```

tce-Id-r16
absoluteTimeInfo-r16
areaConfiguration-r16
plmn-IdentityList-r16
bt-NameList-r16
wlan-NameList-r16
sensor-NameList-r16
loggingDuration-r16
reportType
    periodical
    eventTriggered
    ...
},
lateNonCriticalExtension
nonCriticalExtension
}

LoggedPeriodicalReportConfig-r16 ::=
    loggingInterval-r16
    ...
}

LoggedEventTriggerConfig-r16 ::=
    eventType-r16
    loggingInterval-r16
    ...
}

EventType-r16 ::= CHOICE {
    outOfCoverage    NULL,
    eventL1          SEQUENCE {
        l1-Threshold    MeasTriggerQuantity,
        hysteresis      Hysteresis,
        timeToTrigger   TimeToTrigger
    },
    ...
}

-- TAG-LOGGEDMEASUREMENTCONFIGURATION-STOP
-- ASN1STOP

```

```

OCTET STRING (SIZE (1)),
AbsoluteTimeInfo-r16,
AreaConfiguration-r16
OPTIONAL, --Need R
PLMN-IdentityList2-r16
OPTIONAL, --Need R
SetupRelease {BT-NameList-r16}
OPTIONAL, --Need M
SetupRelease {WLAN-NameList-r16}
OPTIONAL, --Need M
SetupRelease {Sensor-NameList-r16}
OPTIONAL, --Need M
LoggingDuration-r16,
CHOICE {
    LoggedPeriodicalReportConfig-r16,
    LoggedEventTriggerConfig-r16,
}

OCTET STRING
SEQUENCE {}
OPTIONAL,
OPTIONAL

```

```

SEQUENCE {
    LoggingInterval-r16,
}

SEQUENCE {
    EventType-r16,
    LoggingInterval-r16,
}

```



<i>LoggedMeasurementConfiguration</i> field descriptions
<b><i>absoluteTimeInfo</i></b> Indicates the absolute time in the current cell.
<b><i>areaConfiguration</i></b> Used to restrict the area in which the UE performs measurement logging to cells broadcasting either one of the included cell identities or one of the included tracking area codes/frequencies.
<b><i>eventType</i></b> The value outOfCoverage indicates the UE to perform logging of measurements when the UE enters any cell selection state, and the value eventL1 indicates the UE to perform logging of measurements when the triggering condition (similar as event A2 as specified in 5.5.4.3) as configured in the event is met for the camping cell in camped normally state.
<b><i>plmn-IdentityList</i></b> Indicates a set of PLMNs defining when the UE performs measurement logging as well as the associated status indication and information retrieval i.e. the UE performs these actions when the RPLMN is part of this set of PLMNs.
<b><i>tce-Id</i></b> Parameter Trace Collection Entity Id: See TS 32.422 [52].
<b><i>traceRecordingSessionRef</i></b> Parameter Trace Recording Session Reference: See TS 32.422 [52].
<b><i>reportType</i></b> Parameter configures the type of MDT configuration, specifically Periodic MDT configuration or Event Triggered MDT configuration.

## – *MCGFailureInformation*

The *MCGFailureInformation* message is used to provide information regarding NR MCG failures detected by the UE.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

### ***MCGFailureInformation* message**

```
-- ASN1START
-- TAG-MCGFAILUREINFORMATION-START

MCGFailureInformation-r16 ::= SEQUENCE {
    criticalExtensions          CHOICE {
        mcgFailureInformation-r16          MCGFailureInformation-r16-IEs,
        criticalExtensionsFuture          SEQUENCE {}
    }
}

MCGFailureInformation-r16-IEs ::= SEQUENCE {
    failureReportMCG-r16          FailureReportMCG-r16          OPTIONAL,
    lateNonCriticalExtension      OCTET STRING                OPTIONAL,
}
```

```

    nonCriticalExtension          SEQUENCE {}                               OPTIONAL
}

FailureReportMCG-r16 ::=
    failureType-r16              SEQUENCE {
                                  ENUMERATED {t310-Expiry, randomAccessProblem, rlc-MaxNumRetx,
                                                t312-Expiry-r16, lbt-Failure-r16, beamFailureRecoveryFailure-r16,
                                                bh-RLF-r16, spare1}
                                  OPTIONAL,
                                  OPTIONAL,
                                  OPTIONAL,
                                  OPTIONAL,
                                  OPTIONAL,
                                  OPTIONAL,
                                  ...
    }

MeasResultList2UTRA ::= SEQUENCE (SIZE (1..maxFreq)) OF MeasResult2UTRA-FDD-r16

MeasResult2UTRA-FDD-r16 ::= SEQUENCE {
    carrierFreq-r16              ARFCN-ValueUTRA-FDD-r16,
    measResultNeighCellList-r16  MeasResultListUTRA-FDD-r16
}

MeasResultList2EUTRA ::= SEQUENCE (SIZE (1..maxFreq)) OF MeasResult2EUTRA-r16

-- TAG-MCGFAILUREINFORMATION-STOP
-- ASN1STOP

```

### **MCGFailureInformation field descriptions**

#### **measResultFreqList**

The field contains available results of measurements on NR frequencies the UE is configured to measure by the *measConfig* associated with the MCG.

#### **measResultFreqListEUTRA**

The field contains available results of measurements on E-UTRA frequencies the UE is configured to measure by *measConfig* associated with the MCG.

#### **measResultFreqListUTRA-FDD**

The field contains available results of measurements on UTRA FDD frequencies the UE is configured to measure by *measConfig* associated with the MCG.

#### **measResultSCG**

The field contains the *MeasResultSCG-Failure* IE which includes available measurement results on NR frequencies the UE is configured to measure by the *measConfig* associated with the SCG.

#### **measResultSCG-EUTRA**

The field contains the EUTRA *MeasResultSCG-FailureMRDC* IE which includes available results of measurements on E-UTRA frequencies the UE is configured to measure by the E-UTRA *RRCConnectionReconfiguration* message as specified in TS 36.331 [10].

## – *MeasurementReport*

The *MeasurementReport* message is used for the indication of measurement results.

Signalling radio bearer: SRB1, SRB3

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

### **MeasurementReport message**

```

-- ASN1START
-- TAG-MEASUREMENTREPORT-START

MeasurementReport ::=
    criticalExtensions          SEQUENCE {
        measurementReport      CHOICE {
            criticalExtensionsFuture SEQUENCE {}
        }
    }

MeasurementReport-IEs ::=
    measResults                SEQUENCE {
        MeasResults,

        lateNonCriticalExtension OCTET STRING OPTIONAL,
        nonCriticalExtension     SEQUENCE{}     OPTIONAL
    }

-- TAG-MEASUREMENTREPORT-STOP
-- ASN1STOP

```

### **– MIB**

The *MIB* includes the system information transmitted on BCH.

Signalling radio bearer: N/A

RLC-SAP: TM

Logical channel: BCCH

Direction: Network to UE

### **MIB**

```

-- ASN1START
-- TAG-MIB-START

MIB ::=
    systemFrameNumber          BIT STRING (SIZE (6)),
    subCarrierSpacingCommon    ENUMERATED {scs15or60, scs30or120},
    ssb-SubcarrierOffset       INTEGER (0..15),
    dmrs-TypeA-Position        ENUMERATED {pos2, pos3},
    pdccch-ConfigSIB1          PDCCH-ConfigSIB1,

```

```

cellBarred          ENUMERATED {barred, notBarred},
intraFreqReselection  ENUMERATED {allowed, notAllowed},
spare               BIT STRING (SIZE (1))
}

-- TAG-MIB-STOP
-- ASN1STOP

```

#### MIB field descriptions

<p><b>cellBarred</b> Value <i>barred</i> means that the cell is barred, as defined in TS 38.304 [20]. This field is ignored by IAB-MT.</p>
<p><b>dmrs-TypeA-Position</b> Position of (first) DM-RS for downlink (see TS 38.211 [16], clause 7.4.1.1.2) and uplink (see TS 38.211 [16], clause 6.4.1.1.3).</p>
<p><b>intraFreqReselection</b> Controls cell selection/reselection to intra-frequency cells when the highest ranked cell is barred, or treated as barred by the UE, as specified in TS 38.304 [20]. This field is ignored by IAB-MT.</p>
<p><b>pdccch-ConfigSIB1</b> Determines a common <i>ControlResourceSet</i> (CORESET), a common search space and necessary PDCCH parameters. If the field <i>ssb-SubcarrierOffset</i> indicates that <i>SIB1</i> is absent, the field <i>pdccch-ConfigSIB1</i> indicates the frequency positions where the UE may find SS/PBCH block with <i>SIB1</i> or the frequency range where the network does not provide SS/PBCH block with <i>SIB1</i> (see TS 38.213 [13], clause 13).</p>
<p><b>ssb-SubcarrierOffset</b> Corresponds to <math>k_{SSB}</math> (see TS 38.213 [13]), which is the frequency domain offset between SSB and the overall resource block grid in number of subcarriers. (See TS 38.211 [16], clause 7.4.3.1). For operation with shared spectrum channel access (see 37.213 [48]), this field is used also for deriving the QCL relationship between SS/PBCH blocks in a serving cell as specified in TS 38.213 [13], clause 4.1. The value range of this field may be extended by an additional most significant bit encoded within PBCH as specified in TS 38.213 [13]. This field may indicate that this cell does not provide <i>SIB1</i> and that there is hence no CORESET#0 configured in <i>MIB</i> (see TS 38.213 [13], clause 13). In this case, the field <i>pdccch-ConfigSIB1</i> may indicate the frequency positions where the UE may (not) find a SS/PBCH with a control resource set and search space for <i>SIB1</i> (see TS 38.213 [13], clause 13).</p>
<p><b>subCarrierSpacingCommon</b> Subcarrier spacing for <i>SIB1</i>, Msg.2/4 for initial access, paging and broadcast SI-messages. If the UE acquires this <i>MIB</i> on an FR1 carrier frequency, the value <i>scs15or60</i> corresponds to 15 kHz and the value <i>scs30or120</i> corresponds to 30 kHz. If the UE acquires this <i>MIB</i> on an FR2 carrier frequency, the value <i>scs15or60</i> corresponds to 60 kHz and the value <i>scs30or120</i> corresponds to 120 kHz. For operation with shared spectrum channel access (see 37.213 [48]), the subcarrier spacing for <i>SIB1</i> is same as that for the corresponding SSB and this field instead is used for deriving the QCL relationship between SS/PBCH blocks in a serving cell as specified in TS 38.213 [13], clause 4.1.</p>
<p><b>systemFrameNumber</b> The 6 most significant bits (MSB) of the 10-bit System Frame Number (SFN). The 4 LSB of the SFN are conveyed in the PBCH transport block as part of channel coding (i.e. outside the <i>MIB</i> encoding), as defined in clause 7.1 in TS 38.212 [17].</p>

#### – *MobilityFromNRCommand*

The *MobilityFromNRCommand* message is used to command handover from NR to E-UTRA/EPC, E-UTRA/5GC or UTRA-FDD.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: Network to UE

### MobilityFromNRCommand message

```
-- ASN1START
-- TAG-MOBILITYFROMNRCOMMAND-START

MobilityFromNRCommand ::=
    SEQUENCE {
        rrc-TransactionIdentifier    RRC-TransactionIdentifier,
        criticalExtensions           CHOICE {
            mobilityFromNRCommand    MobilityFromNRCommand-IEs,
            criticalExtensionsFuture  SEQUENCE {}
        }
    }

MobilityFromNRCommand-IEs ::=
    SEQUENCE {
        targetRAT-Type              ENUMERATED { eutra, utra-fdd-v1610, spare2, spare1, ...},
        targetRAT-MessageContainer  OCTET STRING,
        nas-SecurityParamFromNR     OCTET STRING                               OPTIONAL, -- Cond HO-ToEPCUTRAN
        lateNonCriticalExtension     OCTET STRING                               OPTIONAL,
        nonCriticalExtension         MobilityFromNRCommand-v1610-IEs    OPTIONAL
    }

MobilityFromNRCommand-v1610-IEs ::=
    SEQUENCE {
        voiceFallbackIndication-r16  ENUMERATED {true}                               OPTIONAL, -- Need N
        nonCriticalExtension         SEQUENCE {}                               OPTIONAL
    }

-- TAG-MOBILITYFROMNRCOMMAND-STOP
-- ASN1STOP
```

#### MobilityFromNRCommand-IEs field descriptions

##### **nas-SecurityParamFromNR**

If *targetRAT-Type* is *eutra*, this field is used to deliver the key synchronisation and Key freshness for the NR to LTE/EPC handovers and a part of the downlink NAS COUNT as specified in TS 33.501 [11]. If *targetRAT-Type* is *utra-fdd*, this field is used to deliver the key synchronisation and Key freshness for the NR to FDD UTRAN handover and a part of the downlink NAS COUNT as specified in TS 33.501 [11].

##### **targetRAT-MessageContainer**

The field contains a message specified in another standard, as indicated by the *targetRAT-Type*, and carries information about the target cell identifier(s) and radio parameters relevant for the target radio access technology. A complete message is included, as specified in the other standard. See NOTE 1

##### **targetRAT-Type**

Indicates the target RAT type.

##### **voiceFallbackIndication**

Indicates the handover is triggered by EPS fallback for IMS voice as specified in TS 23.502 [43].

NOTE 1: The correspondence between the value of the *targetRAT-Type*, the standard to apply, and the message contained within the *targetRAT-MessageContainer* is shown in the table below:

targetRAT-Type	Standard to apply	targetRAT-MessageContainer
<i>eutra</i>	TS 36.331 [10] (clause 5.4.2)	<i>DL-DCCH-Message</i> including the <i>RRCCONNECTIONRECONFIGURATION</i>
<i>utra-fdd</i>	TS 25.331 [45] (clause 10.2.16a)	<i>Handover TO UTRAN command</i>

Conditional Presence	Explanation
<i>HO-ToEPCUTRAN</i>	This field is mandatory present in case of inter system handover to "EPC" or "FDD UTRAN2". Otherwise it is absent.

## – *Paging*

The *Paging* message is used for the notification of one or more UEs.

Signalling radio bearer: N/A

RLC-SAP: TM

Logical channel: PCCH

Direction: Network to UE

### *Paging message*

```

-- ASN1START
-- TAG-PAGING-START

Paging ::=
    pagingRecordList          SEQUENCE {
        pagingRecordList     PagingRecordList          OPTIONAL, -- Need N
        lateNonCriticalExtension OCTET STRING          OPTIONAL,
        nonCriticalExtension  SEQUENCE{}                OPTIONAL
    }

PagingRecordList ::=
    SEQUENCE (SIZE(1..maxNrofPageRec)) OF PagingRecord

PagingRecord ::=
    SEQUENCE {
        ue-Identity           PagingUE-Identity,
        accessType            ENUMERATED {non3GPP}     OPTIONAL, -- Need N
        ...
    }

PagingUE-Identity ::=
    CHOICE {
        ng-5G-S-TMSI         NG-5G-S-TMSI,
        fullI-RNTI           I-RNTI-Value,
        ...
    }

-- TAG-PAGING-STOP
-- ASN1STOP

```

**PagingRecord** field descriptions**accessType**

Indicates whether the *Paging* message is originated due to the PDU sessions from the non-3GPP access.

– ***RRCReestablishment***

The *RRCReestablishment* message is used to re-establish SRB1.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: Network to UE

***RRCReestablishment* message**

```

-- ASN1START
-- TAG-RRCREESTABLISHMENT-START

RRCReestablishment ::=
    rrc-TransactionIdentifier      SEQUENCE {
    criticalExtensions              RRC-TransactionIdentifier,
    rrcReestablishment              CHOICE {
    criticalExtensionsFuture        RRCReestablishment-IEs,
                                   SEQUENCE {}
    }
}

RRCReestablishment-IEs ::=
    nextHopChainingCount           SEQUENCE {
    lateNonCriticalExtension        NextHopChainingCount,
    nonCriticalExtension            OCTET STRING OPTIONAL,
                                   SEQUENCE {} OPTIONAL
}

-- TAG-RRCREESTABLISHMENT-STOP
-- ASN1STOP

```

– ***RRCReestablishmentComplete***

The *RRCReestablishmentComplete* message is used to confirm the successful completion of an RRC connection re-establishment.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

### ***RRCReestablishmentComplete* message**

```
-- ASN1START
-- TAG-RRCREESTABLISHMENTCOMPLETE-START

RRCReestablishmentComplete ::=
    rrc-TransactionIdentifier          SEQUENCE {
    criticalExtensions                  RRC-TransactionIdentifier,
    rrcReestablishmentComplete         CHOICE {
    criticalExtensionsFuture            RRCReestablishmentComplete-IEs,
                                        SEQUENCE {}
    }
}

RRCReestablishmentComplete-IEs ::=
    lateNonCriticalExtension            SEQUENCE {
    nonCriticalExtension                OCTET STRING OPTIONAL,
                                        RRCReestablishmentComplete-v1610-IEs OPTIONAL
}

RRCReestablishmentComplete-v1610-IEs ::=
    ue-MeasurementsAvailable-r16      SEQUENCE {
    nonCriticalExtension                UE-MeasurementsAvailable-r16 OPTIONAL,
                                        SEQUENCE {} OPTIONAL
}

-- TAG-RRCREESTABLISHMENTCOMPLETE-STOP
-- ASN1STOP
```

### – ***RRCReestablishmentRequest***

The *RRCReestablishmentRequest* message is used to request the reestablishment of an RRC connection.

Signalling radio bearer: SRB0

RLC-SAP: TM

Logical channel: CCCH

Direction: UE to Network

### ***RRCReestablishmentRequest* message**

```
-- ASN1START
-- TAG-RRCREESTABLISHMENTREQUEST-START
```

```
RRCReestablishmentRequest ::= SEQUENCE {
```



```

    rrcReestablishmentRequest          RRCReestablishmentRequest-IEs
}

RRCReestablishmentRequest-IEs ::= SEQUENCE {
    ue-Identity                        ReestabUE-Identity,
    reestablishmentCause               ReestablishmentCause,
    spare                              BIT STRING (SIZE (1))
}

ReestabUE-Identity ::= SEQUENCE {
    c-RNTI                             RNTI-Value,
    physCellId                         PhysCellId,
    shortMAC-I                         ShortMAC-I
}

ReestablishmentCause ::= ENUMERATED {reconfigurationFailure, handoverFailure, otherFailure, spare1}

-- TAG-RRCREESTABLISHMENTREQUEST-STOP
-- ASN1STOP

```

<b>ReestabUE-Identity field descriptions</b>
--

<b>physCellId</b>
-------------------

The Physical Cell Identity of the PCell the UE was connected to prior to the failure.
---

<b>RRCReestablishmentRequest-IEs field descriptions</b>
---

<b>reestablishmentCause</b>
-----------------------------

Indicates the failure cause that triggered the re-establishment procedure. gNB is not expected to reject a <i>RRCReestablishmentRequest</i> due to unknown cause value being used by the UE.
--

<b>ue-Identity</b>
--------------------

UE identity included to retrieve UE context and to facilitate contention resolution by lower layers.
--

## – *RRCReconfiguration*

The *RRCReconfiguration* message is the command to modify an RRC connection. It may convey information for measurement configuration, mobility control, radio resource configuration (including RBs, MAC main configuration and physical channel configuration) and AS security configuration.

Signalling radio bearer: SRB1 or SRB3

RLC-SAP: AM

Logical channel: DCCH

Direction: Network to UE

*RRCReconfiguration message*

```
-- ASN1START
-- TAG-RRCRECONFIGURATION-START
```

<pre>RRCReconfiguration ::=   rrc-TransactionIdentifier   criticalExtensions   rrcReconfiguration   criticalExtensionsFuture }</pre>	<pre>SEQUENCE {   RRC-TransactionIdentifier,   CHOICE {     RRCReconfiguration-IEs,     SEQUENCE {}   } }</pre>	
<pre>RRCReconfiguration-IEs ::=   radioBearerConfig   secondaryCellGroup   measConfig   lateNonCriticalExtension   nonCriticalExtension }</pre>	<pre>SEQUENCE {   RadioBearerConfig   OCTET STRING (CONTAINING CellGroupConfig)   MeasConfig   OCTET STRING   RRCReconfiguration-v1530-IEs</pre>	<pre>OPTIONAL, -- Need M OPTIONAL, -- Cond SCG OPTIONAL, -- Need M OPTIONAL, OPTIONAL</pre>
<pre>RRCReconfiguration-v1530-IEs ::=   masterCellGroup   fullConfig   dedicatedNAS-MessageList   masterKeyUpdate MasterKeyChange   dedicatedSIB1-Delivery   dedicatedSystemInformationDelivery   otherConfig   nonCriticalExtension }</pre>	<pre>SEQUENCE {   OCTET STRING (CONTAINING CellGroupConfig)   ENUMERATED {true}   SEQUENCE (SIZE(1..maxDRB)) OF DedicatedNAS-Message   MasterKeyUpdate   OCTET STRING (CONTAINING SIB1)   OCTET STRING (CONTAINING SystemInformation)   OtherConfig   RRCReconfiguration-v1540-IEs</pre>	<pre>OPTIONAL, -- Need M OPTIONAL, -- Cond FullConfig OPTIONAL, -- Cond nonHO OPTIONAL, -- Cond OPTIONAL, -- Need N OPTIONAL, -- Need N OPTIONAL, -- Need M OPTIONAL</pre>
<pre>RRCReconfiguration-v1540-IEs ::=   otherConfig-v1540   nonCriticalExtension }</pre>	<pre>SEQUENCE {   OtherConfig-v1540   RRCReconfiguration-v1560-IEs</pre>	<pre>OPTIONAL, -- Need M OPTIONAL</pre>
<pre>RRCReconfiguration-v1560-IEs ::=   mrdc-SecondaryCellGroupConfig   radioBearerConfig2   sk-Counter   nonCriticalExtension }</pre>	<pre>SEQUENCE {   SetupRelease { MRDC-SecondaryCellGroupConfig }   OCTET STRING (CONTAINING RadioBearerConfig)   SK-Counter   RRCReconfiguration-v1610-IEs</pre>	<pre>OPTIONAL, -- Need M OPTIONAL, -- Need M OPTIONAL, -- Need N OPTIONAL</pre>
<pre>RRCReconfiguration-v1610-IEs ::=   otherConfig-v1610   bap-Config-r16   iab-IP-AddressConfigurationList-r16   conditionalReconfiguration-r16   daps-SourceRelease-r16   t316-r16   needForGapsConfigNR-r16   onDemandSIB-Request-r16   dedicatedPosSysInfoDelivery-r16</pre>	<pre>SEQUENCE {   OtherConfig-v1610   SetupRelease { BAP-Config-r16 }   IAB-IP-AddressConfigurationList-r16   ConditionalReconfiguration-r16   ENUMERATED{true}   SetupRelease {T316-r16}   SetupRelease {NeedForGapsConfigNR-r16}   SetupRelease { OnDemandSIB-Request-r16 }   OCTET STRING (CONTAINING PosSystemInformation-r16-IEs)</pre>	<pre>OPTIONAL, -- Need M OPTIONAL, -- Need M OPTIONAL, -- Need M OPTIONAL, -- Need M OPTIONAL, -- Need N OPTIONAL, -- Need M OPTIONAL, -- Need M OPTIONAL, -- Need M OPTIONAL, -- Need M OPTIONAL, -- Need M OPTIONAL, -- Need M OPTIONAL, -- Need N</pre>

```

sl-ConfigDedicatedNR-r16          SetupRelease {SL-ConfigDedicatedNR-r16}          OPTIONAL, -- Need M
sl-ConfigDedicatedEUTRA-Info-r16  SetupRelease {SL-ConfigDedicatedEUTRA-Info-r16}        OPTIONAL, -- Need M
smtc-r16                          SSB-MTC                                                    OPTIONAL, -- Need S
nonCriticalExtension              SEQUENCE {}                                                OPTIONAL
}

MRDC-SecondaryCellGroupConfig ::= SEQUENCE {
  mrdc-ReleaseAndAdd              ENUMERATED {true}                                          OPTIONAL, -- Need N
  mrdc-SecondaryCellGroup        CHOICE {
    nr-SCG                        OCTET STRING (CONTAINING RRCReconfiguration),
    eutra-SCG                     OCTET STRING
  }
}

BAP-Config-r16 ::= SEQUENCE {
  bap-Address-r16                 BIT STRING (SIZE (10))                                     OPTIONAL, -- Need M
  defaultUL-BAP-RoutingID-r16    BAP-RoutingID-r16                                         OPTIONAL, -- Need M
  defaultUL-BH-RLC-Channel-r16   BH-RLC-ChannelID-r16                                       OPTIONAL, -- Need M
  flowControlFeedbackType-r16    ENUMERATED {perBH-RLC-Channel, perRoutingID, both}      OPTIONAL, -- Need R
  ...
}

MasterKeyUpdate ::= SEQUENCE {
  keySetChangeIndicator          BOOLEAN,
  nextHopChainingCount           NextHopChainingCount,
  nas-Container                  OCTET STRING                                               OPTIONAL, -- Cond securityNAS
  ...
}

OnDemandSIB-Request-r16 ::= SEQUENCE {
  onDemandSIB-RequestProhibitTimer-r16  ENUMERATED {s0, s0dot5, s1, s2, s5, s10, s20, s30}
}

T316-r16 ::= ENUMERATED {ms50, ms100, ms200, ms300, ms400, ms500, ms600, ms1000, ms1500, ms2000}

IAB-IP-AddressConfigurationList-r16 ::= SEQUENCE {
  iab-IP-AddressToAddModList-r16  SEQUENCE (SIZE(1..maxIAB-IP-Address-r16)) OF IAB-IP-AddressConfiguration-r16  OPTIONAL, -- Need N
  iab-IP-AddressToReleaseList-r16 SEQUENCE (SIZE(1..maxIAB-IP-Address-r16)) OF IAB-IP-AddressIndex-r16  OPTIONAL, -- Need N
  ...
}

IAB-IP-AddressConfiguration-r16 ::= SEQUENCE {
  iab-IP-AddressIndex-r16         IAB-IP-AddressIndex-r16,
  iab-IP-Address-r16              IAB-IP-Address-r16                                         OPTIONAL, -- Need M
  iab-IP-Usage-r16                IAB-IP-Usage-r16                                           OPTIONAL, -- Need M
  iab-donor-DU-BAP-Address-r16    BIT STRING (SIZE(10))                                       OPTIONAL, -- Need M
  ...
}

SL-ConfigDedicatedEUTRA-Info-r16 ::= SEQUENCE {
  sl-ConfigDedicatedEUTRA-r16     OCTET STRING                                               OPTIONAL, -- Need M
  sl-TimeOffsetEUTRA-List-r16     SEQUENCE (SIZE (8)) OF SL-TimeOffsetEUTRA-r16           OPTIONAL, -- Need M
}

```

```
SL-TimeOffsetEUTRA-r16 ::= ENUMERATED {ms0, ms0dot25, ms0dot5, ms0dot625, ms0dot75, ms1, ms1dot25, ms1dot5, ms1dot75,  
ms2, ms2dot5, ms3, ms4, ms5, ms6, ms8, ms10, ms20}  
  
-- TAG-RRCRECONFIGURATION-STOP  
-- ASN1STOP
```

<b><i>RRCReconfiguration-IEs field descriptions</i></b>
<p><b><i>bap-Config</i></b> This field is used to configure the BAP entity for IAB nodes.</p>
<p><b><i>bap-Address</i></b> Indicates the BAP address of an IAB-node.</p>
<p><b><i>conditionalReconfiguration</i></b> Configuration of candidate target SpCell(s) and execution condition(s) for conditional handover or conditional PSCell change. For conditional PSCell change, this field may only be present in an <i>RRCReconfiguration</i> message for intra-SN PSCell change. The network does not configure a UE with both conditional PCell change and conditional PSCell change simultaneously. The field is absent if any DAPS bearer is configured or if the <i>masterCellGroup</i> includes <i>ReconfigurationWithSync</i>. For conditional PSCell change, the field is absent if the <i>secondaryCellGroup</i> includes <i>ReconfigurationWithSync</i>. The <i>RRCReconfiguration</i> message contained in <i>DLInformationTransferMRDC</i> cannot contain the field <i>conditionalReconfiguration</i> for conditional PSCell change.</p>
<p><b><i>daps-SourceRelease</i></b> Indicates to UE that the source cell part of DAPS operation is to be stopped and the source cell part of DAPS configuration is to be released.</p>
<p><b><i>dedicatedNAS-MessageList</i></b> 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.</p>
<p><b><i>dedicatedPosSysInfoDelivery</i></b> This field is used to transfer <i>SIBPos</i> to the UE in RRC_CONNECTED.</p>
<p><b><i>dedicatedSIB1-Delivery</i></b> This field is used to transfer <i>SIB1</i> to the UE. The field has the same values as the corresponding configuration in <i>-servingCellConfigCommon</i>.</p>
<p><b><i>dedicatedSystemInformationDelivery</i></b> This field is used to transfer <i>SIB6</i>, <i>SIB7</i>, <i>SIB8</i> to the UE with an active BWP with no common serach space configured. For UEs in RRC_CONNECTED, this field is used to transfer the SIBs requested on-demand.</p>
<p><b><i>defaultUL-BAP-RoutingID</i></b> This field is used for IAB-node to configure the default uplink Routing ID, which is used by IAB-node during IAB-node bootstrapping, migration, IAB-MT RRC resume and IAB-MT RRC re-establishment for <i>F1-C</i> and <i>non-F1</i> traffic. The <i>defaultUL-BAP-routingID</i> can be (re-)configured when IAB-node IP address for <i>F1-C</i> related traffic changes. This field is mandatory only for IAB-node bootstrapping and change of IP address for IAB-node cases.</p>
<p><b><i>defaultUL-BH-RLC-Channel</i></b> This field is used for IAB-nodes to configure the default uplink BH RLC channel, which is used by IAB-node during IAB-node bootstrapping, migration, IAB-MT RRC resume and IAB-MT RRC re-establishment for <i>F1-C</i> and <i>non-F1</i> traffic. The <i>defaultUL-BH-RLC-Channel</i> can be (re-)configured when IAB-node IP address for <i>F1-C</i> related traffic changes, and the new IP address is anchored at a different IAB-donor-DU. This field is mandatory for IAB-node bootstrapping and change of IP address for IAB-node cases. If the IAB-MT is operating in EN-DC, the default uplink BH RLC channel is referring to an RLC channel on the SCG; Otherwise, it is referring to an RLC channel on the MCG.</p>
<p><b><i>flowControlFeedbackType</i></b> This field is only used for IAB-node that support hop-by-hop flow control to configure the type of flow control feedback. Value <i>perBH-RLC-Channel</i> indicates that the IAB-node shall provide flow control feedback per BH RLC channel, value <i>perRoutingID</i> indicates that the IAB-node shall provide flow control feedback per routing ID, and value <i>both</i> indicates that the IAB-node shall provide flow control feedback both per BH RLC channel and per routing ID.</p>
<p><b><i>fullConfig</i></b> Indicates that the full configuration option is applicable for the <i>RRCReconfiguration</i> message for intra-system intra-RAT HO. For inter-RAT HO from E-UTRA to NR, <i>fullConfig</i> indicates whether or not delta signalling of SDAP/PDCP from source RAT is applicable. This field is absent if any DAPS bearer is configured or when the <i>RRCReconfiguration</i> message is transmitted on SRB3, and in an <i>RRCReconfiguration</i> message contained in another <i>RRCReconfiguration</i> message (or <i>RRCConnectionReconfiguration</i> message, see TS 36.331 [10]) transmitted on SRB1.</p>
<p><b><i>iab-IP-Address</i></b> This field is used to provide the IP address information for IAB-node.</p>
<p><b><i>iab-IP-AddressToAddModList</i></b> List of IP addresses allocated for IAB-node to be added and modified.</p>
<p><b><i>iab-IP-AddressToReleaseList</i></b> List of IP address allocated for IAB-node to be released.</p>

<b>iab-IP-Usage</b>
This field is used to indicate the usage of the assigned IP address. If this field is absent, the assigned IP address is used for all traffic.
<b>iab-donor-DU-BAP-Address</b>
This field is used to indicate the BAP address of the IAB-donor-DU where the IP address is anchored.
<b>keySetChangeIndicator</b>
Indicates whether UE shall derive a new $K_{gNB}$ . If <i>reconfigurationWithSync</i> is included, value <i>true</i> indicates that a $K_{gNB}$ key is derived from a $K_{AMF}$ key taken into use through the latest successful NAS SMC procedure, or N2 handover procedure with $K_{AMF}$ change, as described in TS 33.501 [11] for $K_{gNB}$ re-keying. Value <i>false</i> indicates that the new $K_{gNB}$ key is obtained from the current $K_{gNB}$ key or from the NH as described in TS 33.501 [11].
<b>masterCellGroup</b>
Configuration of master cell group.
<b>mrdc-ReleaseAndAdd</b>
This field indicates that the current SCG configuration is released and a new SCG is added at the same time.
<b>mrdc-SecondaryCellGroup</b>
Includes an RRC message for SCG configuration in NR-DC or NE-DC. For NR-DC (nr-SCG), <i>mrdc-SecondaryCellGroup</i> contains the <i>RRCReconfiguration</i> message as generated (entirely) by SN gNB. In this version of the specification, the RRC message can only include fields <i>secondaryCellGroup</i> , <i>otherConfig</i> , <i>conditionalReconfiguration</i> and <i>measConfig</i> . For NE-DC (eutra-SCG), <i>mrdc-SecondaryCellGroup</i> includes the E-UTRA <i>RRCConnectionReconfiguration</i> message as specified in TS 36.331 [10]. In this version of the specification, the E-UTRA RRC message can only include the field <i>scg-Configuration</i> .
<b>nas-Container</b>
This field is used to transfer UE specific NAS layer information between the network and the UE. The RRC layer is transparent for this field, although it affects activation of AS security after inter-system handover to NR. The content is defined in TS 24.501 [23].
<b>needForGapsConfigNR</b>
Configuration for the UE to report measurement gap requirement information of NR target bands in the <i>RRCReconfigurationComplete</i> and <i>RRCResumeComplete</i> message.
<b>nextHopChainingCount</b>
Parameter NCC: See TS 33.501 [11]
<b>onDemandSIB-Request</b>
If the field is present, the UE is allowed to request SIB(s) on-demand while in RRC_CONNECTED according to clause 5.2.2.3.5.
<b>onDemandSIB-RequestProhibitTimer</b>
Prohibit timer for requesting SIB(s) on-demand while in RRC_CONNECTED according to clause 5.2.2.3.5. Value in seconds. Value s0 means prohibit timer is set to 0 seconds, value s0dot5 means prohibit timer is set to 0.5 seconds, value s1 means prohibit timer is set to 1 second and so on.
<b>otherConfig</b>
Contains configuration related to other configurations. When configured for the SCG, only fields <i>drx-PreferenceConfig</i> , <i>maxBW-PreferenceConfig</i> , <i>maxCC-PreferenceConfig</i> , <i>maxMIMO-LayerPreferenceConfig</i> and <i>minSchedulingOffsetPreferenceConfig</i> can be included.
<b>radioBearerConfig</b>
Configuration of Radio Bearers (DRBs, SRBs) including SDAP/PDCP. In EN-DC this field may only be present if the <i>RRCReconfiguration</i> is transmitted over SRB3.
<b>radioBearerConfig2</b>
Configuration of Radio Bearers (DRBs, SRBs) including SDAP/PDCP. This field can only be used if the UE supports NR-DC or NE-DC.
<b>secondaryCellGroup</b>
Configuration of secondary cell group ((NG)EN-DC or NR-DC).
<b>sk-Counter</b>
A counter used upon initial configuration of S- $K_{gNB}$ or S- $K_{eNB}$ , as well as upon refresh of S- $K_{gNB}$ or S- $K_{eNB}$ . This field is always included either upon initial configuration of an NR SCG or upon configuration of the first RB with <i>keyToUse</i> set to <i>secondary</i> , whichever happens first. This field is absent if there is neither any NR SCG nor any RB with <i>keyToUse</i> set to <i>secondary</i> .
<b>sl-ConfigDedicatedNR</b>
This field is used to provide the dedicated configurations for NR sidelink communication.

<b><i>sl-ConfigDedicatedEUTRA-Info</i></b> This field includes the E-UTRA <i>RRCConnectionReconfiguration</i> as specified in TS 36.331 [10]. In this version of the specification, the E-UTRA <i>RRCConnectionReconfiguration</i> can only include sidelink related fields for V2X sidelink communication, i.e. <i>sl-V2X-ConfigDedicated</i> , <i>sl-V2X-SPS-Config</i> , <i>measConfig</i> and/or <i>otherConfig</i> .
<b><i>sl-TimeOffsetEUTRA</i></b> This field indicates the possible time offset to (de)activation of V2X sidelink transmission after receiving DCI format 3_1 used for scheduling V2X sidelink communication. Value <i>ms0dpt75</i> corresponds to 0.75ms, <i>ms1</i> corresponds to 1ms and so on. The network may configure this field only when <i>sl-ConfigDedicatedEUTRA</i> is present.
<b><i>smtc</i></b> The SSB periodicity/offset/duration configuration of target cell for NR PSCell addition and SN change. When UE receives this field, UE applies the configuration based on the timing reference of NR PCell for PSCell addition and PSCell change. If both this field and the <i>smtc</i> in <i>secondaryCellGroup</i> -> <i>SpCellConfig</i> -> <i>reconfigurationWithSync</i> are absent, the UE uses the SMTC in the <i>measObjectNR</i> having the same SSB frequency and subcarrier spacing, as configured before the reception of the RRC message.
<b><i>t316</i></b> Indicates the value for timer T316 as described in clause 7.1. Value <i>ms50</i> corresponds to 50 ms, value <i>ms100</i> corresponds to 100 ms and so on. This field can be configured only if the UE is configured with split SRB1 or SRB3.

Conditional Presence	Explanation
<i>nonHO</i>	The field is absent in case of reconfiguration with sync within NR or to NR; otherwise it is optionally present, need N.
<i>securityNASC</i>	This field is mandatory present in case of inter system handover. Otherwise the field is optionally present, need N.
<i>MasterKeyChange</i>	This field is mandatory present in case <i>masterCellGroup</i> includes <i>ReconfigurationWithSync</i> and <i>RadioBearerConfig</i> includes <i>SecurityConfig</i> with <i>SecurityAlgorithmConfig</i> , indicating a change of the AS security algorithms associated to the master key. If <i>ReconfigurationWithSync</i> is included for other cases, this field is optionally present, need N. Otherwise the field is absent.
<i>FullConfig</i>	The field is mandatory present in case of inter-system handover from E-UTRA/EPC to NR. It is optionally present, Need N, during reconfiguration with sync and also in first reconfiguration after reestablishment; or for intra-system handover from E-UTRA/5GC to NR. It is absent otherwise.
SCG	The field is optional present, Need M, in: <ul style="list-style-type: none"> <li>- an <i>RRCReconfiguration</i> message transmitted on SRB3,</li> <li>- an <i>RRCReconfiguration</i> message contained in another <i>RRCReconfiguration</i> message (or in an <i>RRCConnectionReconfiguration</i> message, see TS 36.331 [10]) transmitted on SRB1</li> <li>- an <i>RRCReconfiguration</i> message contained in another <i>RRCReconfiguration</i> message (or in an <i>RRCConnectionReconfiguration</i> message, see TS 36.331 [10]) which is contained in <i>DLInformationTransferMRDC</i> transmitted on SRB3 (as a response to <i>ULInformationTransferMRDC</i> including an <i>MCGFailureInformation</i>)</li> <li>- in an <i>RRCReconfiguration</i> message contained in an <i>RRCResume</i> message (or in an <i>RRCConnectionResume</i> message, see TS 36.331 [10]).</li> </ul> Otherwise, the field is absent

– ***RRCReconfigurationComplete***

The *RRCReconfigurationComplete* message is used to confirm the successful completion of an RRC connection reconfiguration.

Signalling radio bearer: SRB1 or SRB3

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

**RRCReconfigurationComplete message**

```

-- ASN1START
-- TAG-RRCRECONFIGURATIONCOMPLETE-START

RRCReconfigurationComplete ::=
    rrc-TransactionIdentifier
    criticalExtensions
        rrcReconfigurationComplete
        criticalExtensionsFuture
    }
}

RRCReconfigurationComplete-IEs ::=
    lateNonCriticalExtension
    nonCriticalExtension
}

RRCReconfigurationComplete-v1530-IEs ::=
    uplinkTxDirectCurrentList
    nonCriticalExtension
}

RRCReconfigurationComplete-v1560-IEs ::=
    scg-Response
        nr-SCG-Response
        eutra-SCG-Response
    }
    nonCriticalExtension
}

RRCReconfigurationComplete-v1610-IEs ::=
    ue-MeasurementsAvailable-r16
    needForGapsInfoNR-r16
    nonCriticalExtension
}

-- TAG-RRCRECONFIGURATIONCOMPLETE-STOP
-- ASN1STOP

```

```

SEQUENCE {
    RRC-TransactionIdentifier,
    CHOICE {
        RRCReconfigurationComplete-IEs,
        SEQUENCE {}
    }
}

SEQUENCE {
    OCTET STRING
    RRCReconfigurationComplete-v1530-IEs
}

SEQUENCE {
    UplinkTxDirectCurrentList
    RRCReconfigurationComplete-v1560-IEs
}

SEQUENCE {
    CHOICE {
        OCTET STRING (CONTAINING RRCReconfigurationComplete),
        OCTET STRING
    }
    RRCReconfigurationComplete-v1610-IEs
}

SEQUENCE {
    UE-MeasurementsAvailable-r16
    NeedForGapsInfoNR-r16
    SEQUENCE {}
}

```

OPTIONAL,  
OPTIONAL

OPTIONAL,  
OPTIONAL

OPTIONAL,  
OPTIONAL

OPTIONAL,  
OPTIONAL



<i>RRCReconfigurationComplete</i> -IEs field descriptions
<p><b><i>needForGapsInfoNR</i></b> This field is used to indicate the measurement gap requirement information of the UE for NR target bands.</p>
<p><b><i>scg-Response</i></b> In case of NR-DC (<i>nr-SCG-Response</i>), this field includes the <i>RRCReconfigurationComplete</i> message. In case of NE-DC (<i>eutra-SCG-Response</i>), this field includes the E-UTRA <i>RRCConnectionReconfigurationComplete</i> message as specified in TS 36.331 [10].</p>
<p><b><i>uplinkTxDirectCurrentList</i></b> The Tx Direct Current locations for the configured serving cells and BWPs if requested by the NW (see <i>reportUplinkTxDirectCurrent</i> in <i>CellGroupConfig</i>).</p>

## – *RRCReject*

The *RRCReject* message is used to reject an RRC connection establishment or an RRC connection resumption.

Signalling radio bearer: SRB0

RLC-SAP: TM

Logical channel: CCCH

Direction: Network to UE

### *RRCReject* message

```

-- ASN1START
-- TAG-RRCREJECT-START

RRCReject ::=
    criticalExtensions
        rrcReject
        criticalExtensionsFuture
    }

SEQUENCE {
    CHOICE {
        RRCReject-IEs,
        SEQUENCE {}
    }
}

RRCReject-IEs ::=
    waitTime
    lateNonCriticalExtension
    nonCriticalExtension
}

SEQUENCE {
    RejectWaitTime
    OCTET STRING
    SEQUENCE {}
}

OPTIONAL, -- Need N
OPTIONAL,
OPTIONAL

-- TAG-RRCREJECT-STOP
-- ASN1STOP

```

<i>RRCReject</i> -IEs field descriptions
<p><b><i>waitTime</i></b> Wait time value in seconds. The field is always included.</p>

## – RRCRelease

The *RRCRelease* message is used to command the release of an RRC connection or the suspension of the RRC connection.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: Network to UE

### RRCRelease message

```

-- ASN1START
-- TAG-RRCRELEASE-START

RRCRelease ::=
    rrc-TransactionIdentifier          SEQUENCE {
    criticalExtensions                 RRC-TransactionIdentifier,
    rrcRelease                         CHOICE {
    criticalExtensionsFuture           RRCRelease-IEs,
    }                                 SEQUENCE {}
}

RRCRelease-IEs ::=
    redirectedCarrierInfo             SEQUENCE {
    cellReselectionPriorities         RedirectedCarrierInfo                OPTIONAL, -- Need N
    suspendConfig                     CellReselectionPriorities           OPTIONAL, -- Need R
    deprioritisationReq               SuspendConfig                       OPTIONAL, -- Need R
    deprioritisationType              SEQUENCE {
    deprioritisationTimer             ENUMERATED {frequency, nr},
    }                                 ENUMERATED {min5, min10, min15, min30}
    lateNonCriticalExtension           OPTIONAL, -- Need N
    nonCriticalExtension              OCTET STRING                       OPTIONAL,
    RRCRelease-v1540-IEs              OPTIONAL
}

RRCRelease-v1540-IEs ::=
    waitTime                          SEQUENCE {
    nonCriticalExtension              RejectWaitTime                       OPTIONAL, -- Need N
    RRCRelease-v1610-IEs             RRCRelease-v1610-IEs                OPTIONAL
}

RRCRelease-v1610-IEs ::=
    voiceFallbackIndication-r16       SEQUENCE {
    measIdleConfig-r16               ENUMERATED {true}                    OPTIONAL, -- Need N
    nonCriticalExtension              SetupRelease {MeasIdleConfigDedicated-r16} OPTIONAL, -- Need M
    }                                 SEQUENCE {}
    OPTIONAL

RedirectedCarrierInfo ::=
    nr                                 CHOICE {
    eutra                             CarrierInfoNR,
    ...                               RedirectedCarrierInfo-EUTRA,

```

```

}

RedirectedCarrierInfo-EUTRA ::= SEQUENCE {
    eutraFrequency
    cnType
}
OPTIONAL -- Need N

CarrierInfoNR ::= SEQUENCE {
    carrierFreq
    ssbSubcarrierSpacing
    smtc
    ...
}
OPTIONAL, -- Need S

SuspendConfig ::= SEQUENCE {
    fullI-RNTI
    shortI-RNTI
    ran-PagingCycle
    ran-NotificationAreaInfo
    t380
    nextHopChainingCount
    ...
}
OPTIONAL, -- Need M
OPTIONAL, -- Need R

PeriodicRNAU-TimerValue ::= ENUMERATED { min5, min10, min20, min30, min60, min120, min360, min720}

CellReselectionPriorities ::= SEQUENCE {
    freqPriorityListEUTRA
    freqPriorityListNR
    t320
    ...
}
OPTIONAL, -- Need M
OPTIONAL, -- Need M
OPTIONAL, -- Need R

PagingCycle ::= ENUMERATED {rf32, rf64, rf128, rf256}

FreqPriorityListEUTRA ::= SEQUENCE (SIZE (1..maxFreq)) OF FreqPriorityEUTRA

FreqPriorityListNR ::= SEQUENCE (SIZE (1..maxFreq)) OF FreqPriorityNR

FreqPriorityEUTRA ::= SEQUENCE {
    carrierFreq
    cellReselectionPriority
    cellReselectionSubPriority
}
OPTIONAL -- Need R

FreqPriorityNR ::= SEQUENCE {
    carrierFreq
    cellReselectionPriority
    cellReselectionSubPriority
}
OPTIONAL -- Need R

RAN-NotificationAreaInfo ::= CHOICE {
    cellList
    PLMN-RAN-AreaCellList,

```

```

    ran-AreaConfigList          PLMN-RAN-AreaConfigList,
    ...
}

PLMN-RAN-AreaCellList ::=      SEQUENCE (SIZE (1.. maxPLMNIdentities)) OF PLMN-RAN-AreaCell

PLMN-RAN-AreaCell ::=         SEQUENCE {
    plmn-Identity              PLMN-Identity                               OPTIONAL,    -- Need S
    ran-AreaCells              SEQUENCE (SIZE (1..32)) OF CellIdentity
}

PLMN-RAN-AreaConfigList ::=   SEQUENCE (SIZE (1..maxPLMNIdentities)) OF PLMN-RAN-AreaConfig

PLMN-RAN-AreaConfig ::=      SEQUENCE {
    plmn-Identity              PLMN-Identity                               OPTIONAL,    -- Need S
    ran-Area                  SEQUENCE (SIZE (1..16)) OF RAN-AreaConfig
}

RAN-AreaConfig ::=           SEQUENCE {
    trackingAreaCode           TrackingAreaCode,
    ran-AreaCodeList          SEQUENCE (SIZE (1..32)) OF RAN-AreaCode       OPTIONAL    -- Need R
}

-- TAG-RRCRELEASE-STOP
-- ASN1STOP

```

<b>RRCRelease-IEs field descriptions</b>	
<b>cnType</b>	Indicate that the UE is redirected to EPC or 5GC.
<b>deprioritisationReq</b>	Indicates whether the current frequency or RAT is to be de-prioritised.
<b>deprioritisationTimer</b>	Indicates the period for which either the current carrier frequency or NR is deprioritised. Value <i>minN</i> corresponds to N minutes.
<b>measIdleConfig</b>	Indicates measurement configuration to be stored and used by the UE while in RRC_IDLE or RRC_INACTIVE.
<b>suspendConfig</b>	Indicates configuration for the RRC_INACTIVE state. The network does not configure <i>suspendConfig</i> when the network redirect the UE to an inter-RAT carrier frequency or if the UE is configured with a DAPS bearer.
<b>redirectedCarrierInfo</b>	Indicates a carrier frequency (downlink for FDD) and is used to redirect the UE to an NR or an inter-RAT carrier frequency, by means of cell selection at transition to RRC_IDLE or RRC_INACTIVE as specified in TS 38.304 [20]. In this release of specification, <i>redirectedCarrierInfo</i> is not included in an <i>RRCRelease</i> message with <i>suspendConfig</i> if this message is in response to an <i>RRCResumeRequest</i> or an <i>RRCResumeRequest1</i> which is triggered by the NAS layer.
<b>voiceFallbackIndication</b>	Indicates the RRC release is triggered by EPS fallback for IMS voice as specified in TS 23.502 [43].

<b>CarrierInfoNR field descriptions</b>
<b>carrierFreq</b> Indicates the redirected NR frequency.
<b>ssbSubcarrierSpacing</b> Subcarrier spacing of SSB in the redirected SSB frequency. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable.
<b>smtc</b> The SSB periodicity/offset/duration configuration for the redirected SSB frequency. It is based on timing reference of PCell. If the field is absent, the UE uses the SMTTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing.

<b>RAN-NotificationAreaInfo field descriptions</b>
<b>cellList</b> A list of cells configured as RAN area.
<b>ran-AreaConfigList</b> A list of RAN area codes or RA code(s) as RAN area.

<b>PLMN-RAN-AreaConfig field descriptions</b>
<b>plmn-Identity</b> PLMN Identity to which the cells in <i>ran-Area</i> belong. If the field is absent the UE uses the ID of the registered PLMN.
<b>ran-AreaCodeList</b> The total number of RAN-AreaCodes of all PLMNs does not exceed 32.
<b>ran-Area</b> Indicates whether TA code(s) or RAN area code(s) are used for the RAN notification area. The network uses only TA code(s) or both TA code(s) and RAN area code(s) to configure a UE. The total number of TACs across all PLMNs does not exceed 16.

<b>PLMN-RAN-AreaCell field descriptions</b>
<b>plmn-Identity</b> PLMN Identity to which the cells in <i>ran-AreaCells</i> belong. If the field is absent the UE uses the ID of the registered PLMN.
<b>ran-AreaCells</b> The total number of cells of all PLMNs does not exceed 32.

<b>SuspendConfig field descriptions</b>
<b>ran-NotificationAreaInfo</b> Network ensures that the UE in RRC_INACTIVE always has a valid <i>ran-NotificationAreaInfo</i> .
<b>ran-PagingCycle</b> Refers to the UE specific cycle for RAN-initiated paging. Value <i>rf32</i> corresponds to 32 radio frames, value <i>rf64</i> corresponds to 64 radio frames and so on.
<b>t380</b> Refers to the timer that triggers the periodic RNAU procedure in UE. Value <i>min5</i> corresponds to 5 minutes, value <i>min10</i> corresponds to 10 minutes and so on.

– **RRCResume**

The *RRCResume* message is used to resume the suspended RRC connection.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: Network to UE

### RRCResume message

```

-- ASN1START
-- TAG-RRCRESUME-START

RRCResume ::=
  rrc-TransactionIdentifier
  criticalExtensions
    rrcResume
    criticalExtensionsFuture
  }
}

RRCResume-IEs ::=
  radioBearerConfig
  masterCellGroup
  measConfig
  fullConfig
  lateNonCriticalExtension
  nonCriticalExtension
}

RRCResume-v1560-IEs ::=
  radioBearerConfig2
  sk-Counter
  nonCriticalExtension
}

RRCResume-v1610-IEs ::=
  idleModeMeasurementReq-r16
  restoreMCG-SCells-r16
  restoreSCG-r16
  mrdc-SecondaryCellGroup-r16
    nr-SCG-r16
    eutra-SCG-r16
  }
  needForGapsConfigNR-r16
  nonCriticalExtension
}

-- TAG-RRCRESUME-STOP
-- ASN1STOP

```

```

SEQUENCE {
  RRC-TransactionIdentifier,
  CHOICE {
    RRCResume-IEs,
    SEQUENCE {}
  }
}

SEQUENCE {
  RadioBearerConfig
  OCTET STRING (CONTAINING CellGroupConfig)
  MeasConfig
  ENUMERATED {true}
  OCTET STRING
  RRCResume-v1560-IEs
}
OPTIONAL, -- Need M
OPTIONAL, -- Need M
OPTIONAL, -- Need M
OPTIONAL, -- Need N
OPTIONAL,
OPTIONAL

SEQUENCE {
  OCTET STRING (CONTAINING RadioBearerConfig)
  SK-Counter
  RRCResume-v1610-IEs
}
OPTIONAL, -- Need M
OPTIONAL, -- Need N
OPTIONAL

SEQUENCE {
  ENUMERATED {true}
  ENUMERATED {true}
  ENUMERATED {true}
  CHOICE {
    OCTET STRING (CONTAINING RRCReconfiguration),
    OCTET STRING
  }
  SetupRelease {NeedForGapsConfigNR-r16}
  SEQUENCE {}
}
OPTIONAL, -- Need N
OPTIONAL, -- Need N
OPTIONAL, -- Need N
OPTIONAL, -- Cond RestoreSCG
OPTIONAL, -- Need M
OPTIONAL

```

<b><i>RRCResume-IEs field descriptions</i></b>	
<b><i>idleModeMeasurementReq</i></b>	This field indicates that the UE shall report the idle/inactive measurements, if available, to the network in the <i>RRCResumeComplete</i> message
<b><i>masterCellGroup</i></b>	Configuration of the master cell group.
<b><i>mrdc-SecondaryCellGroup</i></b>	Includes an RRC message for SCG configuration in NR-DC or NE-DC. For NR-DC ( <i>nr-SCG</i> ), <i>mrdc-SecondaryCellGroup</i> contains the <i>RRCReconfiguration</i> message as generated (entirely) by SN gNB. In this version of the specification, the RRC message only includes fields <i>secondaryCellGroup</i> , with at least <i>reconfigurationWithSync</i> , and <i>measConfig</i> . For NE-DC ( <i>eutra-SCG</i> ), <i>mrdc-SecondaryCellGroup</i> includes the E-UTRA <i>RRCConnectionReconfiguration</i> message as specified in TS 36.331 [10]. In this version of the specification, the E-UTRA RRC message only include the field <i>scg-Configuration</i> with at least <i>mobilityControlInfoSCG</i> .
<b><i>needForGapsConfigNR</i></b>	Configuration for the UE to report measurement gap requirement information of NR target bands in the <i>RRCReconfigurationComplete</i> and <i>RRCResumeComplete</i> message.
<b><i>radioBearerConfig</i></b>	Configuration of Radio Bearers (DRBs, SRBs) including SDAP/PDCP.
<b><i>radioBearerConfig2</i></b>	Configuration of Radio Bearers (DRBs, SRBs) including SDAP/PDCP. This field can only be used if the UE supports NR-DC or NE-DC.
<b><i>restoreMCG-SCells</i></b>	Indicates that the UE shall restore the MCG SCells from the UE Inactive AS Context, if stored.
<b><i>restoreSCG</i></b>	Indicates that the UE shall restore the SCG configurations from the UE Inactive AS Context, if stored.
<b><i>sk-Counter</i></b>	A counter used to derive S-K <sub>gNB</sub> or S-K <sub>eNB</sub> based on the newly derived K <sub>gNB</sub> during RRC Resume. The field is only included when there is one or more RB with <i>keyToUse</i> set to <i>secondary</i> or <i>SCG is configured</i> .

<b>Conditional Presence</b>	<b>Explanation</b>
<i>RestoreSCG</i>	The field is mandatory present if <i>restoreSCG</i> is included. It is optionally present, Need M, otherwise.

– ***RRCResumeComplete***

The *RRCResumeComplete* 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 Network

***RRCResumeComplete* message**

```
-- ASN1START
-- TAG-RRCRESUMECOMplete-START
```

```

RRCResumeComplete ::=
  rrc-TransactionIdentifier
  criticalExtensions
    rrcResumeComplete
    criticalExtensionsFuture
  }
}

RRCResumeComplete-IEs ::=
  dedicatedNAS-Message
  selectedPLMN-Identity
  uplinkTxDirectCurrentList
  lateNonCriticalExtension
  nonCriticalExtension

RRCResumeComplete-v1610-IEs ::=
  idleMeasAvailable-r16
  measResultIdleEUTRA-r16
  measResultIdleNR-r16
  scg-Response-r16
    nr-SCG-Response
    eutra-SCG-Response
  }
  ue-MeasurementsAvailable-r16
  mobilityHistoryAvail-r16
  mobilityState-r16
  needForGapsInfoNR-r16
  nonCriticalExtension

-- TAG-RRCRESUMECOMplete-STOP
-- ASN1STOP

```

SEQUENCE {  
 RRC-TransactionIdentifier,  
 CHOICE {  
 RRCResumeComplete-IEs,  
 SEQUENCE {}  
}

SEQUENCE {  
 DedicatedNAS-Message OPTIONAL,  
 INTEGER (1..maxPLMN) OPTIONAL,  
 UplinkTxDirectCurrentList OPTIONAL,  
 OCTET STRING OPTIONAL,  
 RRCResumeComplete-v1610-IEs OPTIONAL

SEQUENCE {  
 ENUMERATED {true} OPTIONAL,  
 MeasResultIdleEUTRA-r16 OPTIONAL,  
 MeasResultIdleNR-r16 OPTIONAL,  
 CHOICE {  
 OCTET STRING (CONTAINING RRCReconfigurationComplete),  
 OCTET STRING  
} OPTIONAL,  
 UE-MeasurementsAvailable-r16 OPTIONAL,  
 ENUMERATED {true} OPTIONAL,  
 ENUMERATED {normal, medium, high, spare} OPTIONAL,  
 NeedForGapsInfoNR-r16 OPTIONAL,  
 SEQUENCE{} OPTIONAL

### RRCResumeComplete-IEs field descriptions

**idleMeasAvailable**

Indication that the UE has idle/inactive measurement report available.

**measResultIdleEUTRA**

EUTRA measurement results performed during RRC\_INACTIVE.

**measResultIdleNR**

NR measurement results performed during RRC\_INACTIVE.

**needForGapsInfoNR**

This field is used to indicate the measurement gap requirement information of the UE for NR target bands.

**selectedPLMN-Identity**

Index of the PLMN selected by the UE from the *plmn-IdentityList* or *npr-IdentityInfoList* fields included in *SIB1*.

**uplinkTxDirectCurrentList**

The Tx Direct Current locations for the configured serving cells and BWPs if requested by the NW (see *reportUplinkTxDirectCurrent* in *CellGroupConfig*).



– *RRCResumeRequest*

The *RRCResumeRequest* message is used to request the resumption of a suspended RRC connection or perform an RNA update.

Signalling radio bearer: SRB0

RLC-SAP: TM

Logical channel: CCCH

Direction: UE to Network

***RRCResumeRequest* message**

```
-- ASN1START
-- TAG-RRCRESUMEREQUEST-START

RRCResumeRequest ::= SEQUENCE {
    rrcResumeRequest    RRCResumeRequest-IEs
}

RRCResumeRequest-IEs ::= SEQUENCE {
    resumeIdentity      ShortI-RNTI-Value,
    resumeMAC-I         BIT STRING (SIZE (16)),
    resumeCause         ResumeCause,
    spare               BIT STRING (SIZE (1))
}

-- TAG-RRCRESUMEREQUEST-STOP
-- ASN1STOP
```

***RRCResumeRequest-IEs* field descriptions**

***resumeCause***

Provides the resume cause for the RRC connection resume request as provided by the upper layers or RRC. The network is not expected to reject an *RRCResumeRequest* due to unknown cause value being used by the UE.

***resumeIdentity***

UE identity to facilitate UE context retrieval at gNB.

***resumeMAC-I***

Authentication token to facilitate UE authentication at gNB. The 16 least significant bits of the MAC-I calculated using the AS security configuration as specified in 5.3.13.3.

– *RRCResumeRequest1*

The *RRCResumeRequest1* message is used to request the resumption of a suspended RRC connection or perform an RNA update.

Signalling radio bearer: SRB0

RLC-SAP: TM

Logical channel: CCCH1

Direction: UE to Network

### ***RRCResumeRequest1*** message

```
-- ASN1START
-- TAG-RRCRESUMEREQUEST1-START

RRCResumeRequest1 ::= SEQUENCE {
    rrcResumeRequest1 RRCResumeRequest1-IEs
}

RRCResumeRequest1-IEs ::= SEQUENCE {
    resumeIdentity I-RNTI-Value,
    resumeMAC-I BIT STRING (SIZE (16)),
    resumeCause ResumeCause,
    spare BIT STRING (SIZE (1))
}

-- TAG-RRCRESUMEREQUEST1-STOP
-- ASN1STOP
```

#### ***RRCResumeRequest1-IEs*** field descriptions

##### ***resumeCause***

Provides the resume cause for the *RRCResumeRequest1* as provided by the upper layers or RRC. A gNB is not expected to reject an *RRCResumeRequest1* due to unknown cause value being used by the UE.

##### ***resumeIdentity***

UE identity to facilitate UE context retrieval at gNB.

##### ***resumeMAC-I***

Authentication token to facilitate UE authentication at gNB. The 16 least significant bits of the MAC-I calculated using the AS security configuration as specified in 5.3.13.3.

### – ***RRCSetup***

The *RRCSetup* message is used to establish SRB1.

Signalling radio bearer: SRB0

RLC-SAP: TM

Logical channel: CCCH

Direction: Network to UE

**RRCSetup message**

```

-- ASN1START
-- TAG-RRCSETUP-START

RRCSetup ::=
    rrc-TransactionIdentifier          SEQUENCE {
        criticalExtensions             CHOICE {
            rrcSetup                   RRCSetup-IEs,
            criticalExtensionsFuture    SEQUENCE {}
        }
    }

RRCSetup-IEs ::=
    radioBearerConfig                 SEQUENCE {
        masterCellGroup                OCTET STRING (CONTAINING CellGroupConfig),
        lateNonCriticalExtension         OCTET STRING                               OPTIONAL,
        nonCriticalExtension             SEQUENCE {}                               OPTIONAL
    }

-- TAG-RRCSETUP-STOP
-- ASN1STOP

```

**RRCSetup-IEs field descriptions****masterCellGroup**

The network configures only the RLC bearer for the SRB1, *mac-CellGroupConfig*, *physicalCellGroupConfig* and *spCellConfig*.

**radioBearerConfig**

Only SRB1 can be configured in RRC setup.

– **RRCSetupComplete**

The *RRCSetupComplete* message is used to confirm the successful completion of an RRC connection establishment.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

**RRCSetupComplete message**

```

-- ASN1START
-- TAG-RRCSETUPCOMPLETE-START

RRCSetupComplete ::=
    SEQUENCE {

```

```

rrc-TransactionIdentifier      RRC-TransactionIdentifier,
criticalExtensions             CHOICE {
  rrcSetupComplete            RRCSetupComplete-IEs,
  criticalExtensionsFuture    SEQUENCE {}
}
}

RRCSetupComplete-IEs ::=    SEQUENCE {
  selectedPLMN-Identity      INTEGER (1..maxPLMN),
  registeredAMF              REGISTEREDAMF OPTIONAL,
  guami-Type                 ENUMERATED {native, mapped} OPTIONAL,
  s-NSSAI-List               SEQUENCE (SIZE (1..maxNrofS-NSSAI)) OF S-NSSAI OPTIONAL,
  dedicatedNAS-Message      DedicatedNAS-Message,
  ng-5G-S-TMSI-Value        CHOICE {
    ng-5G-S-TMSI             NG-5G-S-TMSI,
    ng-5G-S-TMSI-Part2      BIT STRING (SIZE (9))
  }
  lateNonCriticalExtension   OCTET STRING OPTIONAL,
  nonCriticalExtension       RRCSetupComplete-v1610-IEs OPTIONAL
}

RRCSetupComplete-v1610-IEs ::= SEQUENCE {
  iab-NodeIndication-r16    ENUMERATED {true} OPTIONAL,
  idleMeasAvailable-r16     ENUMERATED {true} OPTIONAL,
  ue-MeasurementsAvailable-r16 UE-MeasurementsAvailable-r16 OPTIONAL,
  mobilityHistoryAvail-r16  ENUMERATED {true} OPTIONAL,
  mobilityState-r16         ENUMERATED {normal, medium, high, spare} OPTIONAL,
  nonCriticalExtension       SEQUENCE {} OPTIONAL
}

RegisteredAMF ::=          SEQUENCE {
  plmn-Identity              PLMN-Identity OPTIONAL,
  amf-Identifier             AMF-Identifier
}

-- TAG-RRCSETUPCOMPLETE-STOP
-- ASN1STOP

```

<i>RRCSetupComplete-IEs</i> field descriptions
<p><b><i>guami-Type</i></b> 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 [23].</p>
<p><b><i>iab-NodeIndication</i></b> This field is used to indicate that the connection is being established by an IAB-node [2].</p>
<p><b><i>idleMeasAvailable</i></b> Indication that the UE has idle/inactive measurement report available.</p>
<p><b><i>mobilityState</i></b> This field indicates the UE mobility state (as defined in TS 38.304 [20], clause 5.2.4.3) just prior to UE going into RRC_CONNECTED state. The UE indicates the value of <i>medium</i> and <i>high</i> when being in Medium-mobility and High-mobility states respectively. Otherwise the UE indicates the value <i>normal</i>.</p>
<p><b><i>ng-5G-S-TMSI-Part2</i></b> The leftmost 9 bits of 5G-S-TMSI.</p>
<p><b><i>registeredAMF</i></b> 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 [21].</p>
<p><b><i>selectedPLMN-Identity</i></b> Index of the PLMN or SNPN selected by the UE from the <i>plmn-IdentityList</i> or <i>npr-IdentityInfoList</i> fields included in SIB1.</p>

## – *RRCSetupRequest*

The *RRCSetupRequest* message is used to request the establishment of an RRC connection.

Signalling radio bearer: SRB0

RLC-SAP: TM

Logical channel: CCCH

Direction: UE to Network

### *RRCSetupRequest* message

```
-- ASN1START
-- TAG-RRCSETUPREQUEST-START

RRCSetupRequest ::=
    SEQUENCE {
        rrcSetupRequest
    }

RRCSetupRequest-IEs ::=
    SEQUENCE {
        ue-Identity
        establishmentCause
        spare
    }

InitialUE-Identity ::=
    CHOICE {
        ng-5G-S-TMSI-Part1
        BIT STRING (SIZE (39)),
```

```

    randomValue                BIT STRING (SIZE (39))
}

EstablishmentCause ::=      ENUMERATED {
    emergency, highPriorityAccess, mt-Access, mo-Signalling,
    mo-Data, mo-VoiceCall, mo-VideoCall, mo-SMS, mps-PriorityAccess, mcs-PriorityAccess,
    spare6, spare5, spare4, spare3, spare2, spare1}

-- TAG-RRCSETUPREQUEST-STOP
-- ASN1STOP

```

#### ***RRCSetupRequest-IEs field descriptions***

##### ***establishmentCause***

Provides the establishment cause for the *RRCSetupRequest* in accordance with the information received from upper layers. gNB is not expected to reject an *RRCSetupRequest* due to unknown cause value being used by the UE.

##### ***ue-Identity***

UE identity included to facilitate contention resolution by lower layers.

#### ***InitialUE-Identity field descriptions***

##### ***ng-5G-S-TMSI-Part1***

The rightmost 39 bits of 5G-S-TMSI.

##### ***randomValue***

Integer value in the range 0 to  $2^{39} - 1$ .

## – ***RRCSystemInfoRequest***

The *RRCSystemInfoRequest* message is used to request SI message(s) required by the UE as specified in clause 5.2.2.3.3.

Signalling radio bearer: SRB0

RLC-SAP: TM

Logical channel: CCCH

Direction: UE to Network

### ***RRCSystemInfoRequest message***

```

-- ASN1START
-- TAG-RRCSYSTEMINFOREQUEST-START

RRCSystemInfoRequest ::=      SEQUENCE {
    criticalExtensions          CHOICE {
        rrcSystemInfoRequest   RRCSystemInfoRequest-IEs,
        criticalExtensionsFuture-r16 CHOICE {

```

```

        rrcPosSystemInfoRequest-r16      RRC-PosSystemInfoRequest-r16-IEs,
        criticalExtensionsFuture        SEQUENCE {}
    }
}

RRCSysInfoRequest-IEs ::= SEQUENCE {
    requested-SI-List                BIT STRING (SIZE (maxSI-Message)), --32bits
    spare                            BIT STRING (SIZE (12))
}

RRC-PosSystemInfoRequest-r16-IEs ::= SEQUENCE {
    requestedPosSI-List              BIT STRING (SIZE (maxSI-Message)), --32bits
    spare                            BIT STRING (SIZE (11))
}

-- TAG-RRCSYSTEMINFOREQUEST-STOP
-- ASN1STOP

```

#### **RRCSysInfoRequest-IEs field descriptions**

##### ***requested-SI-List***

Contains a list of requested SI messages. According to the order of entry in the list of SI messages configured by *schedulingInfoList* in *si-SchedulingInfo* in *SIB1*, first bit corresponds to first/leftmost listed SI message, second bit corresponds to second listed SI message, and so on.

##### ***requestedPosSI-List***

Contains a list of requested SI messages. According to the order of entry in the list of SI messages configured by *posSchedulingInfoList* in *posSI-SchedulingInfo* in *SIB1*, first bit corresponds to first/leftmost listed SI message, second bit corresponds to second listed SI message, and so on.

## – ***SCGFailureInformation***

The *SCGFailureInformation* message is used to provide information regarding NR SCG failures detected by the UE.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

#### ***SCGFailureInformation* message**

```

-- ASN1START
-- TAG-SCGFAILUREINFORMATION-START

SCGFailureInformation ::= SEQUENCE {
    criticalExtensions          CHOICE {
        scgFailureInformation  SCGFailureInformation-IEs,

```

```

        criticalExtensionsFuture          SEQUENCE {}
    }
}

SCGFailureInformation-IEs ::=
    failureReportSCG                    SEQUENCE {
        nonCriticalExtension              FailureReportSCG                    OPTIONAL,
                                           SCGFailureInformation-v1590-IEs    OPTIONAL
    }

SCGFailureInformation-v1590-IEs ::=
    lateNonCriticalExtension             SEQUENCE {
        nonCriticalExtension              OCTET STRING                    OPTIONAL,
                                           SEQUENCE {}                          OPTIONAL
    }

FailureReportSCG ::=
    failureType                          SEQUENCE {
                                           ENUMERATED {
                                               t310-Expiry, randomAccessProblem,
                                               rlc-MaxNumRetx,
                                               synchReconfigFailureSCG, scg-ReconfigFailure,
                                               srb3-IntegrityFailure, other-r16, spare1},
                                           MeasResultFreqList                    OPTIONAL,
                                           OCTET STRING (CONTAINING MeasResultSCG-Failure)  OPTIONAL,
                                           LocationInfo-r16                    OPTIONAL,
                                           ENUMERATED {scg-lbtFailure-r16, beamFailureRecoveryFailure-r16,
                                               t312-Expiry-r16, bh-RLF-r16, spare4, spare3, spare2, spare1}  OPTIONAL
    }

    measResultFreqList                    MeasResultFreqList
    measResultSCG-Failure                  OCTET STRING (CONTAINING MeasResultSCG-Failure)
    ...
    [[
        locationInfo-r16                  LocationInfo-r16
        failureType-v1610                  ENUMERATED {scg-lbtFailure-r16, beamFailureRecoveryFailure-r16,
                                               t312-Expiry-r16, bh-RLF-r16, spare4, spare3, spare2, spare1}
    ]]
}

MeasResultFreqList ::=
    SEQUENCE (SIZE (1..maxFreq)) OF MeasResult2NR

-- TAG-SCGFAILUREINFORMATION-STOP
-- ASN1STOP

```

#### **SCGFailureInformation field descriptions**

##### ***measResultFreqList***

The field contains available results of measurements on NR frequencies the UE is configured to measure by *measConfig*.

##### ***measResultSCG-Failure***

The field contains the *MeasResultSCG-Failure* IE which includes available results of measurements on NR frequencies the UE is configured to measure by the NR SCG *RRCReconfiguration* message.

## – SCGFailureInformationEUTRA

The *SCGFailureInformationEUTRA* message is used to provide information regarding E-UTRA SCG failures detected by the UE.

Signalling radio bearer: SRB1



RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

**SCGFailureInformationEUTRA message**

```

-- ASN1START
-- TAG-SCGFAILUREINFORMATIONEUTRA-START

SCGFailureInformationEUTRA ::=
    criticalExtensions
        scgFailureInformationEUTRA
        criticalExtensionsFuture
    }
}

SCGFailureInformationEUTRA-IEs ::=
    failureReportSCG-EUTRA
    nonCriticalExtension
}

SCGFailureInformationEUTRA-v1590-IEs ::=
    lateNonCriticalExtension
    nonCriticalExtension
}

FailureReportSCG-EUTRA ::=
    failureType
    measResultFreqListMRDC
    measResultSCG-FailureMRDC
    ...
    [[
    locationInfo-r16
    ]]
}

MeasResultFreqListFailMRDC ::=
    SEQUENCE (SIZE (1.. maxFreq)) OF MeasResult2EUTRA

```

SEQUENCE {

CHOICE {

SCGFailureInformationEUTRA-IEs,

SEQUENCE {}

SEQUENCE {

FailureReportSCG-EUTRA OPTIONAL,

SCGFailureInformationEUTRA-v1590-IEs OPTIONAL

SEQUENCE {

OCTET STRING OPTIONAL,

SEQUENCE {} OPTIONAL

SEQUENCE {

ENUMERATED {

t313-Expiry, randomAccessProblem,rlc-MaxNumRetx,

scg-ChangeFailure,scg-lbtFailure-r16,

beamFailureRecoveryFailure-r16, t312-Expiry-r16, spare},

MeasResultFreqListFailMRDC OPTIONAL,

OCTET STRING OPTIONAL,

LocationInfo-r16 OPTIONAL

SEQUENCE (SIZE (1.. maxFreq)) OF MeasResult2EUTRA

-- TAG-SCGFAILUREINFORMATIONEUTRA-STOP

-- ASN1STOP

**SCGFailureInformationEUTRA field descriptions****measResultFreqListMRDC**

The field contains available results of measurements on E-UTRA frequencies the UE is configured to measure by *measConfig*.

**measResultSCG-FailureMRDC**

Includes the E-UTRA *MeasResultSCG-FailureMRDC* IE as specified in TS 36.331 [10]. The field contains available results of measurements on E-UTRA frequencies the UE is configured to measure by the E-UTRA *RRCConnectionReconfiguration* message.

– **SecurityModeCommand**

The *SecurityModeCommand* message is used to command the activation of AS security.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: Network to UE

**SecurityModeCommand message**

```
-- ASN1START
-- TAG-SECURITYMODECOMMAND-START

SecurityModeCommand ::=
    rrc-TransactionIdentifier          SEQUENCE {
        criticalExtensions              CHOICE {
            securityModeCommand        SecurityModeCommand-IEs,
            criticalExtensionsFuture     SEQUENCE {}
        }
    }

SecurityModeCommand-IEs ::=
    securityConfigSMC                 SEQUENCE {
        lateNonCriticalExtension        OCTET STRING OPTIONAL,
        nonCriticalExtension            SEQUENCE {}          OPTIONAL
    }

SecurityConfigSMC ::=
    securityAlgorithmConfig           SEQUENCE {
        ...
    }

-- TAG-SECURITYMODECOMMAND-STOP
-- ASN1STOP
```

## – *SecurityModeComplete*

The *SecurityModeComplete* message is used to confirm the successful completion of a security mode command.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

### ***SecurityModeComplete* message**

```

-- ASN1START
-- TAG-SECURITYMODECOMPLETE-START

SecurityModeComplete ::=
    rrc-TransactionIdentifier          SEQUENCE {
    criticalExtensions                 RRC-TransactionIdentifier,
    securityModeComplete              CHOICE {
    criticalExtensionsFuture           SecurityModeComplete-IEs,
    }                                 SEQUENCE {}
}

SecurityModeComplete-IEs ::=
    lateNonCriticalExtension          SEQUENCE {
    nonCriticalExtension              OCTET STRING                OPTIONAL,
    }                                 SEQUENCE{}                OPTIONAL
-- TAG-SECURITYMODECOMPLETE-STOP
-- ASN1STOP

```

## – *SecurityModeFailure*

The *SecurityModeFailure* message is used to indicate an unsuccessful completion of a security mode command.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

**SecurityModeFailure message**

```

-- ASN1START
-- TAG-SECURITYMODEFAILURE-START

SecurityModeFailure ::=
    rrc-TransactionIdentifier
    criticalExtensions
        securityModeFailure
        criticalExtensionsFuture
    }
}

SecurityModeFailure-IEs ::=
    lateNonCriticalExtension
    nonCriticalExtension
}

-- TAG-SECURITYMODEFAILURE-STOP
-- ASN1STOP

```

SEQUENCE {  
RRC-TransactionIdentifier,  
CHOICE {  
SecurityModeFailure-IEs,  
SEQUENCE {}  
}

SEQUENCE {  
OCTET STRING OPTIONAL,  
SEQUENCE {} OPTIONAL

**– SIB1**

*SIB1* contains information relevant when evaluating if a UE is allowed to access a cell and defines the scheduling of other system information. It also contains radio resource configuration information that is common for all UEs and barring information applied to the unified access control.

Signalling radio bearer: N/A

RLC-SAP: TM

Logical channels: BCCH

Direction: Network to UE

**SIB1 message**

```

-- ASN1START
-- TAG-SIB1-START

SIB1 ::= SEQUENCE {
    cellSelectionInfo SEQUENCE {
        q-RxLevMin Q-RxLevMin,
        q-RxLevMinOffset INTEGER (1..8) OPTIONAL, -- Need S
        q-RxLevMinSUL Q-RxLevMin OPTIONAL, -- Need R
        q-QualMin Q-QualMin OPTIONAL, -- Need S
        q-QualMinOffset INTEGER (1..8) OPTIONAL, -- Need S
    }
    cellAccessRelatedInfo CellAccessRelatedInfo,
    connEstFailureControl ConnEstFailureControl OPTIONAL, -- Need R
}

```

```

si-SchedulingInfo                SI-SchedulingInfo                OPTIONAL, -- Need R
servingCellConfigCommon          ServingCellConfigCommonSIB        OPTIONAL, -- Need R
ims-EmergencySupport             ENUMERATED {true}                OPTIONAL, -- Need R
eCallOverIMS-Support            ENUMERATED {true}                OPTIONAL, -- Need R
ue-TimersAndConstants           UE-TimersAndConstants            OPTIONAL, -- Need R
uac-BarringInfo                 SEQUENCE {
  uac-BarringForCommon           UAC-BarringPerCatList           OPTIONAL, -- Need S
  uac-BarringPerPLMN-List       UAC-BarringPerPLMN-List       OPTIONAL, -- Need S
  uac-BarringInfoSetList       UAC-BarringInfoSetList,
  uac-AccessCategory1-SelectionAssistanceInfo CHOICE {
    plmnCommon                  UAC-AccessCategory1-SelectionAssistanceInfo,
    individualPLMNList         SEQUENCE (SIZE (2..maxPLMN)) OF UAC-AccessCategory1-SelectionAssistanceInfo
  }
}
}
useFullResumeID                 ENUMERATED {true}                OPTIONAL, -- Need R
lateNonCriticalExtension         OCTET STRING                     OPTIONAL, -- Need R
nonCriticalExtension             SIB1-v1610-IEs                 OPTIONAL
}

SIB1-v1610-IEs ::= SEQUENCE {
  idleModeMeasurementsEUTRA-r16  ENUMERATED{true}                OPTIONAL, -- Need R
  idleModeMeasurementsNR-r16     ENUMERATED{true}                OPTIONAL, -- Need R
  posSI-SchedulingInfo-r16       PosSI-SchedulingInfo-r16       OPTIONAL, -- Need R
  nonCriticalExtension           SEQUENCE {}                     OPTIONAL
}

UAC-AccessCategory1-SelectionAssistanceInfo ::= ENUMERATED {a, b, c}

-- TAG-SIB1-STOP
-- ASN1STOP

```

<b>SIB1 field descriptions</b>	
<b>cellSelectionInfo</b> Parameters for cell selection related to the serving cell.	
<b>eCallOverIMS-Support</b> Indicates whether the cell supports eCall over IMS services as defined in TS 23.501 [32]. If absent, eCall over IMS is not supported by the network in the cell.	
<b>idleModeMeasurementsEUTRA</b> This field indicates that a UE that is configured for EUTRA idle/inactive measurements shall perform the measurements while camping in this cell and report availability of these measurements when establishing or resuming a connection in this cell. If absent, a UE is not required to perform EUTRA idle/inactive measurements.	
<b>idleModeMeasurementsNR</b> This field indicates that a UE that is configured for NR idle/inactive measurements shall perform the measurements while camping in this cell and report availability of these measurements when establishing or resuming a connection in this cell. If absent, a UE is not required to perform NR idle/inactive measurements.	
<b>ims-EmergencySupport</b> Indicates whether the cell supports IMS emergency bearer services for UEs in limited service mode. If absent, IMS emergency call is not supported by the network in the cell for UEs in limited service mode.	
<b>q-QualMin</b> Parameter "Q <sub>qualmin</sub> " in TS 38.304 [20], applicable for serving cell. If the field is absent, the UE applies the (default) value of negative infinity for Q <sub>qualmin</sub> .	
<b>q-QualMinOffset</b> Parameter "Q <sub>qualminoffset</sub> " in TS 38.304 [20]. Actual value Q <sub>qualminoffset</sub> = field value [dB]. If the field is absent, the UE applies the (default) value of 0 dB for Q <sub>qualminoffset</sub> . Affects the minimum required quality level in the cell.	
<b>q-RxLevMin</b> Parameter "Q <sub>rxlevmin</sub> " in TS 38.304 [20], applicable for serving cell.	
<b>q-RxLevMinOffset</b> Parameter "Q <sub>rxlevminoffset</sub> " in TS 38.304 [20]. Actual value Q <sub>rxlevminoffset</sub> = field value * 2 [dB]. If absent, the UE applies the (default) value of 0 dB for Q <sub>rxlevminoffset</sub> . Affects the minimum required Rx level in the cell.	
<b>q-RxLevMinSUL</b> Parameter "Q <sub>rxlevmin</sub> " in TS 38.304 [20], applicable for serving cell.	
<b>servingCellConfigCommon</b> Configuration of the serving cell.	
<b>uac-AccessCategory1-SelectionAssistanceInfo</b> Information used to determine whether Access Category 1 applies to the UE, as defined in TS 22.261 [25].	
<b>uac-BarringForCommon</b> Common access control parameters for each access category. Common values are used for all PLMNs, unless overwritten by the PLMN specific configuration provided in <i>uac-BarringPerPLMN-List</i> . The parameters are specified by providing an index to the set of configurations ( <i>uac-BarringInfoSetList</i> ). UE behaviour upon absence of this field is specified in clause 5.3.14.2.	
<b>ue-TimersAndConstants</b> Timer and constant values to be used by the UE. The cell operating as PCell always provides this field.	
<b>useFullResumeID</b> Indicates which resume identifier and Resume request message should be used. UE uses <i>fullI-RNTI</i> and <i>RRCResumeRequest1</i> if the field is present, or <i>shortI-RNTI</i> and <i>RRCResumeRequest</i> if the field is absent.	

Conditional Presence	Explanation
<i>Standalone</i>	The field is mandatory present in a cell that supports standalone operation, otherwise it is absent.

– *SidelinkUEInformationNR*

The *SidelinkUEInformationNR* message is used for the indication of NR sidelink UE information to the network.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

***SidelinkUEInformationNR* message**

```
-- ASN1START
-- TAG-SIDELINKUEINFORMATIONNR-START

SidelinkUEInformationNR-r16 ::= SEQUENCE {
    criticalExtensions          CHOICE {
        sidelinkUEInformationNR-r16
        criticalExtensionsFuture
    }
}

SidelinkUEInformationNR-r16-IEs ::= SEQUENCE {
    sl-RxInterestedFreqList-r16          OPTIONAL,
    sl-TxResourceReqList-r16            OPTIONAL,
    sl-FailureList-r16                  OPTIONAL,
    lateNonCriticalExtension             OPTIONAL,
    nonCriticalExtension                 OPTIONAL
}

SL-InterestedFreqList-r16 ::= SEQUENCE (SIZE (1..maxNrofFreqSL-r16)) OF INTEGER (1..maxNrofFreqSL-r16)

SL-TxResourceReqList-r16 ::= SEQUENCE (SIZE (1..maxNrofSL-Dest-r16)) OF SL-TxResourceReq-r16

SL-TxResourceReq-r16 ::= SEQUENCE {
    sl-DestinationIdentity-r16,
    sl-CastType-r16
    ENUMERATED {broadcast, groupcast, unicast, spare1},
    sl-RLC-ModeIndicationList-r16      SEQUENCE (SIZE (1.. maxNrofSLRB-r16)) OF SL-RLC-ModeIndication-r16 OPTIONAL,
    sl-QoS-InfoList-r16                SEQUENCE (SIZE (1..maxNrofSL-QFIsPerDest-r16)) OF SL-QoS-Info-r16 OPTIONAL,
    sl-TypeTxSyncList-r16              SEQUENCE (SIZE (1..maxNrofFreqSL-r16)) OF SL-TypeTxSync-r16 OPTIONAL,
    sl-TxInterestedFreqList-r16        SL-TxInterestedFreqList-r16 OPTIONAL,
    sl-CapabilityInformationSidelink-r16 OCTET STRING OPTIONAL
}

SL-TxInterestedFreqList-r16 ::= SEQUENCE (SIZE (1..maxNrofFreqSL-r16)) OF INTEGER (1..maxNrofFreqSL-r16)

SL-QoS-Info-r16 ::= SEQUENCE {
    sl-QoS-FlowIdentity-r16,
    sl-QoS-Profile-r16
}
OPTIONAL
```

```

SL-RLC-ModeIndication-r16 ::=
  sl-Mode-r16
    sl-AM-Mode-r16
    sl-UM-Mode-r16
  },
  sl-QoS-InfoList-r16
}
SEQUENCE {
  CHOICE {
    NULL,
    NULL
  }
  SEQUENCE (SIZE (1..maxNrofSL-QFIsPerDest-r16)) OF SL-QoS-Info-r16
}

SL-FailureList-r16 ::=
SEQUENCE (SIZE (1..maxNrofSL-Dest-r16)) OF SL-Failure-r16

SL-Failure-r16 ::=
SEQUENCE {
  sl-DestinationIdentity-r16
  SL-DestinationIdentity-r16,
  sl-Failure-r16
  ENUMERATED {rlf,configFailure, spare6, spare5, spare4, spare3, spare2, spare1}
}

-- TAG-SIDELINKUEINFORMATIONNR-STOP
-- ASN1STOP

```

#### **SidelinkUEInformationNR field descriptions**

##### ***sl-RxInterestedFreqList***

Indicates the index of frequency on which the UE is interested to receive NR sidelink communication. The value 1 corresponds to the frequency of first entry in *sl-FreqInfoList* broadcast in *SIB12*, the value 2 corresponds to the frequency of second entry in *sl-FreqInfoList* broadcast in *SIB12* and so on. In this release, only value 1 can be included in the interested frequency list.

##### ***sl-TxResourceReq***

Parameters to request the transmission resources for NR sidelink communication to the network in the Sidelink UE Information report.



<b>SL-TxResourceReq field descriptions</b>
<p><b>sl-CapabilityInformationSidelink</b> Includes the <i>UECapabilityInformationSidelink</i> message (which can be also included in <i>ueCapabilityInformationSidelink-r16</i> in <i>UECapabilityEnquirySidelink</i> from peer UE) received from the peer UE.</p>
<p><b>sl-CastType</b> Indicates the cast type for the corresponding destination for which to request the resource.</p>
<p><b>sl-DestinationIdentity</b> Indicates the destination for which the TX resource request and allocation from the network are concerned.</p>
<p><b>sl-QoS-InfoList</b> Includes the QoS profile of the sidelink QoS flow as specified in TS 23.287 [55]</p>
<p><b>sl-QoS-FlowIdentity</b> This identity uniquely identifies one sidelink QoS flow between the UE and the network in the scope of UE, which is unique for different destination and cast type.</p>
<p><b>sl-RLC-ModeIndication</b> This field indicates the RLC mode and optionally the related QoS profiles for the sidelink radio bearer, which has not been configured by the network and is initiated by another UE in unicast. The RLC mode for one sidelink radio bearer is aligned between UE and NW by the <i>sl-QoS-FlowIdentity</i>.</p>
<p><b>sl-TxInterestedFreqList</b> Each entry of this field indicates the index of frequency on which the UE is interested to transmit NR sidelink communication. The value 1 corresponds to the frequency of first entry in <i>sl-FreqInfoList</i> broadcast in <i>SIB12</i>, the value 2 corresponds to the frequency of second entry in <i>sl-FreqInfoList</i> broadcast in <i>SIB12</i> and so on. In this release, only value 1 can be included in the interested frequency list. In this release, only one entry can be included in the list.</p>
<p><b>sl-TypeTxSyncList</b> A list of synchronization reference used by the UE. The UE shall include the same number of entries, listed in the same order, as in <i>sl-TxInterestedFreqList</i>, i.e. one for each carrier frequency included in <i>sl-TxInterestedFreqList</i>.</p>

<b>SL-Failure field descriptions</b>
<p><b>sl-DestinationIdentity</b> Indicates the destination for which the SL failure is reporting for unicast.</p>
<p><b>sl-Failure</b> Indicates the sidelink RLF (value <i>rlf</i>) for the associated destination for unicast, when the sidelink RLF is detected. Indicates the sidelink AS configuration failure (value <i>configFailure</i>) for the associated destination for unicast, in case of PC5-RRC AS configuration failure by receiving <i>RRCReconfigurationFailureSidelink</i>.</p>

## – 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.

Signalling radio bearer: N/A

RLC-SAP: TM

Logical channels: BCCH

Direction: Network to UE

**SystemInformation message**

```

-- ASN1START
-- TAG-SYSTEMINFORMATION-START

SystemInformation ::=
    criticalExtensions          SEQUENCE {
        systemInformation      CHOICE {
            systemInformation-IEs,
            criticalExtensionsFuture-r16 CHOICE {
                posSystemInformation-r16 PosSystemInformation-r16-IEs,
                criticalExtensionsFuture SEQUENCE {}
            }
        }
    }

SystemInformation-IEs ::=
    sib-TypeAndInfo           SEQUENCE {
        sib2                   SIB2,
        sib3                   SIB3,
        sib4                   SIB4,
        sib5                   SIB5,
        sib6                   SIB6,
        sib7                   SIB7,
        sib8                   SIB8,
        sib9                   SIB9,
        ...,
        sib10-v1610            SIB10-r16,
        sib11-v1610            SIB11-r16,
        sib12-v1610            SIB12-r16,
        sib13-v1610            SIB13-r16,
        sib14-v1610            SIB14-r16
    },
    lateNonCriticalExtension   OCTET STRING OPTIONAL,
    nonCriticalExtension       SEQUENCE {} OPTIONAL
}

-- TAG-SYSTEMINFORMATION-STOP
-- ASN1STOP

```

– **UEAssistanceInformation**

The *UEAssistanceInformation* message is used for the indication of UE assistance information to the network.

Signalling radio bearer: SRB1, SRB3

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

**UEAssistanceInformation message**

```

-- ASN1START
-- TAG-UEASSISTANCEINFORMATION-START

UEAssistanceInformation ::= SEQUENCE {
    criticalExtensions          CHOICE {
        ueAssistanceInformation UEAssistanceInformation-IEs,
        criticalExtensionsFuture SEQUENCE {}
    }
}

UEAssistanceInformation-IEs ::= SEQUENCE {
    delayBudgetReport          DelayBudgetReport          OPTIONAL,
    lateNonCriticalExtension    OCTET STRING          OPTIONAL,
    nonCriticalExtension        UEAssistanceInformation-v1540-IEs OPTIONAL
}

DelayBudgetReport ::= CHOICE {
    type1 ENUMERATED {
        msMinus1280, msMinus640, msMinus320, msMinus160, msMinus80, msMinus60, msMinus40,
        msMinus20, ms0, ms20, ms40, ms60, ms80, ms160, ms320, ms640, ms1280},
    ...
}

UEAssistanceInformation-v1540-IEs ::= SEQUENCE {
    overheatingAssistance      OverheatingAssistance          OPTIONAL,
    nonCriticalExtension        UEAssistanceInformation-v1610-IEs OPTIONAL
}

OverheatingAssistance ::= SEQUENCE {
    reducedMaxCCs              ReducedMaxCCs-r16          OPTIONAL,
    reducedMaxBW-FR1           ReducedMaxBW-FRx-r16        OPTIONAL,
    reducedMaxBW-FR2           ReducedMaxBW-FRx-r16        OPTIONAL,
    reducedMaxMIMO-LayersFR1   SEQUENCE {
        reducedMIMO-LayersFR1-DL MIMO-LayersDL,
        reducedMIMO-LayersFR1-UL MIMO-LayersUL
    } OPTIONAL,
    reducedMaxMIMO-LayersFR2   SEQUENCE {
        reducedMIMO-LayersFR2-DL MIMO-LayersDL,
        reducedMIMO-LayersFR2-UL MIMO-LayersUL
    } OPTIONAL
}

ReducedAggregatedBandwidth ::= ENUMERATED {mhz0, mhz10, mhz20, mhz30, mhz40, mhz50, mhz60, mhz80, mhz100, mhz200, mhz300, mhz400}

UEAssistanceInformation-v1610-IEs ::= SEQUENCE {
    idc-Assistance-r16         IDC-Assistance-r16          OPTIONAL,
    drx-Preference-r16        DRX-Preference-r16        OPTIONAL,
    maxBW-Preference-r16      MaxBW-Preference-r16      OPTIONAL,
    maxCC-Preference-r16      MaxCC-Preference-r16      OPTIONAL,
}

```

```

maxMIMO-LayerPreference-r16      MaxMIMO-LayerPreference-r16      OPTIONAL,
minSchedulingOffsetPreference-r16 MinSchedulingOffsetPreference-r16 OPTIONAL,
releasePreference-r16            ReleasePreference-r16            OPTIONAL,
sl-UE-AssistanceInformationNR-r16 SL-UE-AssistanceInformationNR-r16 OPTIONAL,
referenceTimeInfoPreference-r16  BOOLEAN                          OPTIONAL,
nonCriticalExtension              SEQUENCE {}                      OPTIONAL
}

IDC-Assistance-r16 ::=
  affectedCarrierFreqList-r16     AffectedCarrierFreqList-r16     OPTIONAL,
  affectedCarrierFreqCombList-r16 AffectedCarrierFreqCombList-r16 OPTIONAL,
  ...
}

AffectedCarrierFreqList-r16 ::= SEQUENCE (SIZE (1.. maxFreqIDC-r16)) OF AffectedCarrierFreq-r16

AffectedCarrierFreq-r16 ::= SEQUENCE {
  carrierFreq-r16                ARFCN-ValueNR,
  interferenceDirection-r16      ENUMERATED {nr, other, both, spare}
}

AffectedCarrierFreqCombList-r16 ::= SEQUENCE (SIZE (1..maxCombIDC-r16)) OF AffectedCarrierFreqComb-r16

AffectedCarrierFreqComb-r16 ::= SEQUENCE {
  affectedCarrierFreqComb-r16    SEQUENCE (SIZE (2..maxNrofServingCells)) OF ARFCN-ValueNR  OPTIONAL,
  victimSystemType-r16          VictimSystemType-r16
}

VictimSystemType-r16 ::= SEQUENCE {
  gps-r16                       ENUMERATED {true}          OPTIONAL,
  glonass-r16                   ENUMERATED {true}          OPTIONAL,
  bds-r16                       ENUMERATED {true}          OPTIONAL,
  galileo-r16                   ENUMERATED {true}          OPTIONAL,
  navIC-r16                     ENUMERATED {true}          OPTIONAL,
  wlan-r16                      ENUMERATED {true}          OPTIONAL,
  bluetooth-r16                 ENUMERATED {true}          OPTIONAL,
  ...
}

DRX-Preference-r16 ::= SEQUENCE {
  preferredDRX-InactivityTimer-r16 ENUMERATED {
    ms0, ms1, ms2, ms3, ms4, ms5, ms6, ms8, ms10, ms20, ms30, ms40, ms50, ms60, ms80,
    ms100, ms200, ms300, ms500, ms750, ms1280, ms1920, ms2560, spare9, spare8,
    spare7, spare6, spare5, spare4, spare3, spare2, spare1} OPTIONAL,
  preferredDRX-LongCycle-r16     ENUMERATED {
    ms10, ms20, ms32, ms40, ms60, ms64, ms70, ms80, ms128, ms160, ms256, ms320, ms512,
    ms640, ms1024, ms1280, ms2048, ms2560, ms5120, ms10240, spare12, spare11, spare10,
    spare9, spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 } OPTIONAL,
  preferredDRX-ShortCycle-r16    ENUMERATED {
    ms2, ms3, ms4, ms5, ms6, ms7, ms8, ms10, ms14, ms16, ms20, ms30, ms32,
    ms35, ms40, ms64, ms80, ms128, ms160, ms256, ms320, ms512, ms640, spare9,
    spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 } OPTIONAL,
  preferredDRX-ShortCycleTimer-r16 INTEGER (1..16)  OPTIONAL
}

```

```

MaxBW-Preference-r16 ::= SEQUENCE {
    reducedMaxBW-FR1-r16      ReducedMaxBW-FRx-r16      OPTIONAL,
    reducedMaxBW-FR2-r16      ReducedMaxBW-FRx-r16      OPTIONAL
}

MaxCC-Preference-r16 ::= SEQUENCE {
    reducedMaxCCs-r16        ReducedMaxCCs-r16          OPTIONAL
}

MaxMIMO-LayerPreference-r16 ::= SEQUENCE {
    reducedMaxMIMO-LayersFR1-r16 SEQUENCE {
        reducedMIMO-LayersFR1-DL-r16    INTEGER (1..8),
        reducedMIMO-LayersFR1-UL-r16    INTEGER (1..4)
    } OPTIONAL,
    reducedMaxMIMO-LayersFR2-r16 SEQUENCE {
        reducedMIMO-LayersFR2-DL-r16    INTEGER (1..8),
        reducedMIMO-LayersFR2-UL-r16    INTEGER (1..4)
    } OPTIONAL
}

MinSchedulingOffsetPreference-r16 ::= SEQUENCE {
    preferredK0-r16 SEQUENCE {
        preferredK0-SCS-15kHz-r16    ENUMERATED {s11, s12, s14, s16}    OPTIONAL,
        preferredK0-SCS-30kHz-r16    ENUMERATED {s11, s12, s14, s16}    OPTIONAL,
        preferredK0-SCS-60kHz-r16    ENUMERATED {s12, s14, s18, s112}    OPTIONAL,
        preferredK0-SCS-120kHz-r16   ENUMERATED {s12, s14, s18, s112}    OPTIONAL
    } OPTIONAL,
    preferredK2-r16 SEQUENCE {
        preferredK2-SCS-15kHz-r16    ENUMERATED {s11, s12, s14, s16}    OPTIONAL,
        preferredK2-SCS-30kHz-r16    ENUMERATED {s11, s12, s14, s16}    OPTIONAL,
        preferredK2-SCS-60kHz-r16    ENUMERATED {s12, s14, s18, s112}    OPTIONAL,
        preferredK2-SCS-120kHz-r16   ENUMERATED {s12, s14, s18, s112}    OPTIONAL
    } OPTIONAL
}

ReleasePreference-r16 ::= SEQUENCE {
    preferredRRC-State-r16    ENUMERATED {idle, inactive, connected, outOfConnected}
}

ReducedMaxBW-FRx-r16 ::= SEQUENCE {
    reducedBW-DL-r16          ReducedAggregatedBandwidth,
    reducedBW-UL-r16          ReducedAggregatedBandwidth
}

ReducedMaxCCs-r16 ::= SEQUENCE {
    reducedCCsDL-r16          INTEGER (0..31),
    reducedCCsUL-r16          INTEGER (0..31)
}

SL-UE-AssistanceInformationNR-r16 ::= SEQUENCE (SIZE (1..maxNrofTrafficPattern-r16)) OF SL-TrafficPatternInfo-r16

SL-TrafficPatternInfo-r16 ::= SEQUENCE {
    trafficPeriodicity-r16    ENUMERATED {ms20,ms50, ms100, ms200, ms300, ms400, ms500, ms600, ms700, ms800, ms900, ms1000},

```

```
    timingOffset-r16          INTEGER (0..10239),
    messageSize-r16          BIT STRING (SIZE (8)),
    sl-QoS-FlowIdentity-r16  SL-QoS-FlowIdentity-r16
  }

-- TAG-UEASSISTANCEINFORMATION-STOP
-- ASN1STOP
```

<b>UEAssistanceInformation</b> field descriptions
<p><b>affectedCarrierFreqList</b> Indicates a list of NR carrier frequencies that are affected by IDC problem.</p>
<p><b>affectedCarrierFreqCombList</b> Indicates a list of NR carrier frequency combinations that are affected by IDC problems due to Inter-Modulation Distortion and harmonics from NR when configured with UL CA.</p>
<p><b>delayBudgetReport</b> Indicates the UE-preferred adjustment to connected mode DRX.</p>
<p><b>interferenceDirection</b> Indicates the direction of IDC interference. Value <i>nr</i> indicates that only NR is victim of IDC interference, value <i>other</i> indicates that only another radio is victim of IDC interference and value <i>both</i> indicates that both NR and another radio are victims of IDC interference. The other radio refers to either the ISM radio or GNSS (see TR 36.816 [44]).</p>
<p><b>messageSize</b> Indicates the maximum TB size based on the observed traffic pattern. The value refers to the index of TS 38.321 [3], table 6.1.3.1-2.</p>
<p><b>minSchedulingOffsetPreference</b> Indicates the UE's preferences on <i>minimumSchedulingOffset</i> of cross-slot scheduling for power saving.</p>
<p><b>preferredDRX-InactivityTimer</b> Indicates the UE's preferred DRX inactivity timer length for power saving. Value in ms (milliSecond). <i>ms0</i> corresponds to 0, <i>ms1</i> corresponds to 1 ms, <i>ms2</i> corresponds to 2 ms, and so on. If the field is absent from the <i>DRX-Preference</i> IE, it is interpreted as the UE having no preference for the DRX inactivity timer.</p>
<p><b>preferredDRX-LongCycle</b> Indicates the UE's preferred long DRX cycle length for power saving. Value in ms. <i>ms10</i> corresponds to 10ms, <i>ms20</i> corresponds to 20 ms, <i>ms32</i> corresponds to 32 ms, and so on. If <i>preferredDRX-ShortCycle</i> is provided, the value of <i>preferredDRX-LongCycle</i> shall be a multiple of the <i>preferredDRX-ShortCycle</i> value. If the field is absent from the <i>DRX-Preference</i> IE, it is interpreted as the UE having no preference for the long DRX cycle.</p>
<p><b>preferredDRX-ShortCycle</b> Indicates the UE's preferred short DRX cycle length for power saving. Value in ms. <i>ms2</i> corresponds to 2ms, <i>ms3</i> corresponds to 3 ms, <i>ms4</i> corresponds to 4 ms, and so on. If the field is absent from the <i>DRX-Preference</i> IE, it is interpreted as the UE having no preference for the short DRX cycle.</p>
<p><b>preferredDRX-ShortCycleTimer</b> Indicates the UE's preferred short DRX cycle timer for power saving. Value in multiples of <i>preferredDRX-ShortCycle</i>. A value of 1 corresponds to <i>preferredDRX-ShortCycle</i>, a value of 2 corresponds to 2 * <i>preferredDRX-ShortCycle</i> and so on. If the field is absent from the <i>DRX-Preference</i> IE, it is interpreted as the UE having no preference for the short DRX cycle timer. A preference for the short DRX cycle is indicated when a preference for the short DRX cycle timer is indicated.</p>
<p><b>preferredK0</b> Indicates the UE's preferred value of <i>k0</i> (slot offset between DCI and its scheduled PDSCH - see TS 38.214 [19], clause 5.1.2.1) for cross-slot scheduling for power saving. Value is defined for each subcarrier spacing (numerology) in units of slots. <i>s1</i> corresponds to 1 slot, <i>s2</i> corresponds to 2 slots, <i>s4</i> corresponds to 4 slots, and so on. If a value for a subcarrier spacing is absent, it is interpreted as the UE having no preference on <i>k0</i> for cross-slot scheduling for that subcarrier spacing. If the field is absent from the <i>MinSchedulingOffsetPreference</i> IE, it is interpreted as the UE having no preference on <i>k0</i> for cross-slot scheduling.</p>
<p><b>preferredK2</b> Indicates the UE's preferred value of <i>k2</i> (slot offset between DCI and its scheduled PUSCH - see TS 38.214 [19], clause 6.1.2.1) for cross-slot scheduling for power saving. Value is defined for each subcarrier spacing (numerology) in units of slots. <i>s1</i> corresponds to 1 slot, <i>s2</i> corresponds to 2 slots, <i>s4</i> corresponds to 4 slots, and so on. If a value for a subcarrier spacing is absent, it is interpreted as the UE having no preference on <i>k2</i> for cross-slot scheduling for that subcarrier spacing. If the field is absent from the <i>MinSchedulingOffsetPreference</i> IE, it is interpreted as the UE having no preference on <i>k2</i> for cross-slot scheduling.</p>
<p><b>preferredRRC-State</b> Indicates the UE's preferred RRC state. The value <i>idle</i> is indicated if the UE prefers to be released from RRC_CONNECTED and transition to RRC_IDLE. The value <i>inactive</i> is indicated if the UE prefers to be released from RRC_CONNECTED and transition to RRC_INACTIVE. The value <i>connected</i> is indicated if the UE prefers to revert an earlier indication to leave RRC_CONNECTED state. The value <i>outOfConnected</i> is indicated if the UE prefers to be released from RRC_CONNECTED and has no preferred RRC state to transition to. The value <i>connected</i> can only be indicated if the UE is configured with <i>connectedReporting</i>.</p>

**UEAssistanceInformation field descriptions****reducedBW-FR1**

Indicates the UE's preference on reduced configuration corresponding to the maximum aggregated bandwidth across all downlink carrier(s) and across all uplink carrier(s) of FR1, to address overheating or power saving. This field is allowed to be reported only when UE is configured with serving cell(s) operating on FR1. The aggregated bandwidth across all downlink carrier(s) of FR1 is the sum of bandwidth of active downlink BWP(s) across all activated downlink carrier(s) of FR1. The aggregated bandwidth across all uplink carrier(s) of FR1 is the sum of bandwidth of active uplink BWP(s) across all activated uplink carrier(s) of FR1. If the field is absent from the *MaxBW-Preference* IE or the *OverheatingAssistance* IE, it is interpreted as the UE having no preference on the maximum aggregated bandwidth of FR1.

When indicated to address overheating, this maximum aggregated bandwidth includes carrier(s) of FR1 of both the NR MCG and the SCG. This maximum aggregated bandwidth only includes carriers of FR1 of the SCG in (NG)EN-DC. Value *mhz0* is not used when indicated to address overheating.

When indicated to address power saving, this maximum aggregated bandwidth includes carrier(s) of FR1 of the cell group that this UE assistance information is associated with. The aggregated bandwidth can only range up to the current active configuration when indicated to address power savings.

**reducedBW-FR2**

Indicates the UE's preference on reduced configuration corresponding to the maximum aggregated bandwidth across all downlink carrier(s) and across all uplink carrier(s) of FR2, to address overheating or power saving. This field is allowed to be reported only when UE is configured with serving cell(s) operating on FR2. The aggregated bandwidth across all downlink carrier(s) of FR2 is the sum of bandwidth of active downlink BWP(s) across all activated downlink carrier(s) of FR2. The aggregated bandwidth across all uplink carrier(s) of FR2 is the sum of bandwidth of active uplink BWP(s) across all activated uplink carrier(s) of FR2. If the field is absent from the *MaxBW-Preference* IE or the *OverheatingAssistance* IE, it is interpreted as the UE having no preference on the maximum aggregated bandwidth of FR2.

When indicated to address overheating, this maximum aggregated bandwidth includes carrier(s) of FR2 of both the NR MCG and the NR SCG. This maximum aggregated bandwidth only includes carriers of FR2 of the SCG in (NG)EN-DC.

When indicated to address power saving, this maximum aggregated bandwidth includes carrier(s) of FR2 of the cell group that this UE assistance information is associated with. The aggregated bandwidth can only range up to the current active configuration when indicated to address power savings.

**reducedCCsDL**

Indicates the UE's preference on reduced configuration corresponding to the maximum number of downlink SCells indicated by the field, to address overheating or power saving.

When indicated to address overheating, this maximum number includes both SCells of the NR MCG and PSCell/SCells of the SCG. This maximum number only includes PSCell/SCells of the SCG in (NG)EN-DC.

When indicated to address power saving, this maximum number includes PSCell/SCells of the cell group that this UE assistance information is associated with. The maximum number of downlink SCells can only range up to the current active configuration when indicated to address power savings.

**reducedCCsUL**

Indicates the UE's preference on reduced configuration corresponding to the maximum number of uplink SCells indicated by the field, to address overheating or power saving.

When indicated to address overheating, this maximum number includes both SCells of the NR MCG and PSCell/SCells of the SCG. This maximum number only includes PSCell/SCells of the SCG in (NG)EN-DC.

When indicated to address power saving, this maximum number includes PSCell/SCells of the cell group that this UE assistance information is associated with. The maximum number of uplink SCells can only range up to the current active configuration when indicated to address power savings.

**reducedMIMO-LayersFR1-DL**

Indicates the UE's preference on reduced configuration corresponding to the maximum number of downlink MIMO layers of each serving cell operating on FR1 indicated by the field, to address overheating or power saving. This field is allowed to be reported only when UE is configured with serving cells operating on FR1. The maximum number of downlink MIMO layers can only range up to the maximum number of MIMO layers configured across all activated downlink carrier(s) of FR1 in the cell group when indicated to address power savings.

**reducedMIMO-LayersFR1-UL**

Indicates the UE's preference on reduced configuration corresponding to the maximum number of uplink MIMO layers of each serving cell operating on FR1 indicated by the field, to address overheating or power saving. This field is allowed to be reported only when UE is configured with serving cells operating on FR1. The maximum number of uplink MIMO layers can only range up to the maximum number of MIMO layers configured across all activated uplink carrier(s) of FR1 in the cell group when indicated to address power savings.



<b>UEAssistanceInformation field descriptions</b>
<p><b>reducedMIMO-LayersFR2-DL</b> Indicates the UE's preference on reduced configuration corresponding to the maximum number of downlink MIMO layers of each serving cell operating on FR2 indicated by the field, to address overheating or power saving. This field is allowed to be reported only when UE is configured with serving cells operating on FR2. The maximum number of downlink MIMO layers can only range up to the maximum number of MIMO layers configured across all activated downlink carrier(s) of FR2 in the cell group when indicated to address power savings.</p>
<p><b>reducedMIMO-LayersFR2-UL</b> Indicates the UE's preference on reduced configuration corresponding to the maximum number of uplink MIMO layers of each serving cell operating on FR2 indicated by the field, to address overheating or power saving. This field is allowed to be reported only when UE is configured with serving cells operating on FR2. The maximum number of uplink MIMO layers can only range up to the maximum number of MIMO layers configured across all activated uplink carrier(s) of FR2 in the cell group when indicated to address power savings.</p>
<p><b>referenceTimeInfoPreference</b> Indicates whether the UE prefers being provisioned with the timing information specified in the IE <i>ReferenceTimeInfo</i>.</p>
<p><b>sl-QoS-FlowIdentity</b> This identity uniquely identifies one sidelink QoS flow between the UE and the network in the scope of UE, which is unique for different destination and cast type.</p>
<p><b>sl-UE-AssistanceInformationNR</b> indicates the traffic characteristic of sidelink logical channel(s) that are setup for NR sidelink communication,</p>
<p><b>timingOffset</b> This field indicates the estimated timing for a packet arrival in a SL logical channel. Specifically, the value indicates the timing offset with respect to subframe#0 of SFN#0 in milliseconds.</p>
<p><b>trafficPeriodicity</b> This field indicates the estimated data arrival periodicity in a SL logical channel. Value <i>ms20</i> corresponds to 20 ms, <i>ms50</i> corresponds to 50 ms and so on.</p>
<p><b>type1</b> Indicates the preferred amount of increment/decrement to the long DRX cycle length with respect to the current configuration. Value in number of milliseconds. Value <i>ms40</i> corresponds to 40 milliseconds, <i>msMinus40</i> corresponds to -40 milliseconds and so on.</p>
<p><b>victimSystemType</b> Indicate the list of victim system types to which IDC interference is caused from NR when configured with UL CA. Value <i>gps</i>, <i>glonass</i>, <i>bds</i>, <i>galileo</i> and <i>navIC</i> indicates the type of GNSS. Value <i>wlan</i> indicates WLAN and value <i>bluetooth</i> indicates Bluetooth.</p>

## – *UECapabilityEnquiry*

The *UECapabilityEnquiry* message is used to request UE radio access capabilities for NR as well as for other RATs.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: Network to UE

### ***UECapabilityEnquiry* message**

```
-- ASN1START
-- TAG-UECAPABILITYENQUIRY-START
```

```

UECapabilityEnquiry ::=
  rrc-TransactionIdentifier
  criticalExtensions
  ueCapabilityEnquiry
  criticalExtensionsFuture
}
SEQUENCE {
  RRC-TransactionIdentifier,
  CHOICE {
    UECapabilityEnquiry-IEs,
    SEQUENCE {}
  }
}

UECapabilityEnquiry-IEs ::=
  ue-CapabilityRAT-RequestList
  lateNonCriticalExtension
  ue-CapabilityEnquiryExt
}
SEQUENCE {
  UE-CapabilityRAT-RequestList,
  OCTET STRING
  OCTET STRING (CONTAINING UECapabilityEnquiry-v1560-IEs)
}
OPTIONAL,
OPTIONAL

UECapabilityEnquiry-v1560-IEs ::=
  capabilityRequestFilterCommon
  nonCriticalExtension
}
SEQUENCE {
  UE-CapabilityRequestFilterCommon
  UECapabilityEnquiry-v1610-IEs
}
OPTIONAL, -- Need N
OPTIONAL

UECapabilityEnquiry-v1610-IEs ::=
  rrc-SegAllowed-r16
  nonCriticalExtension
}
SEQUENCE {
  ENUMERATED {enabled}
  SEQUENCE {}
}
OPTIONAL, -- Need N
OPTIONAL

-- TAG-UECAPABILITYENQUIRY-STOP
-- ASN1STOP

```

## – UECapabilityInformation

The IE *UECapabilityInformation* message is used to transfer UE radio access capabilities requested by the network.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

### UECapabilityInformation message

```

-- ASN1START
-- TAG-UECAPABILITYINFORMATION-START

UECapabilityInformation ::=
  rrc-TransactionIdentifier
  criticalExtensions
  ueCapabilityInformation
  criticalExtensionsFuture
}
SEQUENCE {
  RRC-TransactionIdentifier,
  CHOICE {
    UECapabilityInformation-IEs,
    SEQUENCE {}
  }
}

```

```

    }
  }
UECapabilityInformation-IEs ::= SEQUENCE {
    ue-CapabilityRAT-ContainerList      UE-CapabilityRAT-ContainerList      OPTIONAL,

    lateNonCriticalExtension            OCTET STRING                        OPTIONAL,
    nonCriticalExtension                 SEQUENCE{}                          OPTIONAL
}

-- TAG-UECAPABILITYINFORMATION-STOP
-- ASN1STOP

```

### – *UEInformationRequest*

The *UEInformationRequest* message is used by the network to retrieve information from the UE.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: Network to UE

### *UEInformationRequest* message

```

-- ASN1START
-- TAG-UEINFORMATIONREQUEST-START

UEInformationRequest-r16 ::= SEQUENCE {
    rrc-TransactionIdentifier          RRC-TransactionIdentifier,
    criticalExtensions                 CHOICE {
        ueInformationRequest-r16      UEInformationRequest-r16-IEs,
        criticalExtensionsFuture      SEQUENCE {}
    }
}

UEInformationRequest-r16-IEs ::= SEQUENCE {
    idleModeMeasurementReq-r16        ENUMERATED {true}                OPTIONAL, -- Need N
    logMeasReportReq-r16              ENUMERATED {true}                OPTIONAL, -- Need N
    connEstFailReportReq-r16         ENUMERATED {true}                OPTIONAL, -- Need N
    ra-ReportReq-r16                 ENUMERATED {true}                OPTIONAL, -- Need N
    rlf-ReportReq-r16                 ENUMERATED {true}                OPTIONAL, -- Need N
    mobilityHistoryReportReq-r16     ENUMERATED {true}                OPTIONAL, -- Need N
    lateNonCriticalExtension          OCTET STRING                      OPTIONAL,
    nonCriticalExtension               SEQUENCE {}                          OPTIONAL
}

-- TAG-UEINFORMATIONREQUEST-STOP

```

-- ASN1STOP

<i>UEInformationRequest-IEs</i> field descriptions
<p><b><i>connEstFailReportReq</i></b> This field is used to indicate whether the UE shall report information about the connection failure.</p>
<p><b><i>idleModeMeasurementReq</i></b> This field indicates that the UE shall report the idle/inactive measurement information, if available, to the network in the <i>UEInformationResponse</i> message.</p>
<p><b><i>logMeasReportReq</i></b> This field is used to indicate whether the UE shall report information about logged measurements.</p>
<p><b><i>mobilityHistoryReportReq</i></b> This field is used to indicate whether the UE shall report information about mobility history information.</p>
<p><b><i>ra-ReportReq</i></b> This field is used to indicate whether the UE shall report information about the random access procedure.</p>
<p><b><i>rlf-ReportReq</i></b> This field is used to indicate whether the UE shall report information about the radio link failure.</p>

## – *UEInformationResponse*

The *UEInformationResponse* message is used by the UE to transfer information requested by the network.

Signalling radio bearer: SRB1 or SRB2 (when logged measurement information is included)

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to network

### *UEInformationResponse* message

-- ASN1START  
-- TAG-UEINFORMATIONRESPONSE-START

```

UEInformationResponse-r16 ::=
    rrc-TransactionIdentifier
    criticalExtensions
        ueInformationResponse-r16
        criticalExtensionsFuture
    }
}

UEInformationResponse-r16-IEs ::=
    measResultIdleEUTRA-r16
    measResultIdleNR-r16
    logMeasReport-r16
    connEstFailReport-r16
    SEQUENCE {
        MeasResultIdleEUTRA-r16
        MeasResultIdleNR-r16
        LogMeasReport-r16
        ConnEstFailReport-r16
        OPTIONAL,
        OPTIONAL,
        OPTIONAL,
        OPTIONAL,
    }

```

```

    ra-ReportList-r16          RA-ReportList-r16          OPTIONAL,
    rlf-Report-r16             RLF-Report-r16             OPTIONAL,
    mobilityHistoryReport-r16  MobilityHistoryReport-r16  OPTIONAL,
    lateNonCriticalExtension   OCTET STRING             OPTIONAL,
    nonCriticalExtension       SEQUENCE {}              OPTIONAL
}

LogMeasReport-r16 ::=
    absoluteTimeStamp-r16     AbsoluteTimeInfo-r16,
    traceReference-r16        TraceReference-r16,
    traceRecordingSessionRef-r16 OCTET STRING (SIZE (2)),
    tce-Id-r16                OCTET STRING (SIZE (1)),
    logMeasInfoList-r16       LogMeasInfoList-r16,
    logMeasAvailable-r16      ENUMERATED {true}          OPTIONAL,
    logMeasAvailableBT-r16    ENUMERATED {true}          OPTIONAL,
    logMeasAvailableWLAN-r16  ENUMERATED {true}          OPTIONAL
    ...
}

LogMeasInfoList-r16 ::= SEQUENCE (SIZE (1..maxLogMeasReport-r16)) OF LogMeasInfo-r16

LogMeasInfo-r16 ::=
    locationInfo-r16          LocationInfo-r16          OPTIONAL,
    relativeTimeStamp-r16     INTEGER (0..7200),
    servCellIdentity-r16      CGI-Info-Logging-r16      OPTIONAL,
    measResultServingCell-r16 MeasResultServingCell-r16  OPTIONAL,
    measResultNeighCells-r16  SEQUENCE {
        measResultNeighCellListNR      MeasResultListLogging2NR-r16  OPTIONAL,
        measResultNeighCellListEUTRA   MeasResultList2EUTRA-r16     OPTIONAL
    },
    anyCellSelectionDetected-r16  ENUMERATED {true}          OPTIONAL
}

ConnEstFailReport-r16 ::= SEQUENCE {
    measResultFailedCell-r16  MeasResultFailedCell-r16,
    locationInfo-r16          LocationInfo-r16          OPTIONAL,
    measResultNeighCells-r16  SEQUENCE {
        measResultNeighCellListNR      MeasResultList2NR-r16        OPTIONAL,
        measResultNeighCellListEUTRA   MeasResultList2EUTRA-r16     OPTIONAL
    },
    numberOfConnFail-r16     INTEGER (1..8),
    perRAInfoList-r16        PerRAInfoList-r16,
    timeSinceFailure-r16     TimeSinceFailure-r16,
    ...
}

MeasResultServingCell-r16 ::= SEQUENCE {
    resultsSSB-Cell          MeasQuantityResults,
    resultsSSB               SEQUENCE {
        best-ssb-Index          SSB-Index,
        best-ssb-Results        MeasQuantityResults,
        numberOfGoodSSB         INTEGER (1..maxNrofSSBs-r16)
    }
}

```

```

MeasResultFailedCell-r16 ::= SEQUENCE {
  cgi-Info          CGI-Info-Logging-r16,
  measResult-r16   SEQUENCE {
    cellResults-r16 SEQUENCE {
      resultsSSB-Cell-r16 MeasQuantityResults
    },
    rsIndexResults-r16 SEQUENCE {
      resultsSSB-Indexes-r16 ResultsPerSSB-IndexList
    }
  }
}

RA-ReportList-r16 ::= SEQUENCE (SIZE (1..maxRAReport-r16)) OF RA-Report-r16

RA-Report-r16 ::= SEQUENCE {
  cellId-r16 CHOICE {
    cellGlobalId-r16 CGI-Info-Logging-r16,
    pci-arfcn-r16 SEQUENCE {
      physCellId-r16 PhysCellId,
      carrierFreq-r16 ARFCN-ValueNR
    }
  },
  ra-InformationCommon-r16 RA-InformationCommon-r16,
  raPurpose-r16 ENUMERATED {accessRelated, beamFailureRecovery, reconfigurationWithSync, ulUnSynchronized,
  schedulingRequestFailure, noPUCCHResourceAvailable, requestForOtherSI,
  spare9, spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1}
}

RA-InformationCommon-r16 ::= SEQUENCE {
  absoluteFrequencyPointA-r16 ARFCN-ValueNR,
  locationAndBandwidth-r16 INTEGER (0..37949),
  subcarrierSpacing-r16 SubcarrierSpacing,
  msg1-FrequencyStart-r16 INTEGER (0..maxNrofPhysicalResourceBlocks-1) OPTIONAL,
  msg1-FrequencyStartCFRA-r16 INTEGER (0..maxNrofPhysicalResourceBlocks-1) OPTIONAL,
  msg1-SubcarrierSpacing-r16 SubcarrierSpacing OPTIONAL,
  msg1-SubcarrierSpacingCFRA-r16 SubcarrierSpacing OPTIONAL,
  msg1-FDM-r16 ENUMERATED {one, two, four, eight} OPTIONAL,
  msg1-FDMCFRA-r16 ENUMERATED {one, two, four, eight} OPTIONAL,
  perRAInfoList-r16 PerRAInfoList-r16
}

PerRAInfoList-r16 ::= SEQUENCE (SIZE (1..200)) OF PerRAInfo-r16

PerRAInfo-r16 ::= CHOICE {
  perRASSBInfoList-r16 PerRASSBInfo-r16,
  perRACSI-RSInfoList-r16 PerRACSI-RSInfo-r16
}

PerRASSBInfo-r16 ::= SEQUENCE {
  ssb-Index-r16 SSB-Index,
  numberOfPreamblesSentOnSSB-r16 INTEGER (1..200),
  perRAAttemptInfoList-r16 PerRAAttemptInfoList-r16
}

```

```

PerRACSI-RSInfo-r16 ::= SEQUENCE {
  csi-RS-Index-r16          CSI-RS-Index,
  numberOfPreamblesSentOnCSI-RS-r16  INTEGER (1..200)
}

PerRAAttemptInfoList-r16 ::= SEQUENCE (SIZE (1..200)) OF PerRAAttemptInfo-r16

PerRAAttemptInfo-r16 ::= SEQUENCE {
  contentionDetected-r16    BOOLEAN OPTIONAL,
  dlRSRPAboveThreshold-r16  BOOLEAN OPTIONAL,
  ...
}

RLF-Report-r16 ::= CHOICE {
  nr-RLF-Report-r16 SEQUENCE {
    measResultLastServCell-r16 MeasResultRLFNR-r16,
    measResultNeighCells-r16 SEQUENCE {
      measResultListNR-r16 MeasResultList2NR-r16 OPTIONAL,
      measResultListEUTRA-r16 MeasResultList2EUTRA-r16 OPTIONAL
    } OPTIONAL,
    c-RNTI-r16 RNTI-Value,
    previousPCellId-r16 CHOICE {
      nrPreviousCell-r16 CGI-Info-Logging-r16,
      eutraPreviousCell-r16 CGI-InfoEUTRALogging OPTIONAL,
    }
    failedPCellId-r16 CHOICE {
      nrFailedPCellId-r16 CHOICE {
        cellGlobalId-r16 CGI-Info-Logging-r16,
        pci-arfcn-r16 SEQUENCE {
          physCellId-r16 PhysCellId,
          carrierFreq-r16 ARFCN-ValueNR
        }
      }
      eutraFailedPCellId-r16 CHOICE {
        cellGlobalId-r16 CGI-InfoEUTRALogging,
        pci-arfcn-r16 SEQUENCE {
          physCellId-r16 EUTRA-PhysCellId,
          carrierFreq-r16 ARFCN-ValueEUTRA
        }
      }
    }
  },
  reconnectCellId-r16 CHOICE {
    nrReconnectCellId-r16 CGI-Info-Logging-r16,
    eutraReconnectCellId-r16 CGI-InfoEUTRALogging
  }
  timeUntilReconnection-16 TimeUntilReconnection-16 OPTIONAL,
  reestablishmentCellId-r16 CGI-Info-Logging-r16 OPTIONAL,
  timeConnFailure-r16 INTEGER (0..1023) OPTIONAL,
  timeSinceFailure-r16 TimeSinceFailure-r16,
  connectionFailureType-r16 ENUMERATED {rlf, hof},
  rlf-Cause-r16 ENUMERATED {t310-Expiry, randomAccessProblem, rlc-MaxNumRetx,
    beamFailureRecoveryFailure, lbtFailure-r16,
    bh-rlfRecoveryFailure, spare2, spare1},

```

```

    locationInfo-r16                LocationInfo-r16                OPTIONAL,
    noSuitableCellFound-r16         ENUMERATED {true}             OPTIONAL,
    ra-InformationCommon-r16        RA-InformationCommon-r16     OPTIONAL,
    ...
  },
  eutra-RLF-Report-r16             SEQUENCE {
    failedPCellId-EUTRA            CGI-InfoEUTRALogging,
    measResult-RLF-Report-EUTRA-r16 OCTET STRING,
    ...
  }
}

MeasResultList2NR-r16 ::= SEQUENCE(SIZE (1..maxFreq)) OF MeasResult2NR-r16
MeasResultList2EUTRA-r16 ::= SEQUENCE(SIZE (1..maxFreq)) OF MeasResult2EUTRA-r16

MeasResult2NR-r16 ::= SEQUENCE {
  ssbFrequency-r16                ARFCN-ValueNR                OPTIONAL,
  refFreqCSI-RS-r16               ARFCN-ValueNR                OPTIONAL,
  measResultList-r16              MeasResultListNR
}

MeasResultListLogging2NR-r16 ::= SEQUENCE(SIZE (1..maxFreq)) OF MeasResultLogging2NR-r16

MeasResultLogging2NR-r16 ::= SEQUENCE {
  carrierFreq-r16                 ARFCN-ValueNR,
  measResultListLoggingNR-r16     MeasResultListLoggingNR-r16
}

MeasResultListLoggingNR-r16 ::= SEQUENCE (SIZE (1..maxCellReport)) OF MeasResultLoggingNR-r16

MeasResultLoggingNR-r16 ::= SEQUENCE {
  physCellId-r16                  PhysCellId,
  resultsSSB-Cell-r16             MeasQuantityResults,
  numberOfGoodSSB-r16             INTEGER (1..maxNrofSSBs-r16) OPTIONAL
}

MeasResult2EUTRA-r16 ::= SEQUENCE {
  carrierFreq-r16                 ARFCN-ValueEUTRA,
  measResultList-r16              MeasResultListEUTRA
}

MeasResultRLFNR-r16 ::= SEQUENCE {
  measResult-r16                   SEQUENCE {
    cellResults-r16                SEQUENCE{
      resultsSSB-Cell-r16           MeasQuantityResults           OPTIONAL,
      resultsCSI-RS-Cell-r16       MeasQuantityResults           OPTIONAL
    },
    rsIndexResults-r16             SEQUENCE{
      resultsSSB-Indexes-r16        ResultsPerSSB-IndexList        OPTIONAL,
      ssbRLMConfigBitmap-r16       BIT STRING (SIZE (64))        OPTIONAL,
      resultsCSI-RS-Indexes-r16    ResultsPerCSI-RS-IndexList    OPTIONAL,
      csi-rsRLMConfigBitmap-r16    BIT STRING (SIZE (96))        OPTIONAL
    }
  }
}

```



```

}
TimeSinceFailure-r16 ::= INTEGER (0..172800)

MobilityHistoryReport-r16 ::= VisitedCellInfoList-r16

TimeUntilReconnection-r16 ::= INTEGER (0..172800)

-- TAG-UEINFORMATIONRESPONSE-STOP
-- ASN1STOP

```

#### **UEInformationResponse-IEs field descriptions**

<b>logMeasReport</b>
This field is used to provide the measurement results stored by the UE associated to logged MDT.
<b>measResultIdleEUTRA</b>
EUTRA measurement results performed during RRC_INACTIVE or RRC_IDLE.
<b>measResultIdleNR</b>
NR measurement results performed during RRC_INACTIVE or RRC_IDLE.
<b>ra-Report</b>
This field is used to provide the list of RA reports that is stored by the UE for the past upto <i>maxRARReport-r16</i> number of successful random access procedures.
<b>rlf-Report</b>
This field is used to indicate the RLF report related contents.

#### **LogMeasReport field descriptions**

<b>absoluteTimeStamp</b>
Indicates the absolute time when the logged measurement configuration logging is provided, as indicated by NR within <i>absoluteTimeInfo</i> .
<b>anyCellSelectionDetected</b>
This field is used to indicate the detection of <i>any cell selection</i> state, as defined in TS 38.304 [20]. The UE sets this field when performing the logging of measurement results in RRC_IDLE or RRC_INACTIVE and there is no suitable cell or no acceptable cell.
<b>measResultServingCell</b>
This field refers to the log measurement results taken in the Serving cell.
<b>relativeTimeStamp</b>
Indicates the time of logging measurement results, measured relative to the <i>absoluteTimeStamp</i> . Value in seconds.
<b>tce-Id</b>
Parameter Trace Collection Entity Id: See TS 32.422 [52].
<b>timeStamp</b>
Includes time stamps for the waypoints that describe planned locations for the UE.
<b>traceRecordingSessionRef</b>
Parameter Trace Recording Session Reference: See TS 32.422 [52].

<b>ConnEstFailReport field descriptions</b>	
<b>measResultFailedCell</b>	This field refers to the last measurement results taken in the cell, where connection establishment failure or connection resume failure happened.
<b>measResultNeighCells</b>	This field refers to the neighbour cell measurements when connection establishment failure or connection resume failure happened.
<b>numberOfConnFail</b>	This field is used to indicate the latest number of consecutive failed RRCSetup or RRCResume procedures in the same cell independent of RRC state transition.
<b>numberOfPreamblesSent</b>	This field is used to indicate the number of random access preambles that were transmitted.
<b>maxTxPowerReached</b>	This field is used to indicate whether or not the maximum power level was used for the last transmitted preamble.
<b>timeSinceFailure</b>	This field is used to indicate the time that elapsed since the connection (establishment or resume) failure. Value in seconds. The maximum value 172800 means 172800s or longer.

<b>RA-Report field descriptions</b>	
<b><i>absoluteFrequencyPointA</i></b>	This field indicates the absolute frequency position of the reference resource block (Common RB 0).
<b><i>cellID</i></b>	This field indicates the CGI of the cell in which the associated random access procedure was performed.
<b><i>contentionDetected</i></b>	This field is used to indicate that contention was detected for the transmitted preamble in the given random access attempt or not. This field is not included when the UE performs random access attempt is using contention free random-access resources or when the <i>ra-Purpose</i> is set to <i>requestForOtherSI</i> .
<b><i>csi-RS-Index</i></b>	This field is used to indicate the CSI-RS index corresponding to the random access attempt.
<b><i>dirSRPAboveThreshold</i></b>	This field is used to indicate whether the DL beam (SSB) quality associated to the random access attempt was above or below the threshold ( <i>rsrp-ThresholdSSB</i> in <i>beamFailureRecoveryConfig</i> in UL BWP configuration of UL BWP selected for random access procedure initiated for beam failure recovery; Otherwise, <i>rsrp-ThresholdSSB</i> in <i>rach-ConfigCommon</i> in UL BWP configuration of UL BWP selected for random access procedure.
<b><i>locationAndBandwidth</i></b>	Frequency domain location and bandwidth of the bandwidth part associated to the random-access resources used by the UE.
<b><i>numberOfPreamblesSentOnCSI-RS</i></b>	This field is used to indicate the total number of successive RA preambles that were transmitted on the corresponding CSI-RS.
<b><i>numberOfPreamblesSentOnSSB</i></b>	This field is used to indicate the total number of successive RA preambles that were transmitted on the corresponding SSB/PBCH block.
<b><i>perRAAttemptInfoList</i></b>	This field provides detailed information about a random access attempt.
<b><i>perRAInfoList</i></b>	This field provides detailed information about each of the random access attempts in the chronological order of the random access attempts.
<b><i>perRACSI-RSInfoList</i></b>	This field provides detailed information about the successive random access attempts associated to the same CSI-RS.
<b><i>perRASSBInfoList</i></b>	This field provides detailed information about the successive random access attempts associated to the same SS/PBCH block.
<b><i>raPurpose</i></b>	This field is used to indicate the RA scenario for which the RA report entry is triggered. The RA accesses associated to Initial access from RRC_IDLE, transition from RRC_INACTIVE and the MSG3 based SI request are indicated using the indicator 'accessRelated'. The indicator <i>beamFailureRecovery</i> is used in case of beam failure recovery failure in the SpCell [3]. The indicator <i>reconfigurationWithSync</i> is used if the UE executes a reconfiguration with sync. The indicator <i>ulUnSynchronized</i> is used if the random access procedure is initiated in a SpCell by DL or UL data arrival during RRC_CONNECTED when the timeAlignmentTimer is not running in the PTAG or in a serving cell by a PDCCH order [3]. The indicator <i>schedulingRequestFailure</i> is used in case of SR failures [3]. The indicator <i>noPUCCHResourceAvailable</i> is used when the UE has no valid SR PUCCH resources configured [3]. The indicator <i>requestForOtherSI</i> is used for MSG1 based on demand SI request.
<b><i>ra-InformationCommon</i></b>	This field is used to indicate the common random-access related information between <i>RA-report</i> and <i>RLF-report</i> . For RA report, this field is mandatory presented. For <i>RLF-report</i> , this field is optionally included when <i>connectionFailureType</i> is set to 'hof' or when <i>connectionFailureType</i> is set to 'rlf' and the <i>rlf-Cause</i> equals to 'randomAccessProblem' or 'beamRecoveryFailure'; otherwise this field is absent.
<b><i>ssb-Index</i></b>	This field is used to indicate the SS/PBCH index of the SS/PBCH block corresponding to the random access attempt.
<b><i>subcarrierSpacing</i></b>	Subcarrier spacing used in the BWP associated to the random-access resources used by the UE.

<b>RLF-Report field descriptions</b>
<p><b>connectionFailureType</b> This field is used to indicate whether the connection failure is due to radio link failure or handover failure.</p>
<p><b>csi-rsRLMConfigBitmap</b> This field is used to indicate the CSI-RS indexes that are also part of the RLM configurations.</p>
<p><b>c-RNTI</b> This field indicates the C-RNTI used in the PCell upon detecting radio link failure or the C-RNTI used in the source PCell upon handover failure.</p>
<p><b>failedPCellId</b> This field is used to indicate the PCell in which RLF is detected or the target PCell of the failed handover. For intra-NR handover <i>nrFailedPCellId</i> is included and for the handover from NR to EUTRA <i>eutraFailedPCellId</i> is included. The UE sets the ARFCN according to the frequency band used for transmission/ reception when the failure occurred.</p>
<p><b>failedPCellId-EUTRA</b> This field is used to indicate the PCell in which RLF is detected or the source PCell of the failed handover in an E-UTRA RLF report.</p>
<p><b>measResultListEUTRA</b> This field refers to the last measurement results taken in the neighboring EUTRA Cells, when the radio link failure or handover failure happened.</p>
<p><b>measResultListNR</b> This field refers to the last measurement results taken in the neighboring NR Cells, when the radio link failure or handover failure happened.</p>
<p><b>measResultServCell</b> This field refers to the log measurement results taken in the Serving cell.</p>
<p><b>measResult-RLF-Report-EUTRA</b> Includes the E-UTRA <i>RLF-Report-r9</i> IE as specified in TS 36.331 [10].</p>
<p><b>noSuitableCellFound</b> This field is set by the UE when the T311 expires.</p>
<p><b>previousPCellId</b> This field is used to indicate the source PCell of the last handover (source PCell when the last <i>RRCReconfiguration</i> message including <i>reconfigurationWithSync</i> was received). For intra-NR handover <i>nrPreviousCell</i> is included and for the handover from EUTRA to NR <i>eutraPreviousCell</i> is included.</p>
<p><b>reconnectCellId</b> This field is used to indicate the cell in which the UE comes back to connected after connection failure and after failing to perform reestablishment. If the UE comes back to RRC CONNECTED in an NR cell then <i>nrReconnectCellId</i> is included and if the UE comes back to RRC CONNECTED in an LTE cell then <i>eutraReconnectCellId</i> is included</p>
<p><b>reestablishmentCellId</b> This field is used to indicate the cell in which the re-establishment attempt was made after connection failure.</p>
<p><b>rlf-Cause</b> This field is used to indicate the cause of the last radio link failure that was detected. In case of handover failure information reporting (i.e., the <i>connectionFailureType</i> is set to 'hof'), the UE is allowed to set this field to any value.</p>
<p><b>ssbRLMConfigBitmap</b> This field is used to indicate the SS/PBCH block indexes that are also part of the RLM configurations.</p>
<p><b>timeConnFailure</b> This field is used to indicate the time elapsed since the last HO initialization until connection failure. Actual value = field value * 100ms. The maximum value 1023 means 102.3s or longer.</p>
<p><b>timeSinceFailure</b> This field is used to indicate the time that elapsed since the connection (radio link or handover) failure. Value in seconds. The maximum value 172800 means 172800s or longer.</p>
<p><b>timeUntilReconnection</b> This field is used to indicate the time that elapsed between the connection (radio link or handover) failure and the next time the UE comes to RRC CONNECTED in an NR or EUTRA cell. Value in seconds. The maximum value 172800 means 172800s or longer.</p>

– *ULDedicatedMessageSegment*

The *ULDedicatedMessageSegment* message is used to transfer segments of the *UECapabilityInformation* message.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

***ULDedicatedMessageSegment* message**

```
-- ASN1START
-- TAG-ULDEDICATEDMESSAGESEGMENT-START

ULDedicatedMessageSegment-r16 ::= SEQUENCE {
  criticalExtensions CHOICE {
    ulDedicatedMessageSegment-r16 ULDedicatedMessageSegment-r16-IEs,
    criticalExtensionsFuture SEQUENCE {}
  }
}

ULDedicatedMessageSegment-r16-IEs ::= SEQUENCE {
  segmentNumber-r16 INTEGER (0..15),
  rrc-MessageSegmentContainer-r16 OCTET STRING,
  rrc-MessageSegmentType-r16 ENUMERATED {notLastSegment, lastSegment},
  lateNonCriticalExtension OCTET STRING OPTIONAL,
  nonCriticalExtension SEQUENCE {} OPTIONAL
}

-- TAG-ULDEDICATEDMESSAGESEGMENT-STOP
-- ASN1STOP
```

***ULDedicatedMessageSegment* field descriptions**

***segmentNumber***

Identifies the sequence number of a segment within the encoded UL DCCH message.

***rrc-MessageSegmentContainer***

Includes a segment of the encoded UL DCCH message. The size of the included segment in this container should be small enough that the resulting encoded RRC message PDU is less than or equal to the PDCP SDU size limit.

***rrc-MessageSegmentType***

Indicates whether the included UL DCCH message segment is the last segment or not.

## – *ULInformationTransfer*

The *ULInformationTransfer* message is used for the uplink transfer of NAS or non-3GPP dedicated information.

Signalling radio bearer: SRB2 or SRB1 (only if SRB2 not established yet). If SRB2 is suspended, the UE does not send this message until SRB2 is resumed

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to network

### *ULInformationTransfer* message

```
-- ASN1START
-- TAG-ULINFORMATIONTRANSFER-START

ULInformationTransfer ::=
    criticalExtensions
        ulInformationTransfer
        criticalExtensionsFuture
    }
}

ULInformationTransfer-IEs ::=
    dedicatedNAS-Message
    lateNonCriticalExtension
    nonCriticalExtension
}

SEQUENCE {
    CHOICE {
        ULInformationTransfer-IEs,
        SEQUENCE {}
    }
}

SEQUENCE {
    DedicatedNAS-Message
    OCTET STRING
    SEQUENCE {}
}

OPTIONAL,
OPTIONAL,
OPTIONAL

-- TAG-ULINFORMATIONTRANSFER-STOP
-- ASN1STOP
```

## – *ULInformationTransferIRAT*

The *ULInformationTransferIRAT* message is used for the uplink transfer of information terminated at NR MCG but specified by another RAT. In this version of the specification, the message is used for V2X sidelink communication information specified in TS 36.331 [10].

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to network

**ULInformationTransferIRAT message**

```

-- ASN1START
-- TAG-ULINFORMATIONTRANSFERIRAT-START

ULInformationTransferIRAT-r16 ::=
    criticalExtensions
        c1
            ulInformationTransferIRAT-r16
            spare3 NULL, spare2 NULL, spare1 NULL
        },
        criticalExtensionsFuture
    }
}

ULInformationTransferIRAT-r16-IEs ::=
    ul-DCCH-MessageEUTRA-r16
    lateNonCriticalExtension
    nonCriticalExtension
}

-- TAG-ULINFORMATIONTRANSFERIRAT-STOP
-- ASN1STOP

```

**ULInformationTransferIRAT field descriptions****ul-DCCH-MessageEUTRA**

Includes the *UL-DCCH-Message* as defined in TS 36.331 [10]. In this version of the specification, the field is only used to transfer the E-UTRA RRC *MeasurementReport*, E-UTRA RRC *SidelinkUEInformation* and the E-UTRA RRC *UEAssistanceInformation* messages.

**– ULInformationTransferMRDC**

The *ULInformationTransferMRDC* message is used for the uplink transfer of MR-DC dedicated information (e.g. for transferring the NR or E-UTRA RRC *MeasurementReport* message, the *FailureInformation* message, the *UEAssistanceInformation* message, the *RRCReconfigurationComplete* message or the *MCGFailureInformation* message).

Signalling radio bearer: SRB1, SRB3

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to Network

**ULInformationTransferMRDC message**

```

-- ASN1START
-- TAG-ULINFORMATIONTRANSFERMRDC-START

```

```

ULInformationTransferMRDC ::=
    criticalExtensions
        c1
            ulInformationTransferMRDC
                spare3 NULL, spare2 NULL, spare1 NULL
            },
        criticalExtensionsFuture
            SEQUENCE {}
    }

ULInformationTransferMRDC-IEs ::=
    ul-DCCH-MessageNR
        OCTET STRING
        OPTIONAL,
    ul-DCCH-MessageEUTRA
        OCTET STRING
        OPTIONAL,
    lateNonCriticalExtension
        OCTET STRING
        OPTIONAL,
    nonCriticalExtension
        SEQUENCE {}
        OPTIONAL
}

-- TAG-ULINFORMATIONTRANSFERMRDC-STOP
-- ASN1STOP

```

#### ***ULInformationTransferMRDC* field descriptions**

##### ***ul-DCCH-MessageNR***

Includes the *UL-DCCH-Message*. In this version of the specification, the field is only used to transfer the NR RRC *MeasurementReport*, *RRCReconfigurationComplete*, *UEAssistanceInformation* and *FailureInformation* messages when sent via SRB1 and to transfer the NR *MCGFailureInformation* message when sent via SRB3.

##### ***ul-DCCH-MessageEUTRA***

Includes the *UL-DCCH-Message*. In this version of the specification, the field is only used to transfer the E-UTRA RRC *MeasurementReport* message when sent via SRB1 and to transfer the E-UTRA *MCGFailureInformation* message when sent via SRB3.

## 6.3 RRC information elements

### 6.3.0 Parameterized types

#### – *SetupRelease*

*SetupRelease* allows the *ElementTypeParam* to be used as the referenced data type for the setup and release entries. See A.3.8 for guidelines.

```

-- ASN1START
-- TAG-SETUPRELEASE-START

SetupRelease { ElementTypeParam } ::= CHOICE {
    release
        NULL,
    setup
        ElementTypeParam
}

-- TAG-SETUPRELEASE-STOP
-- ASN1STOP

```



## 6.3.1 System information blocks

### – SIB2

SIB2 contains cell re-selection information common for intra-frequency, inter-frequency and/or inter-RAT cell re-selection (i.e. applicable for more than one type of cell re-selection but not necessarily all) as well as intra-frequency cell re-selection information other than neighbouring cell related.

#### SIB2 information element

```

-- ASN1START
-- TAG-SIB2-START

SIB2 ::= SEQUENCE {
  cellReselectionInfoCommon SEQUENCE {
    nrofSS-BlocksToAverage INTEGER (2..maxNrofSS-BlocksToAverage) OPTIONAL, -- Need S
    absThreshSS-BlocksConsolidation ThresholdNR OPTIONAL, -- Need S
    rangeToBestCell RangeToBestCell OPTIONAL, -- Need R
    q-Hyst ENUMERATED {
      dB0, dB1, dB2, dB3, dB4, dB5, dB6, dB8, dB10,
      dB12, dB14, dB16, dB18, dB20, dB22, dB24},
    speedStateReselectionPars SEQUENCE {
      mobilityStateParameters MobilityStateParameters,
      q-HystSF SEQUENCE {
        sf-Medium ENUMERATED {dB-6, dB-4, dB-2, dB0},
        sf-High ENUMERATED {dB-6, dB-4, dB-2, dB0}
      }
    }
  } OPTIONAL, -- Need R
  ...
},
  cellReselectionServingFreqInfo SEQUENCE {
    s-NonIntraSearchP ReselectionThreshold OPTIONAL, -- Need S
    s-NonIntraSearchQ ReselectionThresholdQ OPTIONAL, -- Need S
    threshServingLowP ReselectionThreshold,
    threshServingLowQ ReselectionThresholdQ OPTIONAL, -- Need R
    cellReselectionPriority CellReselectionPriority,
    cellReselectionSubPriority CellReselectionSubPriority OPTIONAL, -- Need R
    ...
  },
  intraFreqCellReselectionInfo SEQUENCE {
    q-RxLevMin Q-RxLevMin,
    q-RxLevMinSUL Q-RxLevMin OPTIONAL, -- Need R
    q-QualMin Q-QualMin OPTIONAL, -- Need S
    s-IntraSearchP ReselectionThreshold,
    s-IntraSearchQ ReselectionThresholdQ OPTIONAL, -- Need S
    t-ReselectionNR T-Reselection,
    frequencyBandList MultiFrequencyBandListNR-SIB OPTIONAL, -- Need S
    frequencyBandListSUL MultiFrequencyBandListNR-SIB OPTIONAL, -- Need R
    p-Max P-Max OPTIONAL, -- Need S
  }
}

```



<b>SIB2 field descriptions</b>
<p><b>absThreshSS-BlocksConsolidation</b> Threshold for consolidation of L1 measurements per RS index. If the field is absent, the UE uses the measurement quantity as specified in TS 38.304 [20].</p>
<p><b>cellEdgeEvaluation</b> Indicates the criteria for a UE to detect that it is not at cell edge, in order to relax measurement requirements for cell reselection (see TS 38.304 [20], clause 5.2.4.9.2).</p>
<p><b>cellReselectionInfoCommon</b> Cell re-selection information common for intra-frequency, inter-frequency and/ or inter-RAT cell re-selection.</p>
<p><b>cellReselectionServingFreqInfo</b> Information common for non-intra-frequency cell re-selection i.e. cell re-selection to inter-frequency and inter-RAT cells.</p>
<p><b>combineRelaxedMeasCondition</b> When both <i>lowMobilityEvaluation</i> and <i>cellEdgeEvaluation</i> criteria are present in SIB2, this parameter configures the UE to fulfil both criteria in order to relax measurement requirements for cell reselection. If the field is absent, the UE is allowed to relax measurement requirements for cell reselection when either or both of the criteria are met. (See TS 38.304 [20], clause 5.2.4.9.0)</p>
<p><b>deriveSSB-IndexFromCell</b> This field indicates whether the UE can utilize serving cell timing to derive the index of SS block transmitted by neighbour cell. If this field is set to <i>true</i>, the UE assumes SFN and frame boundary alignment across cells on the serving frequency as specified in TS 38.133 [14].</p>
<p><b>frequencyBandList</b> Indicates the list of frequency bands for which the NR cell reselection parameters apply. The UE behaviour in case the field is absent is described in subclause 5.2.2.4.3.</p>
<p><b>highPriorityMeasRelax</b> Indicates whether measurements can be relaxed on high priority frequencies (see TS 38.304 [20], clause 5.2.4.9.0). If the field is absent, the UE shall not relax measurements on high priority frequencies beyond "T<sub>higher_priority_search</sub>" (see TS 38.133 [14], clause 4.2.2.7).</p>
<p><b>intraFreqCellReselectionInfo</b> Cell re-selection information common for intra-frequency cells.</p>
<p><b>lowMobilityEvaluation</b> Indicates the criteria for a UE to detect low mobility, in order to relax measurement requirements for cell reselection (see TS 38.304 [20], clause 5.2.4.9.1).</p>
<p><b>nrofSS-BlocksToAverage</b> Number of SS blocks to average for cell measurement derivation. If the field is absent the UE uses the measurement quantity as specified in TS 38.304 [20].</p>
<p><b>p-Max</b> Value in dBm applicable for the intra-frequency neighbouring NR cells. If absent the UE applies the maximum power according to TS 38.101-1 [15] in case of an FR1 cell or TS 38.101-2 [39] in case of an FR2 cell. In this release of the specification, if <i>p-Max</i> is present on a carrier frequency in FR2, the UE shall ignore the field and applies the maximum power according to TS 38.101-2 [39].</p>
<p><b>q-Hyst</b> Parameter "Q<sub>hyst</sub>" in TS 38.304 [20], Value in dB. Value <i>dB1</i> corresponds to 1 dB, <i>dB2</i> corresponds to 2 dB and so on.</p>
<p><b>q-HystSF</b> Parameter "Speed dependent ScalingFactor for Q<sub>hyst</sub>" in TS 38.304 [20]. The <i>sf-Medium</i> and <i>sf-High</i> concern the additional hysteresis to be applied, in Medium and High Mobility state respectively, to Q<sub>hyst</sub> as defined in TS 38.304 [20]. In dB. Value <i>dB-6</i> corresponds to -6dB, <i>dB-4</i> corresponds to -4dB and so on.</p>
<p><b>q-QualMin</b> Parameter "Q<sub>qualmin</sub>" in TS 38.304 [20], applicable for intra-frequency neighbour cells. If the field is absent, the UE applies the (default) value of negative infinity for Q<sub>qualmin</sub>.</p>
<p><b>q-RxLevMin</b> Parameter "Q<sub>rxlevmin</sub>" in TS 38.304 [20], applicable for intra-frequency neighbour cells.</p>
<p><b>q-RxLevMinSUL</b> Parameter "Q<sub>rxlevmin</sub>" in TS 38.304 [20], applicable for intra-frequency neighbour cells.</p>
<p><b>rangeToBestCell</b> Parameter "rangeToBestCell" in TS 38.304 [20]. The network configures only non-negative (in dB) values.</p>
<p><b>relaxedMeasurement</b> Configuration to allow relaxation of RRM measurement requirements for cell reselection (see TS 38.304 [20], clause 5.2.4.9).</p>

<b>SIB2 field descriptions</b>	
<b>s-IntraSearchP</b>	Parameter "S <sub>IntraSearchP</sub> " in TS 38.304 [20].
<b>s-IntraSearchQ</b>	Parameter "S <sub>IntraSearchQ</sub> " in TS 38.304 [20]. If the field is absent, the UE applies the (default) value of 0 dB for S <sub>IntraSearchQ</sub> .
<b>s-NonIntraSearchP</b>	Parameter "S <sub>NonIntraSearchP</sub> " in TS 38.304 [20]. If this field is absent, the UE applies the (default) value of infinity for S <sub>NonIntraSearchP</sub> .
<b>s-NonIntraSearchQ</b>	Parameter "S <sub>NonIntraSearchQ</sub> " in TS 38.304 [20]. If the field is absent, the UE applies the (default) value of 0 dB for S <sub>NonIntraSearchQ</sub> .
<b>s-SearchDeltaP</b>	Parameter "S <sub>SearchDeltaP</sub> " in TS 38.304 [20]. Value dB3 corresponds to 3 dB, dB6 corresponds to 6 dB and so on.
<b>s-SearchThresholdP</b>	Parameter "S <sub>SearchThresholdP</sub> " in TS 38.304 [20]. The network configures <i>s-SearchThresholdP</i> to be less than or equal to <i>s-IntraSearchP</i> and <i>s-NonIntraSearchP</i> .
<b>s-SearchThresholdQ</b>	Parameter "S <sub>SearchThresholdQ</sub> " in TS 38.304 [20]. The network configures <i>s-SearchThresholdQ</i> to be less than or equal to <i>s-IntraSearchQ</i> and <i>s-NonIntraSearchQ</i> .
<b>smtc</b>	Measurement timing configuration for intra-frequency measurement. If this field is absent, the UE assumes that SSB periodicity is 5 ms for the intra-frequency cells.
<b>smtc2-LP-r16</b>	Measurement timing configuration for intra-frequency neighbour cells with a Long Periodicity (LP) indicated by periodicity in <i>smtc2-LP-r16</i> . The timing offset and duration are equal to the offset and duration indicated in <i>smtc</i> in <i>intraFreqCellReselectionInfo</i> . The periodicity in <i>smtc2-LP-r16</i> can only be set to a value strictly larger than the periodicity in <i>smtc</i> in <i>intraFreqCellReselectionInfo</i> (e.g. if <i>smtc</i> indicates sf20 the Long Periodicity can only be set to sf40, sf80 or sf160, if <i>smtc</i> indicates sf160, <i>smtc2-LP-r16</i> cannot be configured). The <i>pci-List</i> , if present, includes the physical cell identities of the intra-frequency neighbour cells with Long Periodicity. If <i>smtc2-LP-r16</i> is absent, the UE assumes that there are no intra-frequency neighbour cells with a Long Periodicity.
<b>ssb-PositionQCL-Common</b>	Indicates the QCL relationship between SS/PBCH blocks for intra-frequency neighbor cells as specified in TS 38.213 [13], clause 4.1.
<b>ssb-ToMeasure</b>	The set of SS blocks to be measured within the SMTC measurement duration (see TS 38.215 [9]). When the field is absent the UE measures on all SS-blocks.
<b>t-ReselectionNR</b>	Parameter "T <sub>ReselectionNR</sub> " in TS 38.304 [20].
<b>t-ReselectionNR-SF</b>	Parameter "Speed dependent ScalingFactor for T <sub>ReselectionNR</sub> " in TS 38.304 [20]. If the field is absent, the UE behaviour is specified in TS 38.304 [20].
<b>threshServingLowP</b>	Parameter "Thresh <sub>Serving, LowP</sub> " in TS 38.304 [20].
<b>threshServingLowQ</b>	Parameter "Thresh <sub>Serving, LowQ</sub> " in TS 38.304 [20].
<b>t-SearchDeltaP</b>	Parameter "T <sub>SearchDeltaP</sub> " in TS 38.304 [20]. Value in seconds. Value s5 means 5 seconds, value s10 means 10 seconds and so on.

<b>Conditional Presence</b>	<b>Explanation</b>
<i>SharedSpectrum</i>	This field is mandatory present if this intra-frequency operates with shared spectrum channel access. Otherwise, it is absent, Need R.

– *SIB3*

*SIB3* contains neighbouring cell related information relevant only for intra-frequency cell re-selection. The IE includes cells with specific re-selection parameters as well as blacklisted cells.

***SIB3* information element**

```

-- ASN1START
-- TAG-SIB3-START

SIB3 ::=
  intraFreqNeighCellList          SEQUENCE {
    intraFreqNeighCellList          OPTIONAL, -- Need R
    intraFreqBlackCellList          OPTIONAL, -- Need R
    lateNonCriticalExtension        OCTET STRING
    ...
  }
  [
    intraFreqNeighCellList-v1610    IntraFreqNeighCellList-v1610    OPTIONAL, -- Need R
    intraFreqWhiteCellList-r16      IntraFreqWhiteCellList-r16    OPTIONAL, -- Cond SharedSpectrum2
    intraFreqCAG-CellList-r16       SEQUENCE (SIZE (1..maxPLMN)) OF IntraFreqCAG-CellListPerPLMN-r16  OPTIONAL -- Need R
  ]
}

IntraFreqNeighCellList ::=
  SEQUENCE (SIZE (1..maxCellIntra)) OF IntraFreqNeighCellInfo

IntraFreqNeighCellList-v1610 ::=
  SEQUENCE (SIZE (1..maxCellIntra)) OF IntraFreqNeighCellInfo-v1610

IntraFreqNeighCellInfo ::=
  SEQUENCE {
    physCellId                      PhysCellId,
    q-OffsetCell                    Q-OffsetRange,
    q-RxLevMinOffsetCell            INTEGER (1..8)          OPTIONAL, -- Need R
    q-RxLevMinOffsetCellSUL        INTEGER (1..8)          OPTIONAL, -- Need R
    q-QualMinOffsetCell             INTEGER (1..8)          OPTIONAL, -- Need R
    ...
  }

IntraFreqNeighCellInfo-v1610 ::=
  SEQUENCE {
    ssb-PositionQCL-r16             SSB-PositionQCL-Relation-r16    OPTIONAL -- Cond SharedSpectrum2
  }

IntraFreqBlackCellList ::=
  SEQUENCE (SIZE (1..maxCellBlack)) OF PCI-Range

IntraFreqWhiteCellList-r16 ::=
  SEQUENCE (SIZE (1..maxCellWhite)) OF PCI-Range

IntraFreqCAG-CellListPerPLMN-r16 ::= SEQUENCE {
  plmn-IdentityIndex-r16           INTEGER (1..maxPLMN),
  cag-CellList-r16                 SEQUENCE (SIZE (1..maxCAG-Cell-r16)) OF PCI-Range
}

-- TAG-SIB3-STOP
-- ASN1STOP

```

<b>SIB3 field descriptions</b>
<b><i>intraFreqBlackCellList</i></b> List of blacklisted intra-frequency neighbouring cells.
<b><i>intraFreqCAG-CellList</i></b> List of intra-frequency neighbouring CAG cells (as defined in TS 38.304 [20]) per PLMN.
<b><i>intraFreqNeighCellList</i></b> List of intra-frequency neighbouring cells with specific cell re-selection parameters. If <i>intraFreqNeighCellList-v1610</i> is present, it shall contain the same number of entries, listed in the same order as in <i>intraFreqNeighCellList</i> (without suffix).
<b><i>intraFreqWhiteCellList</i></b> List of whitelisted intra-frequency neighbouring cells, see TS 38.304 [20], clause 5.2.4.
<b><i>q-OffsetCell</i></b> Parameter "Qoffset <sub>s,n</sub> " in TS 38.304 [20].
<b><i>q-QualMinOffsetCell</i></b> Parameter "Q <sub>qualminoffsetcell</sub> " in TS 38.304 [20]. Actual value Q <sub>qualminoffsetcell</sub> = field value [dB].
<b><i>q-RxLevMinOffsetCell</i></b> Parameter "Q <sub>rxlevminoffsetcell</sub> " in TS 38.304 [20]. Actual value Q <sub>rxlevminoffsetcell</sub> = field value * 2 [dB].
<b><i>q-RxLevMinOffsetCellSUL</i></b> Parameter "Q <sub>rxlevminoffsetcellSUL</sub> " in TS 38.304 [20]. Actual value Q <sub>rxlevminoffsetcellSUL</sub> = field value * 2 [dB].
<b><i>ssb-PositionQCL</i></b> Indicates the QCL relationship between SS/PBCH blocks for a specific intra-frequency neighbor cell as specified in TS 38.213 [13], clause 4.1. If provided, the cell specific value overwrites the value signalled by <i>ssb-PositionQCL-Common</i> in <i>SIB2</i> for the indicated cell.

<b>Conditional Presence</b>	<b>Explanation</b>
<i>SharedSpectrum2</i>	The field is optional present, Need R, if this intra-frequency or neighbor cell operates with shared spectrum channel access. Otherwise, it is absent, Need R.

## – SIB4

*SIB4* contains information relevant for inter-frequency cell re-selection (i.e. information about other NR frequencies and inter-frequency neighbouring cells relevant for cell re-selection), which can also be used for NR idle/inactive measurements. The IE includes cell re-selection parameters common for a frequency as well as cell specific re-selection parameters.

### **SIB4 information element**

```
-- ASN1START
-- TAG-SIB4-START

SIB4 ::= SEQUENCE {
    interFreqCarrierFreqList      InterFreqCarrierFreqList,
    lateNonCriticalExtension      OCTET STRING                OPTIONAL,
    . . .
    [[
    interFreqCarrierFreqList-v1610 InterFreqCarrierFreqList-v1610    OPTIONAL -- Need R
    ]]
}
```

```

InterFreqCarrierFreqList ::= SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo

InterFreqCarrierFreqList-v1610 ::= SEQUENCE (SIZE (1..maxFreq)) OF InterFreqCarrierFreqInfo-v1610

InterFreqCarrierFreqInfo ::= SEQUENCE {
    dl-CarrierFreq ARFCN-ValueNR,
    frequencyBandList MultiFrequencyBandListNR-SIB OPTIONAL, -- Cond Mandatory
    frequencyBandListSUL MultiFrequencyBandListNR-SIB OPTIONAL, -- Need R
    nrofSS-BlocksToAverage INTEGER (2..maxNrofSS-BlocksToAverage) OPTIONAL, -- Need S
    absThreshSS-BlocksConsolidation ThresholdNR OPTIONAL, -- Need S
    smtc SSB-MTC OPTIONAL, -- Need S
    ssbSubcarrierSpacing SubcarrierSpacing,
    ssb-ToMeasure SSB-ToMeasure OPTIONAL, -- Need S
    deriveSSB-IndexFromCell BOOLEAN,
    ss-RSSI-Measurement SS-RSSI-Measurement OPTIONAL,
    q-RxLevMin Q-RxLevMin,
    q-RxLevMinSUL Q-RxLevMin OPTIONAL, -- Need R
    q-QualMin Q-QualMin OPTIONAL, -- Need S
    p-Max P-Max OPTIONAL, -- Need S
    t-ReselectionNR T-Reselection,
    t-ReselectionNR-SF SpeedStateScaleFactors OPTIONAL, -- Need S
    threshX-HighP ReselectionThreshold,
    threshX-LowP ReselectionThreshold,
    threshX-Q SEQUENCE {
        threshX-HighQ ReselectionThresholdQ,
        threshX-LowQ ReselectionThresholdQ
    } OPTIONAL, -- Cond RSRQ
    cellReselectionPriority CellReselectionPriority OPTIONAL, -- Need R
    cellReselectionSubPriority CellReselectionSubPriority OPTIONAL, -- Need R
    q-OffsetFreq Q-OffsetRange DEFAULT dB0,
    interFreqNeighCellList InterFreqNeighCellList OPTIONAL, -- Need R
    interFreqBlackCellList InterFreqBlackCellList OPTIONAL, -- Need R
    ...
}

InterFreqCarrierFreqInfo-v1610 ::= SEQUENCE {
    interFreqNeighCellList-v1610 InterFreqNeighCellList-v1610 OPTIONAL, -- Need R
    smtc2-LP-r16 SSB-MTC2-LP-r16 OPTIONAL, -- Need R
    interFreqWhiteCellList-r16 InterFreqWhiteCellList-r16 OPTIONAL, -- Cond SharedSpectrum2
    ssb-PositionQCL-Common-r16 SSB-PositionQCL-Relation-r16 OPTIONAL, -- Cond SharedSpectrum
    interFreqCAG-CellList-r16 SEQUENCE (SIZE (1..maxPLMN)) OF InterFreqCAG-CellListPerPLMN-r16 OPTIONAL -- Need R
}

InterFreqNeighCellList ::= SEQUENCE (SIZE (1..maxCellInter)) OF InterFreqNeighCellInfo

InterFreqNeighCellList-v1610 ::= SEQUENCE (SIZE (1..maxCellInter)) OF InterFreqNeighCellInfo-v1610

InterFreqNeighCellInfo ::= SEQUENCE {
    physCellId PhysCellId,
    q-OffsetCell Q-OffsetRange,
    q-RxLevMinOffsetCell INTEGER (1..8) OPTIONAL, -- Need R
    q-RxLevMinOffsetCellSUL INTEGER (1..8) OPTIONAL, -- Need R
    q-QualMinOffsetCell INTEGER (1..8) OPTIONAL, -- Need R
}

```

```
    ...
  }
InterFreqNeighCellInfo-v1610 ::= SEQUENCE {
  ssb-PositionQCL-r16          SSB-PositionQCL-Relation-r16          OPTIONAL -- Cond SharedSpectrum2
}
InterFreqBlackCellList ::= SEQUENCE (SIZE (1..maxCellBlack)) OF PCI-Range
InterFreqWhiteCellList-r16 ::= SEQUENCE (SIZE (1..maxCellWhite)) OF PCI-Range
InterFreqCAG-CellListPerPLMN-r16 ::= SEQUENCE {
  plmn-IdentityIndex-r16      INTEGER (1..maxPLMN),
  cag-CellList-r16            SEQUENCE (SIZE (1..maxCAG-Cell-r16)) OF PCI-Range
}
-- TAG-SIB4-STOP
-- ASN1STOP
```



<b>SIB4 field descriptions</b>
<p><b>absThreshSS-BlocksConsolidation</b> Threshold for consolidation of L1 measurements per RS index. If the field is absent, the UE uses the measurement quantity as specified in TS 38.304 [20].</p>
<p><b>deriveSSB-IndexFromCell</b> This field indicates whether the UE may use the timing of any detected cell on that frequency to derive the SSB index of all neighbour cells on that frequency. If this field is set to <i>true</i>, the UE assumes SFN and frame boundary alignment across cells on the neighbor frequency as specified in TS 38.133 [14].</p>
<p><b>dl-CarrierFreq</b> This field indicates center frequency of the SS block of the neighbour cells, where the frequency corresponds to a GSCN value as specified in TS 38.101-1 [15].</p>
<p><b>frequencyBandList</b> Indicates the list of frequency bands for which the NR cell reselection parameters apply.</p>
<p><b>interFreqBlackCellList</b> List of blacklisted inter-frequency neighbouring cells.</p>
<p><b>interFreqCAG-CellList</b> List of inter-frequency neighbouring CAG cells (as defined in TS 38.304 [20] per PLMN).</p>
<p><b>interFreqCarrierFreqList</b> List of neighbouring carrier frequencies and frequency specific cell re-selection information. If <i>iinterFreqCarrierFreqList-v1610</i> is present, it shall contain the same number of entries, listed in the same order as in <i>interFreqCarrierFreqList</i> (without suffix).</p>
<p><b>interFreqNeighCellList</b> List of inter-frequency neighbouring cells with specific cell re-selection parameters. If <i>interFreqNeighCellList-v1610</i> is present, it shall contain the same number of entries, listed in the same order as in <i>interFreqNeighCellList</i> (without suffix).</p>
<p><b>interFreqWhiteCellList</b> List of whitelisted inter-frequency neighbouring cells, see TS 38.304 [20], clause 5.2.4.</p>
<p><b>nrofSS-BlocksToAverage</b> Number of SS blocks to average for cell measurement derivation. If the field is absent, the UE uses the measurement quantity as specified in TS 38.304 [20].</p>
<p><b>p-Max</b> Value in dBm applicable for the neighbouring NR cells on this carrier frequency. If absent the UE applies the maximum power according to TS 38.101-1 [15] in case of an FR1 cell or TS 38.101-2 [39] in case of an FR2 cell. In this release of the specification, if <i>p-Max</i> is present on a carrier frequency in FR2, the UE shall ignore the field and applies the maximum power according to TS 38.101-2 [39].</p>
<p><b>q-OffsetCell</b> Parameter "Qoffset<sub>s,n</sub>" in TS 38.304 [20].</p>
<p><b>q-OffsetFreq</b> Parameter "Qoffset<sub>frequency</sub>" in TS 38.304 [20].</p>
<p><b>q-QualMin</b> Parameter "Q<sub>qualmin</sub>" in TS 38.304 [20]. If the field is absent, the UE applies the (default) value of negative infinity for Q<sub>qualmin</sub>.</p>
<p><b>q-QualMinOffsetCell</b> Parameter "Q<sub>qualminoffsetcell</sub>" in TS 38.304 [20]. Actual value Q<sub>qualminoffsetcell</sub> = field value [dB].</p>
<p><b>q-RxLevMin</b> Parameter "Q<sub>rxlevmin</sub>" in TS 38.304 [20].</p>
<p><b>q-RxLevMinOffsetCell</b> Parameter "Q<sub>rxlevminoffsetcell</sub>" in TS 38.304 [20]. Actual value Q<sub>rxlevminoffsetcell</sub> = field value * 2 [dB].</p>
<p><b>q-RxLevMinOffsetCellSUL</b> Parameter "Q<sub>rxlevminoffsetcellSUL</sub>" in TS 38.304 [20]. Actual value Q<sub>rxlevminoffsetcellSUL</sub> = field value * 2 [dB].</p>
<p><b>q-RxLevMinSUL</b> Parameter "Q<sub>rxlevmin</sub>" in TS 38.304 [20].</p>
<p><b>smtc</b> Measurement timing configuration for inter-frequency measurement. If this field is absent, the UE assumes that SSB periodicity is 5 ms in this frequency.</p>

<b>SIB4 field descriptions</b>
<p><b>smtc2-LP-r16</b> Measurement timing configuration for inter-frequency neighbour cells with a Long Periodicity (LP) indicated by periodicity in <i>smtc2-LP-r16</i>. The timing offset and duration are equal to the offset and duration indicated in <i>smtc</i> in <i>InterFreqCarrierFreqInfo</i>. The periodicity in <i>smtc2-LP-r16</i> can only be set to a value strictly larger than the periodicity in <i>smtc</i> in <i>InterFreqCarrierFreqInfo</i> (e.g. if <i>smtc</i> indicates sf20 the Long Periodicity can only be set to sf40, sf80 or sf160, if <i>smtc</i> indicates sf160, <i>smtc2-LP-r16</i> cannot be configured). The <i>pci-List</i>, if present, includes the physical cell identities of the inter-frequency neighbour cells with Long Periodicity. If <i>smtc2-LP-r16</i> is absent, the UE assumes that there are no inter-frequency neighbour cells with a Long Periodicity.</p>
<p><b>ssb-PositionQCL</b> Indicates the QCL relationship between SS/PBCH blocks for a specific neighbor cell as specified in TS 38.213 [13], clause 4.1. If provided, the cell specific value overwrites the common value signalled by <i>ssb-PositionQCL-Common</i> in <i>SIB4</i> for the indicated cell.</p>
<p><b>ssb-PositionQCL-Common</b> Indicates the QCL relationship between SS/PBCH blocks for inter-frequency neighbor cells as specified in TS 38.213 [13], clause 4.1.</p>
<p><b>ssb-ToMeasure</b> The set of SS blocks to be measured within the SMTc measurement duration (see TS 38.215 [9]). When the field is absent the UE measures on all SS-blocks.</p>
<p><b>ssbSubcarrierSpacing</b> Subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable.</p>
<p><b>threshX-HighP</b> Parameter "Thresh<sub>X, HighP</sub>" in TS 38.304 [20].</p>
<p><b>threshX-HighQ</b> Parameter "Thresh<sub>X, HighQ</sub>" in TS 38.304 [20].</p>
<p><b>threshX-LowP</b> Parameter "Thresh<sub>X, LowP</sub>" in TS 38.304 [20].</p>
<p><b>threshX-LowQ</b> Parameter "Thresh<sub>X, LowQ</sub>" in TS 38.304 [20].</p>
<p><b>t-ReselectionNR</b> Parameter "Treselction<sub>NR</sub>" in TS 38.304 [20].</p>
<p><b>t-ReselectionNR-SF</b> Parameter "Speed dependent ScalingFactor for Treselction<sub>NR</sub>" in TS 38.304 [20]. If the field is absent, the UE behaviour is specified in TS 38.304 [20].</p>

<b>Conditional Presence</b>	<b>Explanation</b>
<i>Mandatory</i>	The field is mandatory present in <i>SIB4</i> .
<i>RSRQ</i>	The field is mandatory present if <i>threshServingLowQ</i> is present in <i>SIB2</i> ; otherwise it is absent.
<i>SharedSpectrum</i>	This field is mandatory present if this inter-frequency operates with shared spectrum channel access. Otherwise, it is absent, Need R.
<i>SharedSpectrum2</i>	The field is optional present, Need R, if this inter-frequency or neighbor cell operates with shared spectrum channel access. Otherwise, it is absent, Need R.

## – SIB5

*SIB5* contains information relevant only for inter-RAT cell re-selection i.e. information about E-UTRA frequencies and E-UTRAs neighbouring cells relevant for cell re-selection. The IE includes cell re-selection parameters common for a frequency.

**SIB5 information element**

```

-- ASN1START
-- TAG-SIB5-START

SIB5 ::=
    carrierFreqListEUTRA          SEQUENCE {
        carrierFreqListEUTRA          OPTIONAL,      -- Need R
        t-ReselectionEUTRA            T-Reselection,
        t-ReselectionEUTRA-SF        SpeedStateScaleFactors    OPTIONAL,      -- Need S
        lateNonCriticalExtension      OCTET STRING          OPTIONAL,
        ...
    }
    [[
        carrierFreqListEUTRA-v1610    CarrierFreqListEUTRA-v1610    OPTIONAL      -- Need R
    ]]

CarrierFreqListEUTRA ::= SEQUENCE (SIZE (1..maxEUTRA-Carrier)) OF CarrierFreqEUTRA

CarrierFreqListEUTRA-v1610 ::= SEQUENCE (SIZE (1..maxEUTRA-Carrier)) OF CarrierFreqEUTRA-v1610

CarrierFreqEUTRA ::= SEQUENCE {
    carrierFreq                ARFCN-ValueEUTRA,
    eutra-multiBandInfoList    EUTRA-MultiBandInfoList          OPTIONAL,      -- Need R
    eutra-FreqNeighCellList    EUTRA-FreqNeighCellList          OPTIONAL,      -- Need R
    eutra-BlackCellList        EUTRA-FreqBlackCellList          OPTIONAL,      -- Need R
    allowedMeasBandwidth        EUTRA-AllowedMeasBandwidth,
    presenceAntennaPort1        EUTRA-PresenceAntennaPort1,
    cellReselectionPriority      CellReselectionPriority          OPTIONAL,      -- Need R
    cellReselectionSubPriority    CellReselectionSubPriority          OPTIONAL,      -- Need R
    threshX-High                ReselectionThreshold,
    threshX-Low                 ReselectionThreshold,
    q-RxLevMin                  INTEGER (-70..-22),
    q-QualMin                    INTEGER (-34..-3),
    p-MaxEUTRA                  INTEGER (-30..33),
    threshX-Q                    SEQUENCE {
        threshX-HighQ            ReselectionThresholdQ,
        threshX-LowQ             ReselectionThresholdQ
    }
}
OPTIONAL      -- Cond RSRQ

CarrierFreqEUTRA-v1610 ::= SEQUENCE {
    highSpeedEUTRACarrier-r16    ENUMERATED {true}          OPTIONAL      -- Need R
}

EUTRA-FreqBlackCellList ::= SEQUENCE (SIZE (1..maxEUTRA-CellBlack)) OF EUTRA-PhysCellIdRange

EUTRA-FreqNeighCellList ::= SEQUENCE (SIZE (1..maxCelleUTRA)) OF EUTRA-FreqNeighCellInfo

EUTRA-FreqNeighCellInfo ::= SEQUENCE {
    physCellId                  EUTRA-PhysCellId,
    dummy                        EUTRA-Q-OffsetRange,
    q-RxLevMinOffsetCell        INTEGER (1..8)          OPTIONAL,      -- Need R
    q-QualMinOffsetCell          INTEGER (1..8)          OPTIONAL      -- Need R
}

```

-- TAG-SIB5-STOP  
-- ASN1STOP

<b>SIB5 field descriptions</b>	
<b>carrierFreqListEUTRA</b>	List of carrier frequencies of E-UTRA. If the <i>carrierFreqListEUTRA-v1610</i> is present, it shall contain the same number of entries, listed in the same order as in the <i>carrierFreqListEUTRA</i> (without suffix).
<b>dummy</b>	This field is not used in the specification. If received it shall be ignored by the UE.
<b>eutra-BlackCellList</b>	List of blacklisted E-UTRA neighbouring cells.
<b>eutra-multiBandInfoList</b>	Indicates the list of frequency bands in addition to the band represented by <i>carrierFreq</i> for which cell reselection parameters are common, and a list of <i>additionalPmax</i> and <i>additionalSpectrumEmission</i> values, as defined in TS 36.101 [22], table 6.2.4-1, for the frequency bands in <i>eutra-multiBandInfoList</i>
<b>highSpeedEUTRACarrier</b>	If the field is present, the UE shall apply the enhanced NR-EUTRA inter-RAT measurement requirements to support high speed up to 500 km/h as specified in TS 38.133 [14] to the E-UTRA carrier.
<b>p-MaxEUTRA</b>	The maximum allowed transmission power in dBm on the (uplink) carrier frequency, see TS 36.304 [27].
<b>q-QualMin</b>	Parameter "Q <sub>qualmin</sub> " in TS 36.304 [27]. Actual value Q <sub>qualmin</sub> = field value [dB].
<b>q-QualMinOffsetCell</b>	Parameter "Q <sub>qualminoffsetcell</sub> " in TS 36.304 [27]. Actual value Q <sub>qualminoffsetcell</sub> = field value [dB].
<b>q-RxLevMin</b>	Parameter "Q <sub>rxlevmin</sub> " in TS 36.304 [27]. Actual value Q <sub>rxlevmin</sub> = field value * 2 [dBm].
<b>q-RxLevMinOffsetCell</b>	Parameter "Q <sub>rxlevminoffsetcell</sub> " in TS 36.304 [27]. Actual value Q <sub>rxlevminoffsetcell</sub> = field value * 2 [dB].
<b>t-ReselectionEUTRA</b>	Parameter "T <sub>reselectionEUTRA</sub> " in TS 38.304 [20].
<b>threshX-High</b>	Parameter "Thresh <sub>X, HighP</sub> " in TS 38.304 [20].
<b>threshX-HighQ</b>	Parameter "Thresh <sub>X, HighQ</sub> " in TS 38.304 [20].
<b>threshX-Low</b>	Parameter "Thresh <sub>X, LowP</sub> " in TS 38.304 [20].
<b>threshX-LowQ</b>	Parameter "Thresh <sub>X, LowQ</sub> " in TS 38.304 [20].
<b>t-ReselectionEUTRA-SF</b>	Parameter "Speed dependent ScalingFactor for T <sub>reselectionEUTRA</sub> " in TS 38.304 [20]. If the field is absent, the UE behaviour is specified in TS 38.304 [20].

Conditional Presence	Explanation
RSRQ	The field is mandatory present if the <i>threshServingLowQ</i> is present in <i>SIB2</i> ; otherwise it is absent.

— **SIB6**

*SIB6* contains an ETWS primary notification.

**SIB6 information element**

```

-- ASN1START
-- TAG-SIB6-START

SIB6 ::=
    messageIdentifier      BIT STRING (SIZE (16)),
    serialNumber           BIT STRING (SIZE (16)),
    warningType            OCTET STRING (SIZE (2)),
    lateNonCriticalExtension OCTET STRING                               OPTIONAL,
    ...
}

-- TAG-SIB6-STOP
-- ASN1STOP

```

**SIB6 field descriptions****messageIdentifier**

Identifies the source and type of ETWS notification.

**serialNumber**

Identifies variations of an ETWS notification.

**warningType**

Identifies the warning type of the ETWS primary notification and provides information on emergency user alert and UE popup.

— **SIB7**

*SIB7* contains an ETWS secondary notification.

**SIB7 information element**

```

-- ASN1START
-- TAG-SIB7-START

SIB7 ::=
    messageIdentifier      BIT STRING (SIZE (16)),
    serialNumber           BIT STRING (SIZE (16)),
    warningMessageSegmentType ENUMERATED {notLastSegment, lastSegment},
    warningMessageSegmentNumber INTEGER (0..63),
    warningMessageSegment  OCTET STRING,
    dataCodingScheme       OCTET STRING (SIZE (1))           OPTIONAL,  -- Cond Segment1
    lateNonCriticalExtension OCTET STRING                     OPTIONAL,
    ...
}

```

```
-- TAG-SIB7-STOP
-- ASN1STOP
```

### SIB7 field descriptions

<b>dataCodingScheme</b>	Identifies the alphabet/coding and the language applied variations of an ETWS notification.
<b>messageIdentifier</b>	Identifies the source and type of ETWS notification.
<b>serialNumber</b>	Identifies variations of an ETWS notification.
<b>warningMessageSegment</b>	Carries a segment of the Warning Message Contents IE.
<b>warningMessageSegmentNumber</b>	Segment number of the ETWS warning message segment contained in the SIB. A segment number of zero corresponds to the first segment, A segment number of one corresponds to the second segment, and so on.
<b>warningMessageSegmentType</b>	Indicates whether the included ETWS warning message segment is the last segment or not.

Conditional Presence	Explanation
Segment1	The field is mandatory present in the first segment of <i>SIB7</i> , otherwise it is absent.

## – SIB8

*SIB8* contains a CMAS notification.

### SIB8 information element

```
-- ASN1START
-- TAG-SIB8-START

SIB8 ::= SEQUENCE {
    messageIdentifier      BIT STRING (SIZE (16)),
    serialNumber           BIT STRING (SIZE (16)),
    warningMessageSegmentType  ENUMERATED {notLastSegment, lastSegment},
    warningMessageSegmentNumber  INTEGER (0..63),
    warningMessageSegment  OCTET STRING,
    dataCodingScheme       OCTET STRING (SIZE (1))
    warningAreaCoordinatesSegment  OCTET STRING
    lateNonCriticalExtension  OCTET STRING
    ...
}

-- TAG-SIB8-STOP
-- ASN1STOP
```

```
OPTIONAL, -- Cond Segment1
OPTIONAL, -- Need R
OPTIONAL,
```

<b>SIB8 field descriptions</b>
<p><b>dataCodingScheme</b> Identifies the alphabet/coding and the language applied variations of a CMAS notification.</p>
<p><b>messageIdentifier</b> Identifies the source and type of CMAS notification.</p>
<p><b>serialNumber</b> Identifies variations of a CMAS notification.</p>
<p><b>warningAreaCoordinatesSegment</b> If present, carries a segment, with one or more octets, of the geographical area where the CMAS warning message is valid as defined in [28]. The first octet of the first <i>warningAreaCoordinatesSegment</i> is equivalent to the first octet of Warning Area Coordinates IE defined in and encoded according to TS 23.041 [29] and so on.</p>
<p><b>warningMessageSegment</b> Carries a segment, with one or more octets, of the <i>Warning Message Contents</i> IE defined in TS 38.413 [42]. The first octet of the <i>Warning Message Contents</i> IE is equivalent to the first octet of the <i>CB data</i> IE defined in and encoded according to TS 23.041 [29], clause 9.4.2.2.5, and so on.</p>
<p><b>warningMessageSegmentNumber</b> Segment number of the CMAS warning message segment contained in the SIB. A segment number of zero corresponds to the first segment, one corresponds to the second segment, and so on. If warning area coordinates are provided for the warning message, then this field applies to both warning message segment and warning area coordinates segment.</p>
<p><b>warningMessageSegmentType</b> Indicates whether the included CMAS warning message segment is the last segment or not. If warning area coordinates are provided for the warning message, then this field applies to both warning message segment and warning area coordinates segment.</p>

<b>Conditional Presence</b>	<b>Explanation</b>
<i>Segment1</i>	The field is mandatory present in the first segment of <i>SIB8</i> , otherwise it is absent.

– **SIB9**

*SIB9* 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.

NOTE: The UE may use the time information for numerous purposes, possibly involving upper layers e.g. to assist GPS initialisation, to synchronise the UE clock.

**SIB9 information element**

```

-- ASN1START
-- TAG-SIB9-START

SIB9 ::=
    timeInfo
        timeInfoUTC
        dayLightSavingTime
        leapSeconds
        localTimeOffset
    }

SEQUENCE {
    SEQUENCE {
        INTEGER (0..549755813887),
        BIT STRING (SIZE (2))
        INTEGER (-127..128)
        INTEGER (-63..64)
    }
    OPTIONAL, -- Need R
    OPTIONAL, -- Need R
    OPTIONAL, -- Need R
    OPTIONAL, -- Need R
}
    
```

```

    lateNonCriticalExtension          OCTET STRING          OPTIONAL,
    ...
    [[
referenceTimeInfo-r16                ReferenceTimeInfo-r16  OPTIONAL  -- Need R
    ]]
}

-- TAG-SIB9-STOP
-- ASN1STOP

```

### SIB9 field descriptions

#### **dayLightSavingTime**

Indicates if and how daylight-saving time (DST) is applied to obtain the local time. The semantics are the same as the semantics of the *Daylight Saving Time* IE in TS 24.501 [23] and TS 24.008 [38]. The first/leftmost bit of the bit string contains the b2 of octet 3 and the second bit of the bit string contains b1 of octet 3 in the value part of the *Daylight Saving Time* IE in TS 24.008 [38].

#### **leapSeconds**

Number of leap seconds offset between GPS Time and UTC. UTC and GPS time are related i.e. GPS time - leapSeconds = UTC time.

#### **localTimeOffset**

Offset between UTC and local time in units of 15 minutes. Actual value = field value \* 15 minutes. Local time of the day is calculated as UTC time + localTimeOffset.

#### **timeInfoUTC**

Coordinated Universal Time corresponding to the SFN boundary at or immediately after the ending boundary of the SI-window in which SIB9 is transmitted. The field counts the number of UTC seconds in 10 ms units since 00:00:00 on Gregorian calendar date 1 January, 1900 (midnight between Sunday, December 31, 1899 and Monday, January 1, 1900). See NOTE 1. This field is excluded when determining changes in system information, i.e. changes of *timeInfoUTC* should neither result in system information change notifications nor in a modification of *valueTag* in *SIB1*.

NOTE 1: The UE may use this field together with the *leapSeconds* field to obtain GPS time as follows: GPS Time (in seconds) = timeInfoUTC (in seconds) - 2,524,953,600 (seconds) + leapSeconds, where 2,524,953,600 is the number of seconds between 00:00:00 on Gregorian calendar date 1 January, 1900 and 00:00:00 on Gregorian calendar date 6 January, 1980 (start of GPS time).

## — SIB10

*SIB10* contains the HRNNs of the NPNs listed in *SIB1*.

### SIB10 information element

```

-- ASN1START
-- TAG-SIB10-START

SIB10-r16 ::= SEQUENCE {
    hrnn-List-r16          HRNN-List-r16          OPTIONAL,  -- Need R
    lateNonCriticalExtension OCTET STRING          OPTIONAL,
    ...
}

HRNN-List-r16 ::= SEQUENCE (SIZE (1..maxNPN-r16)) OF HRNN-r16

HRNN-r16 ::= SEQUENCE {

```



```

    hrnn-r16                OCTET STRING (SIZE(1.. maxHRNN-Len-r16))    OPTIONAL    -- Need R
}
-- TAG-SIB10-STOP
-- ASN1STOP

```

<b>SIB10 field descriptions</b>
---------------------------------

**HRNN-List**

The same amount of HRNN elements as the number of NPNs in SIB 1 are included. The n-th entry of *HRNN-List* contains the human readable network name of the n-th NPN of SIB1. The *hrnn* in the corresponding entry in *HRNN-List* is absent if there is no HRNN associated with the given NPN.

## – SIB11

*SIB11* contains information related to idle/inactive measurements.

### **SIB11 information element**

```

-- ASN1START
-- TAG-SIB11-START

SIB11-r16 ::= SEQUENCE {
    measIdleConfigSIB-r16    MeasIdleConfigSIB-r16    OPTIONAL, -- Need S
    lateNonCriticalExtension OCTET STRING            OPTIONAL,
    ...
}

-- TAG-SIB11-STOP
-- ASN1STOP

```

<b>SIB11 field descriptions</b>
---------------------------------

**measIdleConfigSIB**

Indicates measurement configuration to be stored and used by the UE while in RRC\_IDLE or RRC\_INACTIVE.

## – SIB12

*SIB12* contains NR sidelink communication configuration.

### **SIB12 information element**

```

-- ASN1START
-- TAG-SIB12-START

SIB12-r16 ::= SEQUENCE {
    segmentNumber-r16    INTEGER (0..63),

```

```

    segmentType-r16          ENUMERATED {notLastSegment, lastSegment},
    segmentContainer-r16     OCTET STRING
}

SIB12-IEs-r16 ::=          SEQUENCE {
    sl-ConfigCommonNR-r16   SL-ConfigCommonNR-r16,
    lateNonCriticalExtension OCTET STRING OPTIONAL,
    ...
}

SL-ConfigCommonNR-r16 ::= SEQUENCE {
    sl-FreqInfoList-r16     SEQUENCE (SIZE (1..maxNrofFreqSL-r16)) OF SL-FreqConfigCommon-r16 OPTIONAL, -- Need R
    sl-UE-SelectedConfig-r16 SL-UE-SelectedConfig-r16 OPTIONAL, -- Need R
    sl-NR-AnchorCarrierFreqList-r16 SL-NR-AnchorCarrierFreqList-r16 OPTIONAL, -- Need R
    sl-EUTRA-AnchorCarrierFreqList-r16 SL-EUTRA-AnchorCarrierFreqList-r16 OPTIONAL, -- Need R
    sl-RadioBearerConfigList-r16 SEQUENCE (SIZE (1..maxNrofSLRB-r16)) OF SL-RadioBearerConfig-r16 OPTIONAL, -- Need R
    sl-RLC-BearerConfigList-r16 SEQUENCE (SIZE (1..maxSL-LCID-r16)) OF SL-RLC-BearerConfig-r16 OPTIONAL, -- Need R
    sl-MeasConfigCommon-r16 SL-MeasConfigCommon-r16 OPTIONAL, -- Need R
    sl-CSI-Acquisition-r16     ENUMERATED {enabled} OPTIONAL, -- Need R
    sl-OffsetDFN-r16           INTEGER (1..1000) OPTIONAL, -- Need R
    t400-r16                   ENUMERATED {ms100, ms200, ms300, ms400, ms600, ms1000, ms1500, ms2000} OPTIONAL, -- Need R
    sl-MaxNumConsecutiveDTX-r16 ENUMERATED {n1, n2, n3, n4, n6, n8, n16, n32} OPTIONAL, -- Need R
    sl-SSB-PriorityNR-r16     INTEGER (1..8) OPTIONAL, -- Need R
}

SL-NR-AnchorCarrierFreqList-r16 ::= SEQUENCE (SIZE (1..maxFreqSL-NR-r16)) OF ARFCN-ValueNR

SL-EUTRA-AnchorCarrierFreqList-r16 ::= SEQUENCE (SIZE (1..maxFreqSL-EUTRA-r16)) OF ARFCN-ValueEUTRA

-- TAG-SIB12-STOP
-- ASN1STOP

```

<b>SIB12 field descriptions</b>
<p><b>segmentContainer</b> This field includes a segment of the encoded <i>SIB12-IE</i>s. The size of the included segment in this container should be less than the maximum size of a NR SI, i.e. 2976 bits when SIB12 is broadcast.</p>
<p><b>segmentNumber</b> This field identifies the sequence number of a segment of <i>SIB12-IE</i>s. A segment number of zero corresponds to the first segment, A segment number of one corresponds to the second segment, and so on.</p>
<p><b>segmentType</b> This field indicates whether the included segment is the last segment or not.</p>
<p><b>sl-CSI-Acquisition</b> This field indicates whether CSI reporting is enabled in sidelink unicast. If not set, SL CSI reporting is disabled.</p>
<p><b>sl-EUTRA-AnchorCarrierFreqList</b> This field indicates the EUTRA anchor carrier frequency list, which can provide the NR sidelink communication configurations.</p>
<p><b>sl-FreqInfoList</b> This field indicates the NR sidelink communication configuration on some carrier frequency (ies). In this release, only one entry can be configured in the list.</p>
<p><b>sl-MaxNumConsecutiveDTX</b> This field indicates the maximum number of consecutive HARQ DTX before triggering sidelink RLF. Value n1 corresponds to 1, value n2 corresponds to 2, and so on.</p>
<p><b>sl-MeasConfigCommon</b> This field indicates the measurement configurations (e.g. RSRP) for NR sidelink communication.</p>
<p><b>sl-NR-AnchorCarrierFreqList</b> This field indicates the NR anchor carrier frequency list, which can provide the NR sidelink communication configurations.</p>
<p><b>sl-OffsetDFN</b> Indicates the timing offset for the UE to determine DFN timing when GNSS is used for timing reference. Value 1 corresponds to 0.001 milliseconds, value 2 corresponds to 0.002 milliseconds, and so on.</p>
<p><b>sl-RadioBearerConfigList</b> This field indicates one or multiple sidelink radio bearer configurations.</p>
<p><b>sl-RLC-BearerConfigList</b> This field indicates one or multiple sidelink RLC bearer configurations.</p>
<p><b>sl-SSB-PriorityNR</b> This field indicates the priority of NR sidelink SSB transmission and reception.</p>

## – SIB13

SIB13 contains configurations of V2X sidelink communication defined in TS 36.331 [10].

### **SIB13 information element**

```

-- ASN1START
-- TAG-SIB13-START

SIB13-r16 ::=
    sl-V2X-ConfigCommon-r16          SEQUENCE {
    sl-Bandwidth-r16                  OCTET STRING,
    tdd-Config-r16                    OCTET STRING,
    lateNonCriticalExtension           OCTET STRING
    ...                               OPTIONAL,

```

```

}
-- TAG-SIB13-STOP
-- ASN1STOP

```

<b>SIB13 field descriptions</b>
<b>sl-Bandwidth</b> This field includes the ul-Bandwidth in E-UTRA SystemInformationBlockType2 message as specified in TS 36.331 [10].
<b>sl-V2X-ConfigCommon</b> This field includes the E-UTRA SystemInformationBlockType21 message as specified in TS 36.331 [10].
<b>tdd-Config</b> This field includes the tdd-Config in E-UTRA SystemInformationBlockType1 message as specified in TS 36.331 [10].

## – SIB14

SIB14 contains configurations of V2X sidelink communication defined in TS 36.331 [10], which can be used jointly with that included in *SIB13*.

### **SIB14 information element**

```

-- ASN1START
-- TAG-SIB14-START

SIB14-r16 ::= SEQUENCE {
    sl-V2X-ConfigCommonExt-r16 OCTET STRING,
    lateNonCriticalExtension OCTET STRING OPTIONAL,
    ...
}

-- TAG-SIB14-STOP
-- ASN1STOP

```

<b>SIB14 field descriptions</b>
<b>sl-V2X-ConfigCommonExt</b> This field includes the E-UTRA SystemInformationBlockType26 message as specified in TS 36.331 [10].

## 6.3.1a Positioning System information blocks

### – PosSystemInformation-r16-IEs

```

-- ASN1START
-- TAG-POSSYSTEMINFORMATION-R16-IES-START

PosSystemInformation-r16-IEs ::= SEQUENCE {

```

```

posSIB-TypeAndInfo-r16          SEQUENCE (SIZE (1..maxSIB)) OF CHOICE {
  posSib1-1-r16                 SIBpos-r16,
  posSib1-2-r16                 SIBpos-r16,
  posSib1-3-r16                 SIBpos-r16,
  posSib1-4-r16                 SIBpos-r16,
  posSib1-5-r16                 SIBpos-r16,
  posSib1-6-r16                 SIBpos-r16,
  posSib1-7-r16                 SIBpos-r16,
  posSib1-8-r16                 SIBpos-r16,
  posSib2-1-r16                 SIBpos-r16,
  posSib2-2-r16                 SIBpos-r16,
  posSib2-3-r16                 SIBpos-r16,
  posSib2-4-r16                 SIBpos-r16,
  posSib2-5-r16                 SIBpos-r16,
  posSib2-6-r16                 SIBpos-r16,
  posSib2-7-r16                 SIBpos-r16,
  posSib2-8-r16                 SIBpos-r16,
  posSib2-9-r16                 SIBpos-r16,
  posSib2-10-r16                SIBpos-r16,
  posSib2-11-r16                SIBpos-r16,
  posSib2-12-r16                SIBpos-r16,
  posSib2-13-r16                SIBpos-r16,
  posSib2-14-r16                SIBpos-r16,
  posSib2-15-r16                SIBpos-r16,
  posSib2-16-r16                SIBpos-r16,
  posSib2-17-r16                SIBpos-r16,
  posSib2-18-r16                SIBpos-r16,
  posSib2-19-r16                SIBpos-r16,
  posSib2-20-r16                SIBpos-r16,
  posSib2-21-r16                SIBpos-r16,
  posSib2-22-r16                SIBpos-r16,
  posSib2-23-r16                SIBpos-r16,
  posSib3-1-r16                 SIBpos-r16,
  posSib4-1-r16                 SIBpos-r16,
  posSib5-1-r16                 SIBpos-r16,
  posSib6-1-r16                 SIBpos-r16,
  posSib6-2-r16                 SIBpos-r16,
  posSib6-3-r16                 SIBpos-r16,
  ...
},
lateNonCriticalExtension        OCTET STRING                               OPTIONAL,
nonCriticalExtension            SEQUENCE {}                               OPTIONAL
}

-- TAG-POSSYSTEMINFORMATION-R16-IES-STOP
-- ASN1STOP

```

– *PosSI-SchedulingInfo*

```

-- ASN1START
-- TAG-POSSI-SCHEDULINGINFO-START

```

```

PosSI-SchedulingInfo-r16 ::= SEQUENCE {
    posSchedulingInfoList-r16 SEQUENCE (SIZE (1..maxSI-Message)) OF PosSchedulingInfo-r16,
    posSI-RequestConfig-r16 SI-RequestConfig OPTIONAL, -- Cond MSG-1
    posSI-RequestConfigSUL-r16 SI-RequestConfig OPTIONAL, -- Cond SUL-MSG-1
    ...
}

PosSchedulingInfo-r16 ::= SEQUENCE {
    offsetToSI-Used-r16 ENUMERATED {true} OPTIONAL, -- Need R
    posSI-Periodicity-r16 ENUMERATED {rf8, rf16, rf32, rf64, rf128, rf256, rf512},
    posSI-BroadcastStatus-r16 ENUMERATED {broadcasting, notBroadcasting},
    posSIB-MappingInfo-r16 PosSIB-MappingInfo-r16,
    ...
}

PosSIB-MappingInfo-r16 ::= SEQUENCE (SIZE (1..maxSIB)) OF PosSIB-Type-r16

PosSIB-Type-r16 ::= SEQUENCE {
    encrypted-r16 ENUMERATED { true } OPTIONAL, -- Need R
    gnss-id-r16 GNSS-ID-r16 OPTIONAL, -- Need R
    sbas-id-r16 SBAS-ID-r16 OPTIONAL, -- Need R
    posSibType-r16 ENUMERATED { posSibType1-1, posSibType1-2, posSibType1-3, posSibType1-4, posSibType1-5, posSibType1-6,
        posSibType1-7, posSibType1-8, 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, posSibType2-20,
        posSibType2-21, posSibType2-22, posSibType2-23, posSibType3-1, posSibType4-1,
        posSibType5-1, posSibType6-1, posSibType6-2, posSibType6-3, ... },
    areaScope-r16 ENUMERATED {true} OPTIONAL -- Need S
}

GNSS-ID-r16 ::= SEQUENCE {
    gnss-id-r16 ENUMERATED{gps, sbas, qzss, galileo, glonass, bds, ...},
    ...
}

SBAS-ID-r16 ::= SEQUENCE {
    sbas-id-r16 ENUMERATED { waas, egnos, msas, gagan, ...},
    ...
}

-- TAG-POSSI-SCHEDULINGINFO-STOP
-- ASN1STOP

```

<i>PosSI-SchedulingInfo</i> field descriptions	
<b>areaScope</b>	Indicates that a posSIB is area specific. If the field is absent, the posSIB is cell specific.
<b>encrypted</b>	The presence of this field indicates that the <i>pos-sib-type</i> is encrypted as specified in TS 37.355 [49].
<b>gnss-id</b>	The presence of this field indicates that the positioning SIB type is for a specific GNSS. Indicates a specific GNSS (see also TS 37.355 [49]).
<b>posSI-BroadcastStatus</b>	Indicates if the SI message is being broadcasted or not.
<b>posSI-RequestConfig</b>	Configuration of Msg1 resources that the UE uses for requesting SI-messages for which <i>posSI-BroadcastStatus</i> is set to <i>notBroadcasting</i> .
<b>posSI-RequestConfigSUL</b>	Configuration of Msg1 resources that the UE uses for requesting SI-messages for which <i>posSI-BroadcastStatus</i> is set to <i>notBroadcasting</i> .
<b>pos-SIB-MappingInfo</b>	List of the posSIBs mapped to this <i>SystemInformation</i> message.
<b>posSibType</b>	The positioning SIB type is defined in TS 37.355 [49].
<b>posSI-Periodicity</b>	Periodicity of the SI-message in radio frames, such that rf8 denotes 8 radio frames, rf16 denotes 16 radio frames, and so on.
<b>offsetToSI-Used</b>	This field, if present indicates that the SI messages in <i>pos-SchedulingInfoList</i> are scheduled with an offset of 8 radio frames compared to SI messages in <i>schedulingInfoList</i> . <i>offsetToSI-Used</i> may be present only if the shortest configured SI message periodicity for SI messages in <i>schedulingInfoList</i> is 80ms.
<b>sbas-ID</b>	The presence of this field indicates that the positioning SIB type is for a specific SBAS. Indicates a specific SBAS (see also TS 37.355 [49]).

Conditional presence	Explanation
MSG-1	The field is optionally present, Need R, if <i>posSI-BroadcastStatus</i> is set to <i>notBroadcasting</i> for any SI-message included in <i>PosSchedulingInfo</i> . It is absent otherwise.
SUL-MSG-1	The field is optionally present, Need R, if this serving cell is configured with a supplementary uplink and if <i>posSI-BroadcastStatus</i> is set to <i>notBroadcasting</i> for any SI-message included in <i>PosSchedulingInfo</i> . It is absent otherwise.

## – SIBpos

The IE *SIBpos* contains positioning assistance data as defined in TS 37.355 [49].

### SIBpos information element

```
-- ASN1START
-- TAG-SIPOS-START

SIBpos-r16 ::= SEQUENCE {
    assistanceDataSIB-Element-r16    OCTET STRING,
    lateNonCriticalExtension          OCTET STRING                OPTIONAL,
    ...
}
```

```
-- TAG-SIPOS-STOP
-- ASN1STOP
```

SIBpos field descriptions
---------------------------

<b>assistanceDataSIB-Element</b>
----------------------------------

Parameter <i>AssistanceDataSIBElement</i> defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.
---

## 6.3.2 Radio resource control information elements

### – *AdditionalSpectrumEmission*

The IE *AdditionalSpectrumEmission* is used to indicate emission requirements to be fulfilled by the UE (see TS 38.101-1 [15], clause 6.2.3, and TS 38.101-2 [39], clause 6.2.3).

#### ***AdditionalSpectrumEmission* information element**

```
-- ASN1START
-- TAG-ADDITIONALSPECTRUMEMISSION-START
```

```
AdditionalSpectrumEmission ::=          INTEGER (0..7)
```

```
-- TAG-ADDITIONALSPECTRUMEMISSION-STOP
-- ASN1STOP
```

### – *Alpha*

The IE *Alpha* defines possible values of a the pathloss compensation coefficient for uplink power control. Value *alpha0* corresponds to the value 0, Value *alpha04* corresponds to the value 0.4, Value *alpha05* corresponds to the value 0.5 and so on. Value *alpha1* corresponds to value 1. See also clause 7.1 of TS 38.213 [13].

```
-- ASN1START
-- TAG-ALPHA-START
```

```
Alpha ::=          ENUMERATED {alpha0, alpha04, alpha05, alpha06, alpha07, alpha08, alpha09, alpha1}
```

```
-- TAG-ALPHA-STOP
-- ASN1STOP
```

### – *AMF-Identifier*

The IE *AMF-Identifier* (AMFI) comprises of an AMF Region ID, an AMF Set ID and an AMF Pointer as specified in TS 23.003 [21], clause 2.10.1.



**AMF-Identifier information element**

```
-- ASN1START
-- TAG-AMF-IDENTIFIER-START

AMF-Identifier ::=                               BIT STRING (SIZE (24))

-- TAG-AMF-IDENTIFIER-STOP
-- ASN1STOP
```

**ARFCN-ValueEUTRA**

The IE *ARFCN-ValueEUTRA* is used to indicate the ARFCN applicable for a downlink, uplink or bi-directional (TDD) E-UTRA carrier frequency, as defined in TS 36.101 [22].

**ARFCN-ValueEUTRA information element**

```
-- ASN1START
-- TAG-ARFCN-VALUEEUTRA-START

ARFCN-ValueEUTRA ::=                            INTEGER (0..maxEARFCN)

-- TAG-ARFCN-VALUEEUTRA-STOP
-- ASN1STOP
```

**ARFCN-ValueNR**

The IE *ARFCN-ValueNR* is used to indicate the ARFCN applicable for a downlink, uplink or bi-directional (TDD) NR global frequency raster, as defined in TS 38.101-1 [15] and TS 38.101-2 [39], clause 5.4.2.

```
-- ASN1START
-- TAG-ARFCN-VALUENR-START

ARFCN-ValueNR ::=                              INTEGER (0..maxNARFCN)

-- TAG-ARFCN-VALUENR-STOP
-- ASN1STOP
```

**ARFCN-ValueUTRA-FDD**

The IE *ARFCN-ValueUTRA-FDD* is used to indicate the ARFCN applicable for a downlink (Nd, FDD) UTRA-FDD carrier frequency, as defined in TS 25.331 [45].

**ARFCN-ValueUTRA-FDD information element**

```
-- ASN1START
-- TAG-ARFCN-ValueUTRA-FDD-START

ARFCN-ValueUTRA-FDD-r16 ::=                INTEGER (0..16383)

-- TAG-ARFCN-ValueUTRA-FDD-STOP
-- ASN1STOP
```

– **AvailabilityCombinationsPerCell**

The IE *AvailabilityCombinationsPerCell* is used to configure the AvailabilityCombinations applicable for a serving cell of the IAB-node DU (see TS 38.213 [13], clause 14).

**AvailabilityCombinationsPerCell information element**

```
-- ASN1START
-- TAG-AVAILABILITYCOMBINATIONSPERCELL-START

AvailabilityCombinationsPerCell-r16 ::= SEQUENCE {
    availabilityCombinationsPerCellIndex-r16    AvailabilityCombinationsPerCellIndex-r16,
    iab-DU-CellIdentity-r16                    CellIdentity,
    positionInDCI-AI-r16                       INTEGER(0..maxAI-DCI-PayloadSize-r16-1) OPTIONAL, -- Need M
    availabilityCombinations-r16               SEQUENCE (SIZE (1..maxNrofAvailabilityCombinationsPerSet-r16)) OF AvailabilityCombination-r16,
    ...
}

AvailabilityCombinationsPerCellIndex-r16 ::= INTEGER(0..maxNrofDUCells-r16)

AvailabilityCombination-r16 ::= SEQUENCE {
    availabilityCombinationId-r16              AvailabilityCombinationId-r16,
    resourceAvailability-r16                  SEQUENCE (SIZE (1..maxNrofResourceAvailabilityPerCombination-r16)) OF INTEGER (0..7)
}

AvailabilityCombinationId-r16 ::= INTEGER (0..maxNrofAvailabilityCombinationsPerSet-r16-1)

-- TAG-AVAILABILITYCOMBINATIONSPERCELL-STOP
-- ASN1STOP
```

**AvailabilityCombination-r16 field descriptions****resourceAvailability**

Indicates the resource availability of soft symbols for a set of consecutive slots in the time domain. The meaning of this field is described in TS 38.213 [13], Table 14.2.

**availabilityCombinationId**

This ID is used in the DCI Format 2\_5 payload to dynamically select this *AvailabilityCombination*, see TS 38.213 [13], clause 14.

<b>AvailabilityCombinationsPerCell</b> field descriptions
<b><i>iab-DU-CellIdentity</i></b> The ID of the IAB-DU cell for which the <i>availabilityCombinations</i> are applicable.
<b><i>positionInDC-AI</i></b> The (starting) position (bit) of the <i>AvailabilityCombinationId</i> (AI-Index) for the indicated IAB-DU cell ( <i>iab-DU-CellIdentity</i> ) within the DCI payload.

## – *AvailabilityIndicator*

The IE *AvailabilityIndicator* is used to configure monitoring a PDCCH for Availability Indicators (AI).

### **AvailabilityIndicator** information element

```

-- ASN1START
-- TAG-AVAILABILITYINDICATOR-START

AvailabilityIndicator-r16 ::= SEQUENCE {
    ai-RNTI-r16                AI-RNTI-r16,
    dci-PayloadSizeAI-r16     INTEGER (1..maxAI-DCI-PayloadSize-r16),
    availableCombToAddModList-r16 SEQUENCE (SIZE(1..maxNrofDUCells-r16)) OF AvailabilityCombinationsPerCell-r16 OPTIONAL, -- Need N
    availableCombToReleaseList-r16 SEQUENCE (SIZE(1..maxNrofDUCells-r16)) OF AvailabilityCombinationsPerCellIndex-r16 OPTIONAL, -- Need N
    ...
}

AI-RNTI-r16 ::= RNTI-Value

-- TAG-AVAILABILITYINDICATOR-STOP
-- ASN1STOP

```

<b>AvailabilityIndicator</b> field descriptions
<b><i>ai-RNTI</i></b> Used by an IAB-MT for detection of DCI format 2_5 indicating <i>AvailabilityCombinationId</i> (AI-Index) for an IAB-DU's cells.
<b><i>availableCombToAddModList</i></b> A list of <i>availabilityCombinations</i> to add for the IAB-DU's cells. (see TS 38.213 [13], clause 14).
<b><i>availableCombToReleaseList</i></b> A list of <i>availabilityCombinations</i> to release for the IAB-DU's cells. (see TS 38.213 [13], clause 14).
<b><i>dci-PayloadSizeAI</i></b> Total length of the DCI payload scrambled with ai-RNTI (see TS 38.213 [13]).

## – *BAP-RoutingID*

The IE *BAP-RoutingID* is used for IAB-node to configure the BAP Routing ID.

**BAP-RoutingID** information element

```

-- ASN1START
-- TAG-BAPROUTINGID-START

BAP-RoutingID-r16 ::=
    bap-Address-r16          BIT STRING (SIZE (10)),
    bap-PathId-r16          BIT STRING (SIZE (10))
}

-- TAG-BAPROUTINGID-STOP
-- ASN1STOP

```

**BAP-RoutingID** field descriptions**bap-Address**

The ID of a destination IAB-node or IAB-donor-DU used in the BAP header.

**bap-PathId**

The ID of a path used in the BAP header.

– **BeamFailureRecoveryConfig**

The IE *BeamFailureRecoveryConfig* is used to configure the UE with RACH resources and candidate beams for beam failure recovery in case of beam failure detection. See also TS 38.321 [3], clause 5.1.1.

**BeamFailureRecoveryConfig** information element

```

-- ASN1START
-- TAG-BEAMFAILURERECOVERYCONFIG-START

BeamFailureRecoveryConfig ::=
    rootSequenceIndex-BFR          INTEGER (0..137)                OPTIONAL, -- Need M
    rach-ConfigBFR                  RACH-ConfigGeneric              OPTIONAL, -- Need M
    rsrp-ThresholdSSB                RSRP-Range                     OPTIONAL, -- Need M
    candidateBeamRSList              SEQUENCE (SIZE(1..maxNrofCandidateBeams)) OF PRACH-ResourceDedicatedBFR OPTIONAL, -- Need M
    ssb-perRACH-Occasion              ENUMERATED {oneEighth, oneFourth, oneHalf, one, two,
                                                four, eight, sixteen}          OPTIONAL, -- Need M

    ra-ssb-OccasionMaskIndex          INTEGER (0..15)                OPTIONAL, -- Need M
    recoverySearchSpaceId             SearchSpaceId                OPTIONAL, -- Need R
    ra-Prioritization                 RA-Prioritization            OPTIONAL, -- Need R
    beamFailureRecoveryTimer          ENUMERATED {ms10, ms20, ms40, ms60, ms80, ms100, ms150, ms200} OPTIONAL, -- Need M
    ...
    [[
    msg1-SubcarrierSpacing             SubcarrierSpacing          OPTIONAL -- Need M
    ]],
    [[
    ra-PrioritizationTwoStep-r16       RA-Prioritization          OPTIONAL, -- Need R
    candidateBeamRSListExt-v1610       SetupRelease{ CandidateBeamRSListExt-r16 } OPTIONAL, -- Need M
    ]]
```

```

}
PRACH-ResourceDedicatedBFR ::= CHOICE {
  ssb          BFR-SSB-Resource,
  csi-RS       BFR-CSIRS-Resource
}
BFR-SSB-Resource ::= SEQUENCE {
  ssb          SSB-Index,
  ra-PreambleIndex  INTEGER (0..63),
  ...
}
BFR-CSIRS-Resource ::= SEQUENCE {
  csi-RS       NZP-CSI-RS-ResourceId,
  ra-OccasionList  SEQUENCE (SIZE(1..maxRA-OccasionsPerCSIRS)) OF INTEGER (0..maxRA-Occasions-1) OPTIONAL, -- Need R
  ra-PreambleIndex  INTEGER (0..63) OPTIONAL, -- Need R
  ...
}
CandidateBeamRSLISTExt-r16 ::= SEQUENCE (SIZE(1.. maxNrofCandidateBeamsExt-r16)) OF PRACH-ResourceDedicatedBFR
-- TAG-BEAMFAILURERECOVERYCONFIG-STOP
-- ASN1STOP

```

<b>BeamFailureRecoveryConfig field descriptions</b>
<p><b>beamFailureRecoveryTimer</b> Timer for beam failure recovery timer. Upon expiration of the timer the UE does not use CFRA for BFR. Value in ms. Value <i>ms10</i> corresponds to 10 ms, value <i>ms20</i> corresponds to 20 ms, and so on.</p>
<p><b>candidateBeamRSList, candidateBeamRSListExt-v1610</b> The list of reference signals (CSI-RS and/or SSB) identifying the candidate beams for recovery and the associated RA parameters. The UE shall consider this list to include all elements of <i>candidateBeamRSList</i> (without suffix) and all elements of <i>candidateBeamRSListExt-v1610</i>. The network configures these reference signals to be within the linked DL BWP (i.e., within the DL BWP with the same <i>bwp-Id</i>) of the UL BWP in which the <i>BeamFailureRecoveryConfig</i> is provided.</p>
<p><b>msg1-SubcarrierSpacing</b> Subcarrier spacing for contention free beam failure recovery. Only the values 15 kHz or 30 kHz (FR1), and 60 kHz or 120 kHz (FR2) are applicable. See TS 38.211 [16], clause 5.3.2.</p>
<p><b>rsrp-ThresholdSSB</b> L1-RSRP threshold used for determining whether a candidate beam may be used by the UE to attempt contention free random access to recover from beam failure (see TS 38.213 [13], clause 6).</p>
<p><b>ra-prioritization</b> Parameters which apply for prioritized random access procedure for BFR (see TS 38.321 [3], clause 5.1.1).</p>
<p><b>ra-PrioritizationTwoStep</b> Parameters which apply for prioritized 2-step random access procedure for BFR (see TS 38.321 [3], clause 5.1.1).</p>
<p><b>ra-ssb-OccasionMaskIndex</b> Explicitly signalled PRACH Mask Index for RA Resource selection in TS 38.321 [3]. The mask is valid for all SSB resources.</p>
<p><b>rach-ConfigBFR</b> Configuration of contention free random access occasions for BFR.</p>
<p><b>recoverySearchSpaceId</b> Search space to use for BFR RAR. The network configures this search space to be within the linked DL BWP (i.e., within the DL BWP with the same <i>bwp-Id</i>) of the UL BWP in which the <i>BeamFailureRecoveryConfig</i> is provided. The CORESET associated with the recovery search space cannot be associated with another search space. Network always configures the UE with a value for this field when contention free random access resources for BFR are configured.</p>
<p><b>rootSequenceIndex-BFR</b> PRACH root sequence index (see TS 38.211 [16], clause 6.3.3.1) for beam failure recovery.</p>
<p><b>ssb-perRACH-Occasion</b> Number of SSBs per RACH occasion for CF-BFR, see TS 38.213 [13], clause 8.1.</p>

<b>BFR-CSIRS-Resource field descriptions</b>
<p><b>csi-RS</b> The ID of a <i>NZP-CSI-RS-Resource</i> configured in the <i>CSI-MeasConfig</i> of this serving cell. This reference signal determines a candidate beam for beam failure recovery (BFR).</p>
<p><b>ra-OccasionList</b> RA occasions that the UE shall use when performing BFR upon selecting the candidate beam identified by this CSI-RS. The network ensures that the RA occasion indexes provided herein are also configured by <i>prach-ConfigurationIndex</i> and <i>msg1-FDM</i>. Each RACH occasion is sequentially numbered, first, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions; second, in increasing order of time resource indexes for time multiplexed PRACH occasions within a PRACH slot and Third, in increasing order of indexes for PRACH slots. If the field is absent the UE uses the RA occasion associated with the SSB that is QCLed with this CSI-RS.</p>
<p><b>ra-PreambleIndex</b> The RA preamble index to use in the RA occasions associated with this CSI-RS. If the field is absent, the UE uses the preamble index associated with the SSB that is QCLed with this CSI-RS.</p>

<b>BFR-SSB-Resource field descriptions</b>
<b>ra-PreambleIndex</b> The preamble index that the UE shall use when performing BFR upon selecting the candidate beams identified by this SSB.
<b>ssb</b> The ID of an SSB transmitted by this serving cell. It determines a candidate beam for beam failure recovery (BFR).

### – *BeamFailureRecoverySCellConfig*

The IE *BeamFailureRecoverySCellConfig* is used to configure the UE with candidate beams for beam failure recovery in case of beam failure detection in SCell. See also TS 38.321 [3], clause 5.x.x.

#### **BeamFailureRecoverySCellConfig information element**

```

-- ASN1START
-- TAG-BEAMFAILURERECOVERYSCELLCONFIG-START

BeamFailureRecoverySCellConfig-r16 ::= SEQUENCE {
    rsrp-ThresholdBFR-r16          RSRP-Range                               OPTIONAL, -- Need M
    candidateBeamRSSCellList-r16  SEQUENCE (SIZE(1..maxNrofCandidateBeams-r16)) OF CandidateBeamRS-r16  OPTIONAL, -- Need M
    ...
}

CandidateBeamRS-r16 ::= SEQUENCE {
    candidateBeamConfig-r16      CHOICE {
        ssb-r16                  SSB-Index,
        csi-RS-r16               NZP-CSI-RS-ResourceId
    },
    servingCellId                ServCellIndex                           OPTIONAL -- Need R
}

-- TAG-BEAMFAILURERECOVERYSCELLCONFIG-STOP
-- ASN1STOP

```

<b>BeamFailureRecoverySCellConfig field descriptions</b>
<b>candidateBeamConfig</b> Indicates the resource (i.e. SSB or CSI-RS) defining this beam resource.
<b>candidateBeamRSSCellList</b> A list of reference signals (CSI-RS and/or SSB) identifying the candidate beams for recovery. The network always configures this parameter in every instance of this IE.
<b>rsrp-ThresholdBFR</b> L1-RSRP threshold used for determining whether a candidate beam may be included by the UE be in BFR MAC CE (see TS 38.213 [13], clause X). The network always configures this parameter in every instance of this IE.
<b>servingCellId</b> If the field is absent, the RS belongs to the serving cell in which this <i>BeamFailureSCellRecoveryConfig</i> is configured

## – *BetaOffsets*

The IE *BetaOffsets* is used to configure beta-offset values, see TS 38.213 [13], clause 9.3.

### ***BetaOffsets* information element**

```
-- ASN1START
-- TAG-BETAOFFSETS-START

BetaOffsets ::=
    SEQUENCE {
        betaOffsetACK-Index1    INTEGER(0..31)                OPTIONAL, -- Need S
        betaOffsetACK-Index2    INTEGER(0..31)                OPTIONAL, -- Need S
        betaOffsetACK-Index3    INTEGER(0..31)                OPTIONAL, -- Need S
        betaOffsetCSI-Part1-Index1    INTEGER(0..31)          OPTIONAL, -- Need S
        betaOffsetCSI-Part1-Index2    INTEGER(0..31)          OPTIONAL, -- Need S
        betaOffsetCSI-Part2-Index1    INTEGER(0..31)          OPTIONAL, -- Need S
        betaOffsetCSI-Part2-Index2    INTEGER(0..31)          OPTIONAL, -- Need S
    }

-- TAG-BETAOFFSETS-STOP
-- ASN1STOP
```

### ***BetaOffsets* field descriptions**

<b><i>betaOffsetACK-Index1</i></b>
Up to 2 bits HARQ-ACK (see TS 38.213 [13], clause 9.3). When the field is absent the UE applies the value 11.
<b><i>betaOffsetACK-Index2</i></b>
Up to 11 bits HARQ-ACK (see TS 38.213 [13], clause 9.3). When the field is absent the UE applies the value 11.
<b><i>betaOffsetACK-Index3</i></b>
Above 11 bits HARQ-ACK (see TS 38.213 [13], clause 9.3). When the field is absent the UE applies the value 11.
<b><i>betaOffsetCSI-Part1-Index1</i></b>
Up to 11 bits of CSI part 1 bits (see TS 38.213 [13], clause 9.3). When the field is absent the UE applies the value 13.
<b><i>betaOffsetCSI-Part1-Index2</i></b>
Above 11 bits of CSI part 1 bits (see TS 38.213 [13], clause 9.3). When the field is absent the UE applies the value 13.
<b><i>betaOffsetCSI-Part2-Index1</i></b>
Up to 11 bits of CSI part 2 bits (see TS 38.213 [13], clause 9.3). When the field is absent the UE applies the value 13.
<b><i>betaOffsetCSI-Part2-Index2</i></b>
Above 11 bits of CSI part 2 bits (see TS 38.213 [13], clause 9.3). When the field is absent the UE applies the value 13.

## – *BH-RLC-ChannelConfig*

The IE *BH-RLC-ChannelConfig* is used to configure an RLC entity, a corresponding logical channel in MAC for BH RLC channel between IAB-node and its parent node.

### ***BH-RLC-ChannelConfig* information element**

```
-- ASN1START
-- TAG-BHRLCCHANNELCONFIG-START
```



```

BH-RLC-ChannelConfig-r16 ::= SEQUENCE {
    bh-LogicalChannelIdentity-r16  BH-LogicalChannelIdentity-r16  OPTIONAL, -- Cond LCH-SetupOnly
    bh-RLC-ChannelID-r16          BH-RLC-ChannelID-r16,
    reestablishRLC-r16            ENUMERATED {true}                OPTIONAL, -- Need N
    rlc-Config-r16               RLC-Config                        OPTIONAL, -- Cond LCH-Setup
    mac-LogicalChannelConfig-r16  LogicalChannelConfig          OPTIONAL, -- Cond LCH-Setup
    ...
}
-- TAG-BHRLCCHANNELCONFIG-STOP
-- ASN1STOP

```

#### ***BH-RLCChannelConfig* field descriptions**

##### ***bh-LogicalChannelIdentity***

Indicates the logical channel id for BH RLC channel of the IAB-node.

##### ***bh-RLC-ChannelID***

Indicates the BH RLC channel in the link between IAB-MT of the IAB-node and IAB-DU of the parent IAB-node.

##### ***reestablishRLC***

Indicates that RLC should be re-established.

##### ***rlc-Config***

Determines the RLC mode (UM, AM) and provides corresponding parameters.

Conditional Presence	Explanation
<i>LCH-Setup</i>	This field is mandatory present upon creation of a new logical channel for a BH RLC channel. It is optionally present, Need M, otherwise.
<i>LCH-SetupOnly</i>	This field is mandatory present upon creation of a BH RLC channel. It is absent, Need M otherwise.

## – *BH-LogicalChannelIdentity*

The IE *BH-LogicalChannelIdentity* is used to identify a logical channel between an IAB-node and its parent node.

#### ***BH-LogicalChannelIdentity* information element**

```

-- ASN1START
-- TAG-BHLOGICALCHANNELIDENTITY-START

BH-LogicalChannelIdentity-r16 ::= CHOICE {
    bh-LogicalChannelIdentity-r16  LogicalChannelIdentity,
    bh-LogicalChannelIdentityExt-r16  BH-LogicalChannelIdentity-Ext-r16
}

-- TAG-BHLOGICALCHANNELIDENTITY-STOP
-- ASN1STOP

```

<i>BH-LogicalChannelIdentity</i> field descriptions
<b><i>bh-LogicalChannelIdentity</i></b> ID used for the MAC logical channel.
<b><i>bh-LogicalChannelIdentityExt</i></b> ID used for the MAC logical channel.

### – *BH-LogicalChannelIdentity-Ext*

The IE *BH-LogicalChannelIdentity-Ext* is used to identify a logical channel between an IAB-node and its parent node.

#### ***BH-LogicalChannelIdentity-Ext* information element**

```
-- ASN1START
-- TAG-BHLOGICALCHANNELIDENTITYEXT-START

BH-LogicalChannelIdentity-Ext-r16 ::=  INTEGER (320.. maxLC-ID-Iab-r16)

-- TAG-BHLOGICALCHANNELIDENTITYEXT-STOP
-- ASN1STOP
```

### – *BH-RLC-ChannelID*

The IE *BH-RLC-ChannelID* is used to identify a BH RLC channel in the link between IAB-MT of the IAB-node and IAB-DU of the parent IAB-node or IAB-donor-DU.

#### ***BH-RLC-ChannelID* information element**

```
-- ASN1START
-- TAG-BHRLCCHANNELID-START

BH-RLC-ChannelID-r16 ::=  BIT STRING (SIZE (16))

-- TAG-BHRLCCHANNELID-STOP
-- ASN1STOP
```

### – *BSR-Config*

The IE *BSR-Config* is used to configure buffer status reporting.

#### ***BSR-Config* information element**

```
-- ASN1START
-- TAG-BSR-CONFIG-START
```

```

BSR-Config ::=
  periodicBSR-Timer          SEQUENCE {
    ENUMERATED { sf1, sf5, sf10, sf16, sf20, sf32, sf40, sf64,
                sf80, sf128, sf160, sf320, sf640, sf1280, sf2560, infinity },
  retxBSR-Timer             ENUMERATED { sf10, sf20, sf40, sf80, sf160, sf320, sf640, sf1280, sf2560,
                sf5120, sf10240, spare5, spare4, spare3, spare2, spare1},
  logicalChannelSR-DelayTimer  ENUMERATED { sf20, sf40, sf64, sf128, sf512, sf1024, sf2560, spare1}
  ...
}
-- TAG-BSR-CONFIG-STOP
-- ASN1STOP

```

#### **BSR-Config field descriptions**

##### **logicalChannelSR-DelayTimer**

Value in number of subframes. Value *sf20* corresponds to 20 subframes, *sf40* corresponds to 40 subframes, and so on.

##### **periodicBSR-Timer**

Value in number of subframes. Value *sf1* corresponds to 1 subframe, value *sf5* corresponds to 5 subframes and so on.

##### **retxBSR-Timer**

Value in number of subframes. Value *sf10* corresponds to 10 subframes, value *sf20* corresponds to 20 subframes and so on.

## – **BWP**

The IE *BWP* is used to configure generic parameters of a bandwidth part as defined in TS 38.211 [16], clause 4.5, and TS 38.213 [13], clause 12.

For each serving cell the network configures at least an initial downlink bandwidth part and one (if the serving cell is configured with an uplink) or two (if using supplementary uplink (SUL)) initial uplink bandwidth parts. Furthermore, the network may configure additional uplink and downlink bandwidth parts for a serving cell.

The uplink and downlink bandwidth part configurations are divided into common and dedicated parameters.

#### **BWP information element**

```

-- ASN1START
-- TAG-BWP-START

BWP ::=
  locationAndBandwidth      INTEGER (0..37949),
  subcarrierSpacing         SubcarrierSpacing,
  cyclicPrefix              ENUMERATED { extended }
  ...
}
-- TAG-BWP-STOP
-- ASN1STOP

```

<b>BWP field descriptions</b>
<p><b>cyclicPrefix</b> Indicates whether to use the extended cyclic prefix for this bandwidth part. If not set, the UE uses the normal cyclic prefix. Normal CP is supported for all subcarrier spacings and slot formats. Extended CP is supported only for 60 kHz subcarrier spacing. (see TS 38.211 [16], clause 4.2)</p>
<p><b>locationAndBandwidth</b> Frequency domain location and bandwidth of this bandwidth part. The value of the field shall be interpreted as resource indicator value (RIV) as defined TS 38.214 [19] with assumptions as described in TS 38.213 [13], clause 12, i.e. setting <math>N_{BWP}^{size}=275</math>. The first PRB is a PRB determined by <i>subcarrierSpacing</i> of this BWP and <i>offsetToCarrier</i> (configured in <i>SCS-SpecificCarrier</i> contained within <i>FrequencyInfoDL / FrequencyInfoUL / FrequencyInfoUL-SIB / FrequencyInfoDL-SIB</i> within <i>ServingCellConfigCommon / ServingCellConfigCommonSIB</i>) corresponding to this subcarrier spacing. In case of TDD, a BWP-pair (UL BWP and DL BWP with the same <i>bwp-Id</i>) must have the same center frequency (see TS 38.213 [13], clause 12)</p>
<p><b>subcarrierSpacing</b> Subcarrier spacing to be used in this BWP for all channels and reference signals unless explicitly configured elsewhere. Corresponds to subcarrier spacing according to TS 38.211 [16], table 4.2-1. The value <i>kHz15</i> corresponds to <math>\mu=0</math>, value <i>kHz30</i> corresponds to <math>\mu=1</math>, and so on. Only the values 15 kHz, 30 kHz, or 60 kHz (FR1), and 60 kHz or 120 kHz (FR2) are applicable. For the initial DL BWP this field has the same value as the field <i>subCarrierSpacingCommon</i> in <i>MIB</i> of the same serving cell.</p>

– **BWP-Downlink**

The IE *BWP-Downlink* is used to configure an additional downlink bandwidth part (not for the initial BWP).

**BWP-Downlink information element**

```

-- ASN1START
-- TAG-BWP-DOWNLINK-START

BWP-Downlink ::=
    SEQUENCE {
        bwp-Id
        bwp-Common
        bwp-Dedicated
        ...
    }

-- TAG-BWP-DOWNLINK-STOP
-- ASN1STOP
    
```

<b>BWP-Downlink field descriptions</b>
<p><b>bwp-Id</b> An identifier for this bandwidth part. Other parts of the RRC configuration use the <i>BWP-Id</i> to associate themselves with a particular bandwidth part. The network configures the BWPs with consecutive IDs from 1. The Network does not include the value 0, since value 0 is reserved for the initial BWP.</p>

Conditional Presence	Explanation
<i>SetupOtherBWP</i>	The field is mandatory present upon configuration of a new DL BWP. The field is optionally present, Need M, otherwise.

## – *BWP-DownlinkCommon*

The IE *BWP-DownlinkCommon* is used to configure the common parameters of a downlink BWP. They are "cell specific" and the network ensures the necessary alignment with corresponding parameters of other UEs. The common parameters of the initial bandwidth part of the PCell are also provided via system information. For all other serving cells, the network provides the common parameters via dedicated signalling.

### ***BWP-DownlinkCommon* information element**

```
-- ASN1START
-- TAG-BWP-DOWNLINKCOMMON-START

BWP-DownlinkCommon ::=
    genericParameters
    pdcch-ConfigCommon
    pdsch-ConfigCommon
    ...
}

SEQUENCE {
    BWP,
    SetupRelease { PDCCH-ConfigCommon } OPTIONAL, -- Need M
    SetupRelease { PDSCH-ConfigCommon } OPTIONAL, -- Need M
    ...
}

-- TAG-BWP-DOWNLINKCOMMON-STOP
-- ASN1STOP
```

### ***BWP-DownlinkCommon* field descriptions**

#### ***pdccch-ConfigCommon***

Cell specific parameters for the PDCCH of this BWP. This field is absent for a dormant BWP.

#### ***pdsch-ConfigCommon***

Cell specific parameters for the PDSCH of this BWP.

## – *BWP-DownlinkDedicated*

The IE *BWP-DownlinkDedicated* is used to configure the dedicated (UE specific) parameters of a downlink BWP.

### ***BWP-DownlinkDedicated* information element**

```
-- ASN1START
-- TAG-BWP-DOWNLINKDEDICATED-START

BWP-DownlinkDedicated ::=
    pdcch-Config
    pdsch-Config
    sps-Config
    radioLinkMonitoringConfig
    ...
    [
        sps-ConfigToAddModList-r16
        sps-ConfigToReleaseList-r16
        sps-ConfigDeactivationStateList-r16
        beamFailureRecoverySCellConfig-r16
    ]

SEQUENCE {
    SetupRelease { PDCCH-Config } OPTIONAL, -- Need M
    SetupRelease { PDSCH-Config } OPTIONAL, -- Need M
    SetupRelease { SPS-Config } OPTIONAL, -- Need M
    SetupRelease { RadioLinkMonitoringConfig } OPTIONAL, -- Need M
    ...
    SPS-ConfigToAddModList-r16 OPTIONAL, -- Need N
    SPS-ConfigToReleaseList-r16 OPTIONAL, -- Need N
    SPS-ConfigDeactivationStateList-r16 OPTIONAL, -- Need R
    SetupRelease { BeamFailureRecoverySCellConfig-r16 } OPTIONAL, -- Cond SCellOnly
}

-- TAG-BWP-DOWNLINKDEDICATED-STOP
-- ASN1STOP
```

```

    sl-PDCCH-Config-r16          SetupRelease { PDCCH-Config }          OPTIONAL, -- Need M
    sl-V2X-PDCCH-Config-r16     SetupRelease { PDCCH-Config }          OPTIONAL, -- Need M
  }}
}

SPS-ConfigToAddModList-r16 ::= SEQUENCE (SIZE (1..maxNrofSPS-Config-r16)) OF SPS-Config

SPS-ConfigToReleaseList-r16 ::= SEQUENCE (SIZE (1..maxNrofSPS-Config-r16)) OF SPS-ConfigIndex-r16

SPS-ConfigDeactivationState-r16 ::= SEQUENCE (SIZE (1..maxNrofSPS-Config-r16)) OF SPS-ConfigIndex-r16

SPS-ConfigDeactivationStateList-r16 ::= SEQUENCE (SIZE (1..maxNrofSPS-DeactivationState)) OF SPS-ConfigDeactivationState-r16

-- TAG-BWP-DOWNLINKDEDICATED-STOP
-- ASN1STOP

```

<b>BWP-DownlinkDedicated field descriptions</b>	
<b>beamFailureRecoverySCellConfig</b>	Configuration of candidate RS for beam failure recovery in SCells.
<b>pdccch-Config</b>	UE specific PDCCH configuration for one BWP.
<b>pdsch-Config</b>	UE specific PDSCH configuration for one BWP.
<b>sps-Config</b>	UE specific SPS (Semi-Persistent Scheduling) configuration for one BWP. Except for reconfiguration with sync, the NW does not reconfigure <i>sps-Config</i> when there is an active configured downlink assignment (see TS 38.321 [3]). However, the NW may release the <i>sps-Config</i> at any time. Network can only configure SPS in one BWP using either this field or <i>sps-ConfigToAddModList</i> .
<b>sps-ConfigDeactivationStateList</b>	Indicates a list of the deactivation states in which each state can be mapped to a single or multiple SPS configurations to be deactivated, see clause 10.2 in TS 38.213 [13]. If a state is mapped to multiple SPS configurations, each of these SPS configurations is configured with the same <i>harq-CodebookID</i> .
<b>sps-ConfigToAddModList</b>	Indicates a list of one or more DL SPS configurations to be added or modified in one BWP. Except for reconfiguration with sync, the NW does not reconfigure a SPS configuration when it is active (see TS 38.321 [3]).
<b>sps-ConfigToReleaseList</b>	Indicates a list of one or more DL SPS configurations to be released. The NW may release a SPS configuration at any time.
<b>radioLinkMonitoringConfig</b>	UE specific configuration of radio link monitoring for detecting cell- and beam radio link failure occasions. The maximum number of failure detection resources should be limited up to 8 for both cell and beam radio link failure detection. For SCells, only periodic 1-port CSI-RS can be configured in IE <i>RadioLinkMonitoringConfig</i> .
<b>sl-PDCCH-Config</b>	Indicates the UE specific PDCCH configurations for receiving the SL grants (via SL-RNTI or SL-CS-RNTI) for NR sidelink communication.
<b>sl-V2X-PDCCH-Config</b>	Indicates the UE specific PDCCH configurations for receiving SL grants (i.e. sidelink SPS) for V2X sidelink communication.

Conditional Presence	Explanation
<i>ScellOnly</i>	The field is optionally present, Need M, in the <i>BWP-DownlinkDedicated</i> of an Scell. It is absent otherwise.

## – *BWP-Id*

The IE *BWP-Id* is used to refer to Bandwidth Parts (BWP). The initial BWP is referred to by *BWP-Id* 0. The other BWPs are referred to by *BWP-Id* 1 to *maxNrofBWPs*.

### ***BWP-Id* information element**

```
-- ASN1START
-- TAG-BWP-ID-START

BWP-Id ::=
    INTEGER (0..maxNrofBWPs)

-- TAG-BWP-ID-STOP
-- ASN1STOP
```

## – *BWP-Uplink*

The IE *BWP-Uplink* is used to configure an additional uplink bandwidth part (not for the initial BWP).

### ***BWP-Uplink* information element**

```
-- ASN1START
-- TAG-BWP-UPLINK-START

BWP-Uplink ::=
    SEQUENCE {
        bwp-Id
        bwp-Common
        bwp-Dedicated
        ...
    }

-- TAG-BWP-UPLINK-STOP
-- ASN1STOP
```

*OPTIONAL,*    -- Cond SetupOtherBWP  
*OPTIONAL,*    -- Cond SetupOtherBWP

### ***BWP-Uplink* field descriptions**

#### ***bwp-Id***

An identifier for this bandwidth part. Other parts of the RRC configuration use the *BWP-Id* to associate themselves with a particular bandwidth part. The network configures the BWPs with consecutive IDs from 1. The Network does not include the value 0, since value 0 is reserved for the initial BWP.

Conditional Presence	Explanation
<i>SetupOtherBWP</i>	The field is mandatory present upon configuration of a new UL BWP. The field is optionally present, Need M, otherwise.

## – *BWP-UplinkCommon*

The IE *BWP-UplinkCommon* is used to configure the common parameters of an uplink BWP. They are "cell specific" and the network ensures the necessary alignment with corresponding parameters of other UEs. The common parameters of the initial bandwidth part of the PCell are also provided via system information. For all other serving cells, the network provides the common parameters via dedicated signalling.

### *BWP-UplinkCommon* information element

```
-- ASN1START
-- TAG-BWP-UPLINKCOMMON-START

BWP-UplinkCommon ::=
    genericParameters
    rach-ConfigCommon
    pusch-ConfigCommon
    pucch-ConfigCommon
    . . .
    [
        rach-ConfigCommonIAB-r16
        useInterlacePUCCH-PUSCH-r16
        msgA-ConfigCommon-r16
    ]
}

SEQUENCE {
    BWP,
    SetupRelease { RACH-ConfigCommon } OPTIONAL, -- Need M
    SetupRelease { PUSCH-ConfigCommon } OPTIONAL, -- Need M
    SetupRelease { PUCCH-ConfigCommon } OPTIONAL, -- Need M
    . . .
    SetupRelease { RACH-ConfigCommon } OPTIONAL, -- Need M
    ENUMERATED {enabled} OPTIONAL, -- Need R
    SetupRelease { MsgA-ConfigCommon-r16 } OPTIONAL -- Cond SpCellOnly2
}

-- TAG-BWP-UPLINKCOMMON-STOP
-- ASN1STOP
```

#### *BWP-UplinkCommon* field descriptions

<b><i>msgA-ConfigCommon</i></b>
Configuration of the cell specific PRACH and PUSCH resource parameters for transmission of MsgA in 2-step random access type procedure. The NW can configure <i>msgA-ConfigCommon</i> only for UL BWPs if the linked DL BWPs (same <i>bwp-Id</i> as UL-BWP) are the initial DL BWPs or DL BWPs containing the SSB associated to the initial BL BWP
<b><i>pucch-ConfigCommon</i></b>
Cell specific parameters for the PUCCH of this BWP.
<b><i>pusch-ConfigCommon</i></b>
Cell specific parameters for the PUSCH of this BWP.
<b><i>rach-ConfigCommon</i></b>
Configuration of cell specific random access parameters which the UE uses for contention based and contention free random access as well as for contention based beam failure recovery in this BWP. The NW configures SSB-based RA (and hence <i>RACH-ConfigCommon</i> ) only for UL BWPs if the linked DL BWPs (same <i>bwp-Id</i> as UL-BWP) are the initial DL BWPs or DL BWPs containing the SSB associated to the initial DL BWP. The network configures <i>rach-ConfigCommon</i> , whenever it configures contention free random access (for reconfiguration with sync or for beam failure recovery).
<b><i>rach-ConfigCommonIAB</i></b>
Configuration of cell specific random access parameters for the IAB-MT. The IAB specific IAB RACH configuration is used by IAB-MT, if configured.
<b><i>useInterlacePUCCH-PUSCH</i></b>
If the field is present, the UE uses uplink frequency domain resource allocation Type 2 for cell-specific PUSCH, e.g., PUSCH scheduled by RAR UL grant (see 38.213 clause 8.3 and 38.214 clause 6.1.2.2) and uses interlaced PUCCH Format 0 and 1 for cell-specific PUCCH (see TS 38.213 [13], clause 9.2.1).



Conditional Presence	Explanation
<i>SpCellOnly2</i>	The field is optionally present, Need M, in the <i>BWP-UplinkCommon</i> of an SpCell. It is absent otherwise.

## – *BWP-UplinkDedicated*

The IE *BWP-UplinkDedicated* is used to configure the dedicated (UE specific) parameters of an uplink BWP.

### *BWP-UplinkDedicated* information element

```
-- ASN1START
-- TAG-BWP-UPLINKDEDICATED-START

BWP-UplinkDedicated ::=
    SEQUENCE {
        pucch-Config          SetupRelease { PUCCH-Config }          OPTIONAL, -- Need M
        pusch-Config          SetupRelease { PUSCH-Config }          OPTIONAL, -- Need M
        configuredGrantConfig SetupRelease { ConfiguredGrantConfig } OPTIONAL, -- Need M
        srs-Config            SetupRelease { SRS-Config }            OPTIONAL, -- Need M
        beamFailureRecoveryConfig SetupRelease { BeamFailureRecoveryConfig } OPTIONAL, -- Cond SpCellOnly
        ...
    }

    [
        sl-PUCCH-Config-r16          SetupRelease { PUCCH-Config }          OPTIONAL, -- Need M
        cp-ExtensionC2-r16           INTEGER (1..28)                  OPTIONAL, -- Need R
        cp-ExtensionC3-r16           INTEGER (1..28)                  OPTIONAL, -- Need R
        useInterlacePUCCH-PUSCH-r16  ENUMERATED {enabled}           OPTIONAL, -- Need R
        pucch-ConfigurationList-r16 SetupRelease { PUCCH-ConfigurationList-r16 } OPTIONAL, -- Need M
        lbt-FailureRecoveryConfig-r16 SetupRelease { LBT-FailureRecoveryConfig-r16 } OPTIONAL, -- Need M
        configuredGrantConfigToAddModList-r16 ConfiguredGrantConfigToAddModList-r16 OPTIONAL, -- Need N
        configuredGrantConfigToReleaseList-r16 ConfiguredGrantConfigToReleaseList-r16 OPTIONAL, -- Need N
        configuredGrantConfigType2DeactivationStateList-r16 ConfiguredGrantConfigType2DeactivationStateList-r16 OPTIONAL, -- Need R
    ]

ConfiguredGrantConfigToAddModList-r16 ::= SEQUENCE (SIZE (1..maxNrofConfiguredGrantConfig-r16)) OF ConfiguredGrantConfig

ConfiguredGrantConfigToReleaseList-r16 ::= SEQUENCE (SIZE (1..maxNrofConfiguredGrantConfig-r16)) OF ConfiguredGrantConfigIndex-r16

ConfiguredGrantConfigType2DeactivationState-r16 ::= SEQUENCE (SIZE (1..maxNrofConfiguredGrantConfig-r16)) OF ConfiguredGrantConfigIndex-r16

ConfiguredGrantConfigType2DeactivationStateList-r16 ::=
    SEQUENCE (SIZE (1..maxNrofCG-Type2DeactivationState)) OF ConfiguredGrantConfigType2DeactivationState-r16

-- TAG-BWP-UPLINKDEDICATED-STOP
-- ASN1STOP
```

<b>BWP-UplinkDedicated field descriptions</b>
<p><b>beamFailureRecoveryConfig</b> Configuration of beam failure recovery. If <i>supplementaryUplink</i> is present, the field is present only in one of the uplink carriers, either UL or SUL.</p>
<p><b>configuredGrantConfig</b> A <i>Configured-Grant</i> of <i>type1</i> or <i>type2</i>. It may be configured for UL or SUL but in case of <i>type1</i> not for both at a time. Except for reconfiguration with sync, the NW does not reconfigure <i>configuredGrantConfig</i> when there is an active configured uplink grant Type 2 (see TS 38.321 [3]). However, the NW may release the <i>configuredGrantConfig</i> at any time. Network can only configure configured grant in one BWP using either this field or <i>configuredGrantConfigToAddModList</i>.</p>
<p><b>configuredGrantConfigToAddModList</b> Indicates a list of one or more configured grant configurations to be added or modified for one BWP. Except for reconfiguration with sync, the NW does not reconfigure a Type 2 configured grant configuration when it is active (see TS 38.321 [3]).</p>
<p><b>configuredGrantConfigToReleaseList</b> Indicates a list of one or more UL Configured Grant configurations to be released. The NW may release a configured grant configuration at any time.</p>
<p><b>configuredGrantConfigType2DeactivationStateList</b> Indicates a list of the deactivation states in which each state can be mapped to a single or multiple Configured Grant type 2 configurations to be deactivated when the corresponding deactivation DCI is received, see clause 7.3.1 in TS 38.212 [17] and clause 6.1 in TS 38.214 [19].</p>
<p><b>cp-ExtensionC2, cp-ExtensionC3</b> Configures the cyclic prefix (CP) extension (see TS 38.211 [16], clause 5.3.1). For 15 and 30 kHz SCS, {1..28} are valid for both <i>cp-ExtensionC2</i> and <i>cp-ExtensionC3</i>. For 30 kHz SCS, {1..28} are valid for <i>cp-ExtensionC2</i> and {2..28} are valid for <i>cp-ExtensionC3</i>. For 60 kHz SCS, {2..28} are valid for <i>cp-ExtensionC2</i> and {3..28} are valid for <i>cp-ExtensionC3</i>.</p>
<p><b>lbt-FailureRecoveryConfig</b> Configures parameters used for detection of consistent uplink LBT failures for operation with shared spectrum channel access, as specified in TS 38.321 [3].</p>
<p><b>pucch-Config</b> PUCCH configuration for one BWP of the normal UL or SUL of a serving cell. If the UE is configured with SUL, the network configures PUCCH only on the BWPs of one of the uplinks (normal UL or SUL). The network configures <i>PUCCH-Config</i> at least on non-initial BWP(s) for SpCell and PUCCH SCell. If supported by the UE, the network may configure at most one additional SCell of a cell group with <i>PUCCH-Config</i> (i.e. PUCCH SCell). In (NG)EN-DC and NE-DC, the NW configures at most one serving cell per frequency range with PUCCH. In (NG)EN-DC and NE-DC, if two PUCCH groups are configured, the serving cells of the NR PUCCH group in FR2 use the same numerology. For NR-DC, the maximum number of PUCCH groups in each cell group is one, and only the same numerology is supported for the cell group with carriers only in FR2. The NW may configure PUCCH for a BWP when setting up the BWP. The network may also add/remove the <i>pucch-Config</i> in an <i>RRCReconfiguration</i> with <i>reconfigurationWithSync</i> (for SpCell or PUCCH SCell) or with SCell release and add (for PUCCH SCell) to move the PUCCH between the UL and SUL carrier of one serving cell. In other cases, only modifications of a previously configured <i>pucch-Config</i> are allowed. If one (S)UL BWP of a serving cell is configured with PUCCH, all other (S)UL BWPs must be configured with PUCCH, too.</p>
<p><b>pucch-ConfigurationList</b> PUCCH configurations for two simultaneously constructed HARQ-ACK codebooks (see TS 38.213 [13], clause 9.1). Different PUCCH Resource IDs are configured in different <i>PUCCH-Config</i> within the <i>pucch-ConfigurationList</i> if configured.</p>
<p><b>pusch-Config</b> PUSCH configuration for one BWP of the normal UL or SUL of a serving cell. If the UE is configured with SUL and if it has a <i>PUSCH-Config</i> for both UL and SUL, an UL/SUL indicator field in DCI indicates which of the two to use. See TS 38.212 [17], clause 7.3.1.</p>
<p><b>si-PUCCH-Config</b> Indicates the UE specific PUCCH configurations used for the HARQ-ACK feedback reporting for NR sidelink communication.</p>
<p><b>srs-Config</b> Uplink sounding reference signal configuration.</p>
<p><b>useInterlacePUCCH-PUSCH</b> If the field is present, the UE uses uplink frequency domain resource allocation Type 2 for PUSCH (see 38.213 clause 8.3 and 38.214 clause 6.1.2.2) and uses interlaced PUCCH Format 0, 1, 2, and 3 for PUCCH (see TS 38.213 [13], clause 9.2.1).</p>

Conditional Presence	Explanation
<i>SpCellOnly</i>	The field is optionally present, Need M, in the <i>BWP-UplinkDedicated</i> of an SpCell. It is absent otherwise.

NOTE 1: In case of *RRCReconfiguration* with *reconfigurationWithSync*, the UE performs a MAC reset, which involves releasing the PUCCH-CSI/SRS/SR configuration in accordance with clause 5.3.12 and TS 38.321 [6], clauses 5.12 and 5.2. Hence, for these parts of the dedicated radio resource configuration, delta signalling is not supported in the message when *reconfigurationWithSync* is included.

## – *CellAccessRelatedInfo*

The IE *CellAccessRelatedInfo* indicates cell access related information for this cell.

### *CellAccessRelatedInfo* information element

```
-- ASN1START
-- TAG-CELLACCESSRELATEDINFO-START

CellAccessRelatedInfo ::= SEQUENCE {
  plmn-IdentityList          PLMN-IdentityInfoList,
  cellReservedForOtherUse   ENUMERATED {true}          OPTIONAL, -- Need R
  ...,
  [
    cellReservedForFutureUse-r16   ENUMERATED {true}          OPTIONAL, -- Need R
    npn-IdentityInfoList-r16       NPN-IdentityInfoList-r16   OPTIONAL          -- Need R
  ]
}

-- TAG-CELLACCESSRELATEDINFO-STOP
-- ASN1STOP
```

<b>CellAccessRelatedInfo field descriptions</b>
<p><b>cellReservedForFutureUse</b> Indicates whether the cell is reserved, as defined in 38.304 [20] for future use. The field is applicable to all PLMNs and NPNs. This field is ignored by IAB-MT.</p>
<p><b>cellReservedForOtherUse</b> Indicates whether the cell is reserved, as defined in 38.304 [20]. The field is applicable to all PLMNs. This field is ignored by IAB-MT for cell barring determination, but still considered by NPN capable IAB-MT for determination of an NPN-only cell.</p>
<p><b>nnp-IdentityInfoList</b> The <i>nnp-IdentityInfoList</i> is used to configure a set of <i>NPN-IdentityInfo</i> elements. Each of those elements contains a list of one or more NPN Identities and additional information associated with those NPNs. The total number of PLMNs (identified by a PLMN identity in <i>plmn-IdentityList</i>), PNI-NPNs (identified by a PLMN identity and a CAG-ID), and SNPNs (identified by a PLMN identity and a NID) together in the <i>PLMN-IdentityInfoList</i> and <i>NPN-IdentityInfoList</i> does not exceed 12, except for the NPN-only cells. In case of NPN-only cells the <i>PLMN-IdentityList</i> contains a single element that does not count to the limit of 12. The NPN index is defined as <math>B+c1+c2+\dots+c(n-1)+d1+d2+\dots+d(m-1)+e(i)</math> for the NPN identity included in the <i>n</i>-th entry of <i>NPN-IdentityInfoList</i> and in the <i>m</i>-th entry of <i>NPN-Identitylist</i> within that <i>nnp-IdentityInfoList</i> entry, and the <i>i</i>-th entry of its corresponding <i>NPN-Identity</i>, where</p> <ul style="list-style-type: none"> <li>- <i>B</i> is the index used for the last PLMN in the <i>PLMN-IdentityInfoList</i>; in NPN-only cells <i>B</i> is considered 0;</li> <li>- <i>c(j)</i> is the number of NPN index values used in the <i>j</i>-th <i>NPN-IdentityInfoList</i> entry;</li> <li>- <i>d(k)</i> is the number of NPN index values used in the <i>k</i>-th <i>nnp-IdentityList</i> entry within the <i>n</i>-th <i>NPN-IdentityInfoList</i> entry;</li> <li>- <i>e(i)</i> is <ul style="list-style-type: none"> <li>- <i>i</i> if the <i>n</i>-th entry of <i>NPN-IdentityInfoList</i> entry is for SNPN(s);</li> <li>- 1 if the <i>n</i>-th entry of <i>NPN-IdentityInfoList</i> entry is for PNI-NPN(s).</li> </ul> </li> </ul>
<p><b>plmn-IdentityList</b> The <i>plmn-IdentityList</i> is used to configure a set of <i>PLMN-IdentityInfo</i> elements. Each of those elements contains a list of one or more PLMN Identities and additional information associated with those PLMNs. A PLMN-identity can be included only once, and in only one entry of the <i>PLMN-IdentityInfoList</i>. The PLMN index is defined as <math>b1+b2+\dots+b(n-1)+i</math> for the PLMN included at the <i>n</i>-th entry of <i>PLMN-IdentityInfoList</i> and the <i>i</i>-th entry of its corresponding <i>PLMN-IdentityInfo</i>, where <i>b(j)</i> is the number of <i>PLMN-Identity</i> entries in each <i>PLMN-IdentityInfo</i>, respectively.</p>

## – CellAccessRelatedInfo-EUTRA-5GC

The IE *CellAccessRelatedInfo-EUTRA-5GC* indicates cell access related information for an LTE cell connected to 5GC.

### CellAccessRelatedInfo-EUTRA-5GC information element

```
-- ASN1START
-- TAG-CELLACCESSRELATEDINFOEUTRA-5GC-START

CellAccessRelatedInfo-EUTRA-5GC ::= SEQUENCE {
    plmn-IdentityList-eutra-5gc      PLMN-IdentityList-EUTRA-5GC,
    trackingAreaCode-eutra-5gc      TrackingAreaCode,
    ranac-5gc                        RAN-AreaCode OPTIONAL,
    cellIdentity-eutra-5gc          CellIdentity-EUTRA-5GC
}

PLMN-IdentityList-EUTRA-5GC ::= SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity-EUTRA-5GC

PLMN-Identity-EUTRA-5GC ::= CHOICE {
    plmn-Identity-EUTRA-5GC        PLMN-Identity,
    plmn-index                     INTEGER (1..maxPLMN)
}
```

```

CellIdentity-EUTRA-5GC ::= CHOICE {
    cellIdentity-EUTRA      BIT STRING (SIZE (28)),
    cellId-index            INTEGER (1..maxPLMN)
}

-- TAG-CELLACCESSRELATEDINFOEUTRA-5GC-STOP
-- ASN1STOP

```

## – *CellAccessRelatedInfo-EUTRA-EPC*

The IE *CellAccessRelatedInfo-EUTRA-EPC* indicates cell access related information for an LTE cell connected to EPC.

### **CellAccessRelatedInfo-EUTRA-EPC information element**

```

-- ASN1START
-- TAG-CELLACCESSRELATEDINFOEUTRA-EPC-START

CellAccessRelatedInfo-EUTRA-EPC ::= SEQUENCE {
    plmn-IdentityList-utra-epc    PLMN-IdentityList-EUTRA-EPC,
    trackingAreaCode-utra-epc    BIT STRING (SIZE (16)),
    cellIdentity-utra-epc        BIT STRING (SIZE (28))
}

PLMN-IdentityList-EUTRA-EPC ::= SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity

-- TAG-CELLACCESSRELATEDINFOEUTRA-EPC-STOP
-- ASN1STOP

```

## – *CellGroupConfig*

The *CellGroupConfig* IE is used to configure a master cell group (MCG) or secondary cell group (SCG). A cell group comprises of one MAC entity, a set of logical channels with associated RLC entities and of a primary cell (SpCell) and one or more secondary cells (SCells).

### **CellGroupConfig information element**

```

-- ASN1START
-- TAG-CELLGROUPCONFIG-START

-- Configuration of one Cell-Group:
CellGroupConfig ::= SEQUENCE {
    cellGroupId                CellGroupId,
    rlc-BearerToAddModList     SEQUENCE (SIZE(1..maxLC-ID)) OF RLC-BearerConfig OPTIONAL, -- Need N
    rlc-BearerToReleaseList    SEQUENCE (SIZE(1..maxLC-ID)) OF LogicalChannelIdentity OPTIONAL, -- Need N
    mac-CellGroupConfig        MAC-CellGroupConfig OPTIONAL, -- Need M
    physicalCellGroupConfig    PhysicalCellGroupConfig OPTIONAL, -- Need M
    spCellConfig               SpCellConfig OPTIONAL, -- Need M
}

```

```

sCellToAddModList          SEQUENCE (SIZE (1..maxNrofSCells)) OF SCellConfig          OPTIONAL, -- Need N
sCellToReleaseList         SEQUENCE (SIZE (1..maxNrofSCells)) OF SCellIndex         OPTIONAL, -- Need N
...
[[
reportUplinkTxDirectCurrent  ENUMERATED {true}                                OPTIONAL  -- Cond BWP-Reconfig
]],
[[
bap-Address-r16              BIT STRING (SIZE (10))                                OPTIONAL, -- Need M
bh-RLC-ChannelToAddModList-r16 SEQUENCE (SIZE(1..maxBH-RLC-ChannelID-r16)) OF BH-RLC-ChannelConfig-r16 OPTIONAL, -- Need N
bh-RLC-ChannelToReleaseList-r16 SEQUENCE (SIZE(1..maxBH-RLC-ChannelID-r16)) OF BH-RLC-ChannelID-r16 OPTIONAL, -- Need N
flc-TransferPath-r16         ENUMERATED {lte, nr, both}                                OPTIONAL, -- Need M
simultaneousTCI-UpdateList1-r16 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex  OPTIONAL, -- Need R
simultaneousTCI-UpdateList2-r16 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex  OPTIONAL, -- Need R
simultaneousSpatial-UpdatedList1-r16 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex  OPTIONAL, -- Need R
simultaneousSpatial-UpdatedList2-r16 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex  OPTIONAL, -- Need R
uplinkTxSwitchingOption-r16  ENUMERATED {switchedUL, dualUL}                            OPTIONAL, -- Need R
uplinkTxSwitchingPowerBoosting-r16 ENUMERATED {enabled}                                OPTIONAL  -- Need R
]]
}

-- Serving cell specific MAC and PHY parameters for a SpCell:
SpCellConfig ::=
servCellIndex              SEQUENCE {
reconfigurationWithSync    ServCellIndex                                OPTIONAL, -- Cond SCG
rlf-TimersAndConstants     ReconfigurationWithSync                        OPTIONAL, -- Cond ReconfWithSync
rlmInSyncOutOfSyncThreshold SetupRelease { RLF-TimersAndConstants }      OPTIONAL, -- Need M
spCellConfigDedicated      ENUMERATED {nl}                                OPTIONAL, -- Need S
...
}

ReconfigurationWithSync ::= SEQUENCE {
spCellConfigCommon         ServingCellConfigCommon                        OPTIONAL, -- Need M
newUE-Identity              RNTI-Value,
t304                        ENUMERATED {ms50, ms100, ms150, ms200, ms500, ms1000, ms2000, ms10000},
rach-ConfigDedicated        CHOICE {
uplink                      RACH-ConfigDedicated,
supplementaryUplink          RACH-ConfigDedicated
}
...
[[
smtc                        SSB-MTC                                OPTIONAL  -- Need S
]],
[[
daps-UplinkPowerConfig-r16  DAPS-UplinkPowerConfig-r16                  OPTIONAL  -- Need N
]]
}

DAPS-UplinkPowerConfig-r16 ::= SEQUENCE {
p-DAPS-Source-r16           P-Max,
p-DAPS-Target-r16           P-Max,
uplinkPowerSharingDAPS-Mode-r16 ENUMERATED {semi-static-model, semi-static-mode2, dynamic }
}

SCellConfig ::= SEQUENCE {

```

```

sCellIndex          SCellIndex,
sCellConfigCommon  ServingCellConfigCommon
sCellConfigDedicated ServingCellConfig
...
[[
smtc                SSB-MTC
]],
[[
sCellState-r16      ENUMERATED {activated}
secondaryDRX-GroupConfig-r16 ENUMERATED {true}
]]}

-- TAG-CELLGROUPCONFIG-STOP
-- ASN1STOP
OPTIONAL, -- Cond SCellAdd
OPTIONAL, -- Cond SCellAddMod
OPTIONAL -- Need S
OPTIONAL, -- Cond SCellAddSync
OPTIONAL -- Cond DRX-Config2

```

<b>CellGroupConfig field descriptions</b>
<p><b>bap-Address</b> BAP address of the parent node in cell group.</p>
<p><b>bh-RLC-ChannelToAddModList</b> Configuration of the backhaul RLC entities and the corresponding MAC Logical Channels to be added and modified.</p>
<p><b>bh-RLC-ChannelToReleaseList</b> List of the backhaul RLC entities and the corresponding MAC Logical Channels to be released.</p>
<p><b>f1c-TransferPath</b> The F1-C transfer path that an EN-DC IAB-MT should use for transferring F1-C packets to the IAB-donor-CU. If IAB-MT is configured with lte, IAB-MT can only use LTE leg for F1-C transfer. If IAB-MT is configured with nr, IAB-MT can only use NR leg for F1-C transfer. If IAB-MT is configured with both, it is up to IAB-MT to select an LTE leg or a NR leg for F1-C transfer. If the field is not configured, the IAB node uses the NR leg as the default one.</p>
<p><b>mac-CellGroupConfig</b> MAC parameters applicable for the entire cell group.</p>
<p><b>rlc-BearerToAddModList</b> Configuration of the MAC Logical Channel, the corresponding RLC entities and association with radio bearers.</p>
<p><b>reportUplinkTxDirectCurrent</b> Enables reporting of uplink and supplementary uplink Direct Current location information upon BWP configuration and reconfiguration. This field is only present when the BWP configuration is modified or any serving cell is added or removed. This field is absent in the IE <i>CellGroupConfig</i> when provided as part of <i>RRCSetup</i> message. If UE is configured with SUL carrier, UE reports both UL and SUL Direct Current locations.</p>
<p><b>rlmInSyncOutOfSyncThreshold</b> BLER threshold pair index for IS/OOS indication generation, see TS 38.133 [14], table 8.1.1-1. <i>n1</i> corresponds to the value 1. When the field is absent, the UE applies the value 0. Whenever this is reconfigured, UE resets N310 and N311, and stops T310, if running. Network does not include this field.</p>
<p><b>sCellState</b> Indicates whether the SCell shall be considered to be in activated state upon SCell configuration.</p>
<p><b>sCellToAddModList</b> List of secondary serving cells (SCells) to be added or modified.</p>
<p><b>sCellToReleaseList</b> List of secondary serving cells (SCells) to be released.</p>
<p><b>secondaryDRX-GroupConfig</b> The field is used to indicate whether the SCell belongs to the secondary DRX group. All serving cells in the secondary DRX group shall belong to one Frequency Range and all serving cells in the legacy DRX group shall belong to another Frequency Range.</p>
<p><b>simultaneousTCI-UpdateList1, simultaneousTCI-UpdateList2</b> List of serving cells which can be updated simultaneously for TCI relation with a MAC CE. The <i>simultaneousTCI-UpdateList1</i> and <i>simultaneousTCI-UpdateList2</i> shall not contain same serving cells. Network should not configure serving cells that are configured with a BWP with two different values for the <i>coresetPoolIndex</i> in these lists.</p>
<p><b>simultaneousSpatial-UpdatedList1, simultaneousSpatial-UpdatedList2</b> List of serving cells which can be updated simultaneously for spatial relation with a MAC CE. The <i>simultaneousSpatial-UpdatedList1</i> and <i>simultaneousSpatial-UpdatedList2</i> shall not contain same serving cells. Network should not configure serving cells that are configured with a BWP with two different values for the <i>coresetPoolIndex</i> in these lists.</p>
<p><b>spCellConfig</b> Parameters for the SpCell of this cell group (PCell of MCG or PSCell of SCG).</p>
<p><b>uplinkTxSwitchingOption</b> Indicates which option is configured for dynamic UL Tx switching for inter-band UL CA or (NG)EN-DC. The field is set to <i>switchedUL</i> if network configures option 1 as specified in TS 38.214 [19], or <i>dualUL</i> if network configures option 2 as specified in TS 38.214 [19]. Network always configures UE with a value for this field in inter-band UL CA case and (NG)EN-DC case where UE supports dynamic UL Tx switching.</p>
<p><b>uplinkTxSwitchingPowerBoosting</b> Indicates whether the UE is allowed to enable 3dB boosting on the maximum output power for transmission on carrier2 under the operation state in which 2-port transmission can be supported on carrier2 for inter-band UL CA case with dynamic UL Tx switching as defined in TS 38.101-1 [15]. Network can only configure this field for dynamic UL Tx switching in inter-band UL CA case with power Class 3 as defined in TS 38.101-1 [15].</p>



<b>DAPS-Configuration field descriptions</b>
<p><b>p-DAPS-Source</b> The maximum total transmit power to be used by the UE in the source cell group during DAPS handover.</p>
<p><b>p-DAPS-Target</b> The maximum total transmit power to be used by the UE in the target cell group during DAPS handover.</p>
<p><b>uplinkPowerSharingDAPS-Mode</b> Indicates the uplink power sharing mode that the UE uses in DAPS handover (see TS 38.213 [13]).</p>

<b>ReconfigurationWithSync field descriptions</b>
<p><b>rach-ConfigDedicated</b> Random access configuration to be used for the reconfiguration with sync (e.g. handover). The UE performs the RA according to these parameters in the <i>firstActiveUplinkBWP</i> (see <i>UplinkConfig</i>).</p>
<p><b>smtc</b> The SSB periodicity/offset/duration configuration of target cell for NR PSCell change, NR PCell change and NR PSCell addition. The network sets the <i>periodicityAndOffset</i> to indicate the same periodicity as <i>ssb-periodicityServingCell</i> in <i>spCellConfigCommon</i>. For case of NR PCell change and NR PCell addition, the <i>smtc</i> is based on the timing reference of (source) PCell. For case of NR PSCell change, it is based on the timing reference of source PSCell. If the field is absent, the UE uses the SMTC in the <i>measObjectNR</i> having the same SSB frequency and subcarrier spacing, as configured before the reception of the RRC message.</p>

<b>SCellConfig field descriptions</b>
<p><b>smtc</b> The SSB periodicity/offset/duration configuration of target cell for NR SCell addition. The network sets the <i>periodicityAndOffset</i> to indicate the same periodicity as <i>ssb-periodicityServingCell</i> in <i>sCellConfigCommon</i>. The <i>smtc</i> is based on the timing of the SpCell of associated cell group. In case of inter-RAT handover to NR, the timing reference is the NR PCell. In case of intra-NR PCell change (standalone NR) or NR PSCell change (EN-DC), the timing reference is the target SpCell. If the field is absent, the UE uses the SMTC in the <i>measObjectNR</i> having the same SSB frequency and subcarrier spacing, as configured before the reception of the RRC message.</p>

<b>SpCellConfig field descriptions</b>
<p><b>reconfigurationWithSync</b> Parameters for the synchronous reconfiguration to the target SpCell.</p>
<p><b>rif-TimersAndConstants</b> Timers and constants for detecting and triggering cell-level radio link failure. For the SCG, <i>rif-TimersAndConstants</i> can only be set to <i>setup</i> and is always included at SCG addition.</p>
<p><b>servCellIndex</b> Serving cell ID of a PSCell. The PCell of the Master Cell Group uses ID = 0.</p>

Conditional Presence	Explanation
<i>BWP-Reconfig</i>	The field is optionally present, Need N, if the BWPs are reconfigured or if serving cells are added or removed. Otherwise it is absent.
<i>DRX-Config2</i>	The field is optionally present, Need N, if <i>drx-ConfigSecondaryGroup</i> is configured. It is absent otherwise.
<i>ReconfWithSync</i>	The field is mandatory present in the <i>RRCReconfiguration</i> message: <ul style="list-style-type: none"> <li>- in each configured <i>CellGroupConfig</i> for which the SpCell changes, <ul style="list-style-type: none"> <li>- in the <i>masterCellGroup</i> at change of AS security key derived from <math>K_{gNB}</math>,</li> <li>- in the <i>secondaryCellGroup</i> at: <ul style="list-style-type: none"> <li>- PSCell addition,</li> <li>- SCG resume with NR-DC or (NG)EN-DC,</li> <li>- update of required SI for PSCell,</li> <li>- change of AS security key derived from S-<math>K_{gNB}</math> while the UE is configured with at least one radio bearer with <i>keyToUse</i> set to <i>secondary</i> and that is not released by this <i>RRCReconfiguration</i> message,</li> </ul> </li> </ul> </li> </ul> Otherwise, it is optionally present, need M. The field is absent in the <i>masterCellGroup</i> in <i>RRCResume</i> and <i>RRCSetup</i> messages and is absent in the <i>masterCellGroup</i> in <i>RRCReconfiguration</i> messages if source configuration is not released during DAPS handover.
<i>SCellAdd</i>	The field is mandatory present upon SCell addition; otherwise it is absent, Need M.
<i>SCellAddMod</i>	The field is mandatory present upon SCell addition; otherwise it is optionally present, need M.
<i>SCellAddSync</i>	The field is optionally present, Need N, in case of SCell addition, reconfiguration with sync, and resuming an RRC connection. It is absent otherwise.
<i>SCG</i>	The field is mandatory present in an <i>SpCellConfig</i> for the PSCell. It is absent otherwise.

NOTE: In case of change of AS security key derived from S- $K_{gNB}$ /S- $K_{eNB}$ , if *reconfigurationWithSync* is not included in the *masterCellGroup*, the network releases all existing MCG RLC bearers associated with a radio bearer with *keyToUse* set to *secondary*. In case of change of AS security key derived from  $K_{gNB}$ / $K_{eNB}$ , if *reconfigurationWithSync* is not included in the *secondaryCellGroup*, the network releases all existing SCG RLC bearers associated with a radio bearer with *keyToUse* set to *primary*.

## – *CellGroupId*

The IE *CellGroupId* is used to identify a cell group. Value 0 identifies the master cell group. Other values identify secondary cell groups. In this version of the specification only values 0 and 1 are supported.

### ***CellGroupId* information element**

```
-- ASN1START
-- TAG-CELLGROUPID-START

CellGroupId ::=
-- TAG-CELLGROUPID-STOP
-- ASN1STOP
```

```
INTEGER (0.. maxSecondaryCellGroups)
```

## – *CellIdentity*

The IE *CellIdentity* is used to unambiguously identify a cell within a PLMN.

### ***CellIdentity* information element**

```
-- ASN1START
-- TAG-CELLIDENTITY-START

CellIdentity ::=                               BIT STRING (SIZE (36))

-- TAG-CELLIDENTITY-STOP
-- ASN1STOP
```

## – *CellReselectionPriority*

The IE *CellReselectionPriority* concerns the absolute priority of the concerned carrier frequency, as used by the cell reselection procedure. Corresponds to parameter "priority" in TS 38.304 [20]. Value 0 means lowest priority. The UE behaviour for the case the field is absent, if applicable, is specified in TS 38.304 [20].

### ***CellReselectionPriority* information element**

```
-- ASN1START
-- TAG-CELLRESELECTIONPRIORITY-START

CellReselectionPriority ::=                   INTEGER (0..7)

-- TAG-CELLRESELECTIONPRIORITY-STOP
-- ASN1STOP
```

## – *CellReselectionSubPriority*

The IE *CellReselectionSubPriority* indicates a fractional value to be added to the value of *cellReselectionPriority* to obtain the absolute priority of the concerned carrier frequency for E-UTRA and NR. Value *oDot2* corresponds to 0.2, value *oDot4* corresponds to 0.4 and so on.

### ***CellReselectionSubPriority* information element**

```
-- ASN1START
-- TAG-CELLRESELECTIONSUBPRIORITY-START

CellReselectionSubPriority ::=                 ENUMERATED {oDot2, oDot4, oDot6, oDot8}

-- TAG-CELLRESELECTIONSUBPRIORITY-STOP
-- ASN1STOP
```

## – *CGI-InfoEUTRA*

The IE CGI-InfoEUTRA indicates EUTRA cell access related information, which is reported by the UE as part of E-UTRA report CGI procedure.

### **CGI-InfoEUTRA information element**

```

-- ASN1START
-- TAG-CGI-INFOEUTRA-START

CGI-InfoEUTRA ::=
  cgi-info-EPC                               SEQUENCE {
    cgi-info-EPC-legacy                       SEQUENCE {
      cgi-info-EPC-list                       CellAccessRelatedInfo-EUTRA-EPC,
                                              SEQUENCE (SIZE (1..maxPLMN)) OF CellAccessRelatedInfo-EUTRA-EPC
    }
    cgi-info-5GC                              SEQUENCE (SIZE (1..maxPLMN)) OF CellAccessRelatedInfo-EUTRA-5GC
    freqBandIndicator                         FreqBandIndicatorEUTRA,
    multiBandInfoList                         MultiBandInfoListEUTRA
    freqBandIndicatorPriority                  ENUMERATED {true}
  }

-- TAG-CGI-INFOEUTRA-STOP
-- ASN1STOP

```

## – *CGI-InfoEUTRALogging*

The IE CGI-InfoEUTRALogging indicates EUTRA cell related information, which is reported by the UE as part of RLF reporting procedure.

### **CGI-InfoEUTRALogging information element**

```

-- ASN1START
-- TAG-CGI-INFOEUTRALOGGING-START

CGI-InfoEUTRALogging ::=
  plmn-Identity-eutra-5gc                     PLMN-Identity
  trackingAreaCode-eutra-5gc                 TrackingAreaCode
  cellIdentity-eutra-5gc                     BIT STRING (SIZE (28))
  plmn-Identity-eutra-epc                     PLMN-Identity
  trackingAreaCode-eutra-epc                 BIT STRING (SIZE (16))
  cellIdentity-eutra-epc                     BIT STRING (SIZE (28))
}

-- TAG-CGI-INFOEUTRALOGGING-STOP
-- ASN1STOP

```

<b>CGI-InfoEUTRALogging field descriptions</b>
<p><b>cellIdentity-eutra-epc, cellIdentity-eutra-5GC</b>            Unambiguously identify a cell within the context of the PLMN. It belongs the first PLMN entry of <i>plmn-IdentityList</i> (when connected to EPC) or of <i>plmn-IdentityList-r15</i> (when connected to 5GC) in <i>SystemInformationBlockType1</i>.</p>
<p><b>plmn-Identity-eutra-epc, plmn-Identity-eutra-5GC</b>            Identifies the PLMN of the cell for the reported <i>cellIdentity</i>: the first PLMN entry of <i>plmn-IdentityList</i> (when connected to EPC) or of <i>plmn-IdentityList-r15</i> (when connected to 5GC) in <i>SystemInformationBlockType1</i> that contained the reported <i>cellIdentity</i>.</p>
<p><b>trackingAreaCode-eutra-epc, trackingAreaCode-eutra-5gc</b>            Indicates Tracking Area Code to which the cell indicated by <i>cellIdentity-eutra-epc, cellIdentity-eutra-5GC</i> belongs.</p>

## – CGI-InfoNR

The IE *CGI-InfoNR* indicates cell access related information, which is reported by the UE as part of report CGI procedure.

### CGI-InfoNR information element

```

-- ASN1START
-- TAG-CGI-INFO-NR-START

CGI-InfoNR ::=
    plmn-IdentityInfoList          SEQUENCE {
    frequencyBandList              PLMN-IdentityInfoList          OPTIONAL,
    noSIB1                         MultiFrequencyBandListNR    OPTIONAL,
    ssb-SubcarrierOffset           SEQUENCE {
    pdcch-ConfigSIB1              INTEGER (0..15),
    pdcch-ConfigSIB1              PDCCH-ConfigSIB1
    }                               OPTIONAL,
    . . .
    [[
    npn-IdentityInfoList-r16       NPN-IdentityInfoList-r16    OPTIONAL
    ]]
}

-- TAG-CGI-INFO-NR-STOP
-- ASN1STOP

```

<b>CGI-InfoNR field descriptions</b>
<p><b>noSIB1</b>            Contains <i>ssb-SubcarrierOffset</i> and <i>pdccch-ConfigSIB1</i> fields acquired by the UE from <i>MIB</i> of the cell for which report CGI procedure was requested by the network in case <i>SIB1</i> was not broadcast by the cell.</p>

## – CGI-Info-Logging

The IE *CGI-Info-Logging* indicates the NR Cell Global Identifier (NCGI) for logging purposes (e.g. RLF report), the globally unique identity, and the TAC information of a cell in NR.

**CGI-Info-Logging information element**

```

-- ASN1START
-- TAG-CGI-INFO-LOGGING-START

CGI-Info-Logging-r16 ::= SEQUENCE {
    plmn-Identity-r16          PLMN-Identity,
    cellIdentity-r16          CellIdentity,
    trackingAreaCode-r16      TrackingAreaCode OPTIONAL
}

-- TAG-CGI-INFO-LOGGING-STOP
-- ASN1STOP

```

**CGI-Info-Logging field descriptions****cellIdentity**

Unambiguously identify a cell within the context of the PLMN. It belongs the first *PLMN-IdentityInfo* IE of *PLMN-IdentityInfoList* in *SIB1*.

**plmn-Identity**

Identifies the PLMN of the cell for the reported *cellIdentity*: the first PLMN entry of *plmn-IdentityList* (in *SIB1*) in the instance of *PLMN-IdentityInfoList* that contained the reported *cellIdentity*.

**trackingAreaCode**

Indicates Tracking Area Code to which the cell indicated by *cellIdentity* field belongs.

– **CLI-RSSI-Range**

The IE *CLI-RSSI-Range* specifies the value range used in CLI-RSSI measurements and thresholds. The integer value for CLI-RSSI measurements is according to Table [FFS] in TS 38.133 [14].

**CLI-RSSI-Range information element**

```

-- ASN1START
-- TAG-CLI-RSSI-RANGE-START

CLI-RSSI-Range-r16 ::= INTEGER(0..76)

-- TAG-CLI-RSSI-RANGE-STOP
-- ASN1STOP

```

– **CodebookConfig**

The IE *CodebookConfig* is used to configure codebooks of Type-I and Type-II (see TS 38.214 [19], clause 5.2.2.2)

**CodebookConfig** information element

```

-- ASN1START
-- TAG-CODEBOOKCONFIG-START

CodebookConfig ::=
  codebookType
  type1
  subType
  typeI-SinglePanel
  nrOfAntennaPorts
  two
  twoTX-CodebookSubsetRestriction
  },
  moreThanTwo
  n1-n2
  two-one-TypeI-SinglePanel-Restriction
  two-two-TypeI-SinglePanel-Restriction
  four-one-TypeI-SinglePanel-Restriction
  three-two-TypeI-SinglePanel-Restriction
  six-one-TypeI-SinglePanel-Restriction
  four-two-TypeI-SinglePanel-Restriction
  eight-one-TypeI-SinglePanel-Restriction
  four-three-TypeI-SinglePanel-Restriction
  six-two-TypeI-SinglePanel-Restriction
  twelve-one-TypeI-SinglePanel-Restriction
  four-four-TypeI-SinglePanel-Restriction
  eight-two-TypeI-SinglePanel-Restriction
  sixteen-one-TypeI-SinglePanel-Restriction
  },
  typeI-SinglePanel-codebookSubsetRestriction-i2
  },
  typeI-SinglePanel-ri-Restriction
  },
  typeI-MultiPanel
  ng-n1-n2
  two-two-one-TypeI-MultiPanel-Restriction
  two-four-one-TypeI-MultiPanel-Restriction
  four-two-one-TypeI-MultiPanel-Restriction
  two-two-two-TypeI-MultiPanel-Restriction
  two-eight-one-TypeI-MultiPanel-Restriction
  four-four-one-TypeI-MultiPanel-Restriction
  two-four-two-TypeI-MultiPanel-Restriction
  four-two-two-TypeI-MultiPanel-Restriction
  },
  ri-Restriction
  },
  codebookMode
  },
  type2
  subType

```

```

SEQUENCE {
  CHOICE {
    SEQUENCE {
      CHOICE {
        SEQUENCE {
          CHOICE {
            SEQUENCE {
              SEQUENCE {
                SEQUENCE {
                  CHOICE {
                    SEQUENCE {
                      BIT STRING (SIZE (6))
                    }
                  }
                }
              }
            }
          }
        }
      }
    }
  }
  BIT STRING (SIZE (16))
  BIT STRING (SIZE (8))
  SEQUENCE {
    CHOICE {
      BIT STRING (SIZE (8)),
      BIT STRING (SIZE (16)),
      BIT STRING (SIZE (8)),
      BIT STRING (SIZE (64)),
      BIT STRING (SIZE (32)),
      BIT STRING (SIZE (16)),
      BIT STRING (SIZE (128)),
      BIT STRING (SIZE (64))
    }
  }
  BIT STRING (SIZE (4))
  INTEGER (1..2)
  SEQUENCE {
    CHOICE {

```

OPTIONAL -- Need R

```

    typeII
      n1-n2-codebookSubsetRestriction SEQUENCE {
        CHOICE {
          two-one BIT STRING (SIZE (16)),
          two-two BIT STRING (SIZE (43)),
          four-one BIT STRING (SIZE (32)),
          three-two BIT STRING (SIZE (59)),
          six-one BIT STRING (SIZE (48)),
          four-two BIT STRING (SIZE (75)),
          eight-one BIT STRING (SIZE (64)),
          four-three BIT STRING (SIZE (107)),
          six-two BIT STRING (SIZE (107)),
          twelve-one BIT STRING (SIZE (96)),
          four-four BIT STRING (SIZE (139)),
          eight-two BIT STRING (SIZE (139)),
          sixteen-one BIT STRING (SIZE (128))
        }
      },
      typeII-RI-Restriction BIT STRING (SIZE (2))
    },
    typeII-PortSelection SEQUENCE {
      portSelectionSamplingSize ENUMERATED {n1, n2, n3, n4} OPTIONAL, -- Need R
      typeII-PortSelectionRI-Restriction BIT STRING (SIZE (2))
    }
  },
  phaseAlphabetSize ENUMERATED {n4, n8},
  subbandAmplitude BOOLEAN,
  numberOfBeams ENUMERATED {two, three, four}
}
}

CodebookConfig-r16 ::= SEQUENCE {
  codebookType CHOICE {
    type2 SEQUENCE {
      subType CHOICE {
        typeII-r16 SEQUENCE {
          n1-n2-codebookSubsetRestriction-r16 CHOICE {
            two-one BIT STRING (SIZE (16)),
            two-two BIT STRING (SIZE (43)),
            four-one BIT STRING (SIZE (32)),
            three-two BIT STRING (SIZE (59)),
            six-one BIT STRING (SIZE (48)),
            four-two BIT STRING (SIZE (75)),
            eight-one BIT STRING (SIZE (64)),
            four-three BIT STRING (SIZE (107)),
            six-two BIT STRING (SIZE (107)),
            twelve-one BIT STRING (SIZE (96)),
            four-four BIT STRING (SIZE (139)),
            eight-two BIT STRING (SIZE (139)),
            sixteen-one BIT STRING (SIZE (128))
          },
          typeII-RI-Restriction-r16 BIT STRING (SIZE(4))
        },
        typeII-PortSelection-r16 SEQUENCE {
          portSelectionSamplingSize-r16 ENUMERATED {n1, n2, n3, n4},

```



```
        typeII-PortSelectionRI-Restriction-r16 BIT STRING (SIZE (4))
      },
    numberOfPMI-SubbandsPerCQI-Subband-r16 INTEGER (1..2),
    paramCombination-r16 INTEGER (1..8)
  }
}
-- TAG-CODEBOOKCONFIG-STOP
-- ASN1STOP
```

<b>CodebookConfig field descriptions</b>
<b>codebookMode</b> CodebookMode as specified in TS 38.214 [19], clause 5.2.2.2.2.
<b>codebookType</b> CodebookType including possibly sub-types and the corresponding parameters for each (see TS 38.214 [19], clause 5.2.2.2).
<b>n1-n2-codebookSubsetRestriction</b> Number of antenna ports in first ( $n1$ ) and second ( $n2$ ) dimension and codebook subset restriction (see TS 38.214 [19] clause 5.2.2.2.3). Number of bits for codebook subset restriction is $\text{CEIL}(\log_2(\text{nchoosek}(O1*O2,4)))+8*n1*n2$ where $\text{nchoosek}(a,b) = a!/(b!(a-b)!)$ .
<b>n1-n2</b> Number of antenna ports in first ( $n1$ ) and second ( $n2$ ) dimension and codebook subset restriction (see TS 38.214 [19] clause 5.2.2.2.1).
<b>ng-n1-n2</b> Codebook subset restriction for Type I Multi-panel codebook (see TS 38.214 [19], clause 5.2.2.2.2).
<b>numberOfBeams</b> Number of beams, $L$ , used for linear combination.
<b>numberOfPMI-SubbandsPerCQI-Subband</b> Field indicates how PMI subbands are defined per CQI subband according to TS 38.214 [19], clause 5.2.2.2.5,
<b>paramCombination</b> Field describes supported parameter combination ( $L, p_v, \beta$ ) as specified in TS 38.214.
<b>phaseAlphabetSize</b> The size of the PSK alphabet, QPSK or 8-PSK.
<b>portSelectionSamplingSize</b> The size of the port selection codebook (parameter $d$ ), see TS 38.214 [19] clause 5.2.2.2.6.
<b>ri-Restriction</b> Restriction for RI for <i>Type1-MultiPanel-RI-Restriction</i> (see TS 38.214 [19], clause 5.2.2.2.2).
<b>subbandAmplitude</b> If subband amplitude reporting is activated ( <i>true</i> ).
<b>twoTX-CodebookSubsetRestriction</b> Codebook subset restriction for 2TX codebook (see TS 38.214 [19] clause 5.2.2.2.1).
<b>type1-SinglePanel-codebookSubsetRestriction-i2</b> $i2$ codebook subset restriction for Type I Single-panel codebook used when <i>reportQuantity</i> is CRI/RI/i1/CQI (see TS 38.214 [19] clause 5.2.2.2.1).
<b>type1-SinglePanel-ri-Restriction</b> Restriction for RI for <i>Type1-SinglePanel-RI-Restriction</i> (see TS 38.214 [19], clause 5.2.2.2.1).
<b>type1-PortSelectionRI-Restriction</b> Restriction for RI for <i>Type1-PortSelection-RI-Restriction</i> (see TS 38.214 [19], clauses 5.2.2.2.4 and 5.2.2.2.6).
<b>type1-RI-Restriction</b> Restriction for RI for <i>Type1-RI-Restriction</i> (see TS 38.214 [19], clauses 5.2.2.2.3 and 5.2.2.2.5).

– **CommonLocationInfo**

The IE *CommonLocationInfo* is used to transfer detailed location information available at the UE to correlate measurements and UE position information.

**CommonLocationInfo information element**

```
-- ASN1START
-- TAG-COMMONLOCATIONINFO-START
```

```

CommonLocationInfo-r16 ::= SEQUENCE {
    gnss-TOD-msec-r16      OCTET STRING      OPTIONAL,
    locationTimestamp-r16  OCTET STRING      OPTIONAL,
    locationCoordinate-r16 OCTET STRING      OPTIONAL,
    locationError-r16     OCTET STRING      OPTIONAL,
    locationSource-r16    OCTET STRING      OPTIONAL,
    velocityEstimate-r16  OCTET STRING      OPTIONAL
}

-- TAG-COMMONLOCATIONINFO-STOP
-- ASN1STOP

```

#### CommonLocationInfo field descriptions

##### **LocationTimeStamp**

Parameter type *DisplacementTimeStamp* defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.

##### **locationCoordinate**

Parameter type *LocationCoordinate* defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.

##### **locationError**

Parameter *LocationError* defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.

##### **locationSource**

Parameter *LocationSource* defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.

##### **velocityEstimate**

Parameter type *Velocity* defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.

## – *CondReconfigId*

The IE *CondReconfigId* is used to identify a CHO or CPC configuration.

#### **CondReconfigId information element**

```

-- ASN1START
-- TAG-CONDRECONFIGID-START

CondReconfigId-r16 ::=
    INTEGER (1.. maxNrofCondCells-r16)

-- TAG-CONDRECONFIGID-STOP
-- ASN1STOP

```

## – *CondReconfigToAddModList*

The IE *CondReconfigToAddModList* concerns a list of conditional reconfigurations to add or modify, with for each entry the *condReconfigId* and the associated *condExecutionCond* and *condRRCReconfig*.

**CondReconfigToAddModList** information element

```

-- ASN1START
-- TAG-CONDRECONFIGTOADDMODLIST-START

CondReconfigToAddModList-r16 ::= SEQUENCE (SIZE (1.. maxNrofCondCells-r16)) OF CondReconfigToAddMod-r16

CondReconfigToAddMod-r16 ::= SEQUENCE {
    condReconfigId-r16          CondReconfigId-r16,
    condExecutionCond-r16      SEQUENCE (SIZE (1..2)) OF MeasId          OPTIONAL,    -- Cond condReconfigAdd
    condRRCReconfig-r16       OCTET STRING (CONTAINING RRCReconfiguration) OPTIONAL,    -- Cond condReconfigAdd
    ...
}

-- TAG-CONDRECONFIGTOADDMODLIST-STOP
-- ASN1STOP

```

**CondReconfigToAddMod** field descriptions**condExecutionCond**

The execution condition that needs to be fulfilled in order to trigger the execution of a conditional reconfiguration. When configuring 2 triggering events (Meas Ids) for a candidate cell, network ensures that both refer to the same *measObject*.

**condRRCReconfig**

The *RRCReconfiguration* message to be applied when the condition(s) are fulfilled. The *RRCReconfiguration* message contained in *condRRCReconfig* cannot contain the field *conditionalReconfiguration* or the field *daps-Config*.

Conditional Presence	Explanation
<i>condReconfigAdd</i>	The field is mandatory present when a <i>condReconfigId</i> is being added. Otherwise the field is optional, need M.

– **ConditionalReconfiguration**

The IE *ConditionalReconfiguration* is used to add, modify and release the configuration of conditional reconfiguration.

**ConditionalReconfiguration** information element

```

-- ASN1START
-- TAG-CONDITIONALRECONFIGURATION-START

ConditionalReconfiguration-r16 ::= SEQUENCE {
    attemptCondReconfig-r16      ENUMERATED {true}          OPTIONAL,    -- Cond CHO
    condReconfigToRemoveList-r16 CondReconfigToRemoveList-r16 OPTIONAL,    -- Need N
    condReconfigToAddModList-r16 CondReconfigToAddModList-r16 OPTIONAL,    -- Need N
    ...
}

CondReconfigToRemoveList-r16 ::= SEQUENCE (SIZE (1.. maxNrofCondCells-r16)) OF CondReconfigId-r16

-- TAG-CONDITIONALRECONFIGURATION-STOP

```

```
-- ASN1STOP
```

<i>ConditionalReconfiguration</i> field descriptions
<b><i>attemptCondReconfig</i></b> If present, the UE shall perform conditional reconfiguration if selected cell is a target candidate cell and it is the first cell selection after failure as described in clause 5.3.7.3.
<b><i>condReconfigToAddModList</i></b> List of the configuration of candidate SpCells to be added or modified for CHO or CPC.
<b><i>condReconfigToRemoveList</i></b> List of the configuration of candidate SpCells to be removed.

Conditional Presence	Explanation
<i>CHO</i>	The field is optional present, Need N, if <i>conditionalReconfiguration</i> is added for CHO. Otherwise the field is not present.

## – *ConfiguredGrantConfig*

The IE *ConfiguredGrantConfig* is used to configure uplink transmission without dynamic grant according to two possible schemes. The actual uplink grant may either be configured via RRC (*type1*) or provided via the PDCCH (addressed to CS-RNTI) (*type2*). Multiple Configured Grant configurations may be configured in one BWP of a serving cell.

### *ConfiguredGrantConfig* information element

```
-- ASN1START
-- TAG-CONFIGUREDGRANTCONFIG-START
```

```
ConfiguredGrantConfig ::= SEQUENCE {
  frequencyHopping          ENUMERATED {intraSlot, interSlot}          OPTIONAL, -- Need S
  cg-DMRS-Configuration     DMRS-UplinkConfig,
  mcs-Table                 ENUMERATED {qam256, qam64LowSE}          OPTIONAL, -- Need S
  mcs-TableTransformPrecoder ENUMERATED {qam256, qam64LowSE}          OPTIONAL, -- Need S
  uci-OnPUSCH               SetupRelease { CG-UCI-OnPUSCH }          OPTIONAL, -- Need M
  resourceAllocation        ENUMERATED { resourceAllocationType0, resourceAllocationType1, dynamicSwitch },
  rbg-Size                  ENUMERATED {config2}                    OPTIONAL, -- Need S
  powerControlLoopToUse     ENUMERATED {n0, n1},
  p0-PUSCH-Alpha            P0-PUSCH-AlphaSetId,
  transformPrecoder         ENUMERATED {enabled, disabled}          OPTIONAL, -- Need S
  nrofHARQ-Processes        INTEGER(1..16),
  repK                      ENUMERATED {n1, n2, n4, n8},
  repK-RV                   ENUMERATED {s1-0231, s2-0303, s3-0000}  OPTIONAL, -- Need R
  periodicity               ENUMERATED {
    sym2, sym7, sym1x14, sym2x14, sym4x14, sym5x14, sym8x14, sym10x14, sym16x14, sym20x14,
    sym32x14, sym40x14, sym64x14, sym80x14, sym128x14, sym160x14, sym256x14, sym320x14, sym512x14,
    sym640x14, sym1024x14, sym1280x14, sym2560x14, sym5120x14,
    sym6, sym1x12, sym2x12, sym4x12, sym5x12, sym8x12, sym10x12, sym16x12, sym20x12, sym32x12,
    sym40x12, sym64x12, sym80x12, sym128x12, sym160x12, sym256x12, sym320x12, sym512x12, sym640x12,
    sym1280x12, sym2560x12
  },
},
```

```

configuredGrantTimer                INTEGER (1..64)                                OPTIONAL, -- Need R
rrc-ConfiguredUplinkGrant           SEQUENCE {
  timeDomainOffset                  INTEGER (0..5119),
  timeDomainAllocation              INTEGER (0..15),
  frequencyDomainAllocation        BIT STRING (SIZE(18)),
  antennaPort                      INTEGER (0..31),
  dmrs-SeqInitialization           INTEGER (0..1)                                OPTIONAL, -- Need R
  precodingAndNumberOfLayers       INTEGER (0..63),
  srs-ResourceIndicator            INTEGER (0..15)                                OPTIONAL, -- Need R
  mcsAndTBS                        INTEGER (0..31),
  frequencyHoppingOffset           INTEGER (1.. maxNrofPhysicalResourceBlocks-1)  OPTIONAL, -- Need R
  pathlossReferenceIndex           INTEGER (0..maxNrofPUSCH-PathlossReferenceRSs-1),
  . . .
  [[
    pusch-RepTypeIndicator-r16      ENUMERATED {pusch-RepTypeA,pusch-RepTypeB}  OPTIONAL, -- Need M
    frequencyHoppingPUSCH-RepTypeB-r16  ENUMERATED {interRepetition, interSlot}  OPTIONAL, -- Cond RepTypeB
    timeReferenceSFN-r16           ENUMERATED {sfn512}                                OPTIONAL, -- Need S
  ]]
}
. . .
[[
cg-RetransmissionTimer-r16          INTEGER (1..64)                                OPTIONAL, -- Need R
cg-minDFI-Delay-r16                ENUMERATED
  {sym7, sym1x14, sym2x14, sym3x14, sym4x14, sym5x14, sym6x14, sym7x14, sym8x14,
  sym9x14, sym10x14, sym11x14, sym12x14, sym13x14, sym14x14, sym15x14, sym16x14}
  OPTIONAL, -- Need R
cg-nrofPUSCH-InSlot-r16            INTEGER (1..7)                                OPTIONAL, -- Need R
cg-nrofSlots-r16                   INTEGER (1..40)                                OPTIONAL, -- Need R
cg-StartingOffsets-r16             CG-StartingOffsets-r16                        OPTIONAL, -- Need R
cg-UCI-Multiplexing                ENUMERATED {enabled}                                OPTIONAL, -- Need R
cg-COT-SharingOffset-r16           INTEGER (1..39)                                OPTIONAL, -- Need R
betaOffsetCG-UCI-r16               INTEGER (0.. 31)                                OPTIONAL, -- Need R
cg-COT-SharingList-r16             SEQUENCE (SIZE (1..1709)) OF CG-COT-Sharing-r16  OPTIONAL, -- Need R
harq-ProcID-Offset-r16             INTEGER (0..15)                                OPTIONAL, -- Need M
harq-ProcID-Offset2-r16            INTEGER (0..15)                                OPTIONAL, -- Need M
configuredGrantConfigIndex-r16     ConfiguredGrantConfigIndex-r16          OPTIONAL, -- Cond CG-List
configuredGrantConfigIndexMAC-r16  ConfiguredGrantConfigIndexMAC-r16      OPTIONAL, -- Cond CG-IndexMAC
periodicityExt-r16                 INTEGER (1..5120)                                OPTIONAL, -- Need R
startingFromRV0-r16                ENUMERATED {on, off}                                OPTIONAL, -- Need R
phy-PriorityIndex-r16              ENUMERATED {p0, p1}                                OPTIONAL, -- Need R
autonomousTx-r16                   ENUMERATED {enabled}                                OPTIONAL, -- Cond LCH-BasedPrioritization
]]
}

CG-UCI-OnPUSCH ::= CHOICE {
  dynamic                SEQUENCE (SIZE (1..4)) OF BetaOffsets,
  semiStatic             BetaOffsets
}

CG-COT-Sharing-r16 ::= CHOICE {
  noCOT-Sharing-r16     NULL,
  cot-Sharing-r16       SEQUENCE {
    duration-r16        INTEGER (1.. 39),

```

```
        offset-r16                INTEGER (1.. 39),
        channelAccessPriority-r16  INTEGER (1..4)
    }
}

CG-StartingOffsets-r16 ::= SEQUENCE {
    cg-StartingFullBW-InsideCOT-r16    SEQUENCE (SIZE (1..7)) OF INTEGER (0..6)    OPTIONAL, -- Need R
    cg-StartingFullBW-OutsideCOT-r16   SEQUENCE (SIZE (1..7)) OF INTEGER (0..6)    OPTIONAL, -- Need R
    cg-StartingPartialBW-InsideCOT-r16  INTEGER (0..6)                OPTIONAL, -- Need R
    cg-StartingPartialBW-OutsideCOT-r16 INTEGER (0..6)                OPTIONAL, -- Need R
}

-- TAG-CONFIGUREDGRANTCONFIG-STOP
-- ASN1STOP
```

<b>ConfiguredGrantConfig field descriptions</b>
<p><b>antennaPort</b> Indicates the antenna port(s) to be used for this configuration, and the maximum bitwidth is 5. See TS 38.214 [19], clause 6.1.2, and TS 38.212 [17], clause 7.3.1.</p>
<p><b>autonomousTx</b> If this field is present, the Configured Grant configuration is configured with autonomous transmission, see TS 38.321 [3].</p>
<p><b>betaOffsetCG-UCI</b> Beta offset for CG-UCI in CG-PUSCH, see TS 38.213 [13], clause 9.3</p>
<p><b>cg-COT-SharingList</b> Indicates a table for COT sharing combinations (see 37.213 [48], clause 4.1.3). One row of the table can be set to noCOT-Sharing to indicate that there is no channel occupancy sharing.</p>
<p><b>cg-COT-SharingOffset</b> Indicates the offset from the end of the slot where the COT sharing indication in UCI is enabled where the offset in symbols is equal to <math>14 \cdot n</math>, where <math>n</math> is the signaled value for <i>cg-COT-SharingOffset</i>. Applicable when <i>ul-toDL-COT-SharingED-Threshold-r16</i> is not configured (see 37.213 [48], clause 4.1.3).</p>
<p><b>cg-DMRS-Configuration</b> DMRS configuration (see TS 38.214 [19], clause 6.1.2.3).</p>
<p><b>cg-minDFI-Delay</b> Indicates the minimum duration (in unit of symbols) from the ending symbol of the PUSCH to the starting symbol of the PDCCH containing the downlink feedback indication (DFI) carrying HARQ-ACK for this PUSCH. The HARQ-ACK received before this minimum duration is not considered as valid for this PUSCH (see TS 38.213 [13], clause 10.5). The following minimum duration values are supported, depending on the configured subcarrier spacing [symbols]:  15 kHz: 7, <math>m \cdot 14</math>, where <math>m = \{1, 2, 3, 4\}</math>  30 kHz: 7, <math>m \cdot 14</math>, where <math>m = \{1, 2, 3, 4, 5, 6, 7, 8\}</math>  60 kHz: 7, <math>m \cdot 14</math>, where <math>m = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16\}</math></p>
<p><b>cg-nrofPUSCH-InSlot</b> Indicates the number of consecutive PUSCH configured to CG within a slot where the SLIV indicating the first PUSCH and additional PUSCH appended with the same length (see TS 38.214 [19], clause 6.1.2.3).</p>
<p><b>cg-nrofSlots</b> Indicates the number of allocated slots in a configured grant periodicity following the time instance of configured grant offset (see TS 38.214 [19], clause 6.1.2.3).</p>
<p><b>cg-RetransmissionTimer</b> Indicates the initial value of the configured retransmission timer (see TS 38.321 [3]) in multiples of <i>periodicity</i>. The value of <i>cg-RetransmissionTimer</i> is always less than or equal to the value of <i>configuredGrantTimer</i>. This field is always configured for operation with shared spectrum channel access together with <i>harq-ProclD-Offset</i>. This field is not configured for operation in licensed spectrum or simultaneously with <i>harq-ProclD-Offset2</i>.</p>
<p><b>cg-UCI-Multiplexing</b> When configured, in the case of PUCCH overlapping with CG-PUSCH(s) within a PUCCH group, the CG-UCI and HARQ-ACK are jointly encoded (CG-UCI is treated as the same type as a HARQ-ACK). When not configured, in the case of PUCCH overlapping with CG-PUSCH(s) within a PUCCH group and PUCCH carries HARQ ACK feedback, configured grant PUSCH is skipped (see TS 38.214 [19], clause 6.3.2.1.4).</p>
<p><b>configuredGrantConfigIndex</b> Indicates the index of the Configured Grant configurations within the BWP.</p>
<p><b>configuredGrantConfigIndexMAC</b> Indicates the index of the Configured Grant configurations within the MAC entity.</p>
<p><b>configuredGrantTimer</b> Indicates the initial value of the configured grant timer (see TS 38.321 [3]) in multiples of periodicity. When <i>cg-RetransmissionTimer</i> is configured, if HARQ processes are shared among different configured grants on the same BWP, <i>configuredGrantTimer * periodicity</i> is set to the same value for all of configurations on this BWP.</p>
<p><b>dmrs-SeqInitialization</b> The network configures this field if <i>transformPrecoder</i> is disabled. Otherwise the field is absent.</p>
<p><b>frequencyDomainAllocation</b> Indicates the frequency domain resource allocation, see TS 38.214 [19], clause 6.1.2, and TS 38.212 [17], clause 7.3.1).</p>



<b>frequencyHopping</b>
The value <i>intraSlot</i> enables 'Intra-slot frequency hopping' and the value <i>interSlot</i> enables 'Inter-slot frequency hopping'. If the field is absent, frequency hopping is not configured. The field <i>frequencyHopping</i> applies to configured grant for 'pusch-RepTypeA' (see TS 38.214 [19], clause 6.3.1).
<b>frequencyHoppingOffset</b>
Frequency hopping offset used when frequency hopping is enabled (see TS 38.214 [19], clause 6.1.2 and clause 6.3).
<b>frequencyHoppingPUSCH-RepTypeB</b>
Indicates the frequency hopping scheme for Type 1 CG when <i>pusch-RepTypeIndicator</i> is set to 'pusch-RepTypeB' (see TS 38.214 [19], clause 6.1). The value <i>interRepetition</i> enables 'Inter-repetition frequency hopping', and the value <i>interSlot</i> enables 'Inter-slot frequency hopping'. If the field is absent, the frequency hopping is not enabled for Type 1 CG.
<b>harq-ProclD-Offset</b>
For operation with shared spectrum channel access, this configures the range of HARQ process IDs which can be used for this configured grant where the UE can select a HARQ process ID within [ <i>harq-proclD-offset</i> , ..., ( <i>harq-proclD-offset</i> + <i>nrofHARQ-Processes</i> – 1)].
<b>harq-ProclD-Offset2</b>
Indicates the offset used in deriving the HARQ process IDs, see TS 38.321 [3], clause 5.4.1. This field is not configured for operation with shared spectrum channel access.
<b>mcs-Table</b>
Indicates the MCS table the UE shall use for PUSCH without transform precoding. If the field is absent the UE applies the value <i>qam64</i> .
<b>mcs-TableTransformPrecoder</b>
Indicates the MCS table the UE shall use for PUSCH with transform precoding. If the field is absent the UE applies the value <i>qam64</i> .
<b>mcsAndTBS</b>
The modulation order, target code rate and TB size (see TS 38.214 [19], clause 6.1.2). The NW does not configure the values 28–31 in this version of the specification.
<b>nrofHARQ-Processes</b>
The number of HARQ processes configured. It applies for both Type 1 and Type 2. See TS 38.321 [3], clause 5.4.1.
<b>p0-PUSCH-Alpha</b>
Index of the <i>P0-PUSCH-AlphaSet</i> to be used for this configuration.
<b>periodicity</b>
Periodicity for UL transmission without UL grant for type 1 and type 2 (see TS 38.321 [3], clause 5.8.2). The following periodicities are supported depending on the configured subcarrier spacing [symbols]: 15 kHz: 2, 7, $n \cdot 14$ , where $n = \{1, 2, 4, 5, 8, 10, 16, 20, 32, 40, 64, 80, 128, 160, 320, 640\}$ 30 kHz: 2, 7, $n \cdot 14$ , where $n = \{1, 2, 4, 5, 8, 10, 16, 20, 32, 40, 64, 80, 128, 160, 256, 320, 640, 1280\}$ 60 kHz with normal CP: 2, 7, $n \cdot 14$ , where $n = \{1, 2, 4, 5, 8, 10, 16, 20, 32, 40, 64, 80, 128, 160, 256, 320, 512, 640, 1280, 2560\}$ 60 kHz with ECP: 2, 6, $n \cdot 12$ , where $n = \{1, 2, 4, 5, 8, 10, 16, 20, 32, 40, 64, 80, 128, 160, 256, 320, 512, 640, 1280, 2560\}$ 120 kHz: 2, 7, $n \cdot 14$ , where $n = \{1, 2, 4, 5, 8, 10, 16, 20, 32, 40, 64, 80, 128, 160, 256, 320, 512, 640, 1024, 1280, 2560, 5120\}$
<b>periodicityExt</b>
This field is used to calculate the periodicity for UL transmission without UL grant for type 1 and type 2 (see TS 38.321 [3], clause 5.8.2). If this field is present, the field <i>periodicity</i> is ignored. The following periodicities are supported depending on the configured subcarrier spacing [symbols]: 15 kHz: $periodicityExt \cdot 14$ , where <i>periodicityExt</i> has a value between 1 and 640. 30 kHz: $periodicityExt \cdot 14$ , where <i>periodicityExt</i> has a value between 1 and 1280. 60 kHz with normal CP: $periodicityExt \cdot 14$ , where <i>periodicityExt</i> has a value between 1 and 2560. 60 kHz with ECP: $periodicityExt \cdot 12$ , where <i>periodicityExt</i> has a value between 1 and 2560. 120 kHz: $periodicityExt \cdot 14$ , where <i>periodicityExt</i> has a value between 1 and 5120.
<b>phy-PriorityIndex</b>
Indicates the PHY priority of CG PUSCH at least for PHY-layer collision handling. Value <i>p0</i> indicates low priority and value <i>p1</i> indicates high priority.
<b>powerControlLoopToUse</b>
Closed control loop to apply (see TS 38.213 [13], clause 7.1.1).

<b><i>pusch-RepTypeIndicator</i></b>
Indicates whether UE follows the behavior for PUSCH repetition type A or the behavior for PUSCH repetition type B for each Type 1 configured grant configuration. The value <i>pusch-RepTypeA</i> enables the 'PUSCH repetition type A' and the value <i>pusch-RepTypeB</i> enables the 'PUSCH repetition type B' (see TS 38.214 [19], clause 6.1.2.3).
<b><i>rbg-Size</i></b>
Selection between configuration 1 and configuration 2 for RBG size for PUSCH. The UE does not apply this field if <i>resourceAllocation</i> is set to <i>resourceAllocationType1</i> . Otherwise, the UE applies the value <i>config1</i> when the field is absent. Note: <i>rbg-Size</i> is used when the <i>transformPrecoder</i> parameter is disabled.
<b><i>repK-RV</i></b>
The redundancy version (RV) sequence to use. See TS 38.214 [19], clause 6.1.2. The network configures this field if repetitions are used, i.e., if <i>repK</i> is set to <i>n2</i> , <i>n4</i> or <i>n8</i> . This field is not configured when <i>cg-RetransmissionTimer</i> is configured. Otherwise, the field is absent.
<b><i>repK</i></b>
Number of repetitions K, see TS 38.214 [19].
<b><i>resourceAllocation</i></b>
Configuration of resource allocation type 0 and resource allocation type 1. For Type 1 UL data transmission without grant, <i>resourceAllocation</i> should be <i>resourceAllocationType0</i> or <i>resourceAllocationType1</i> .
<b><i>rrc-ConfiguredUplinkGrant</i></b>
Configuration for "configured grant" transmission with fully RRC-configured UL grant (Type1). If this field is absent the UE uses UL grant configured by DCI addressed to CS-RNTI (Type2). Type 1 configured grant may be configured for UL or SUL, but not for both simultaneously.
<b><i>srs-ResourceIndicator</i></b>
Indicates the SRS resource to be used.
<b><i>startingFromRV0</i></b>
This field is used to determine the initial transmission occasion of a transport block for a given RV sequence, see TS 38.214 [19], clause 6.1.2.3.1.
<b><i>timeDomainAllocation</i></b>
Indicates a combination of start symbol and length and PUSCH mapping type, see TS 38.214 [19], clause 6.1.2 and TS 38.212 [17], clause 7.3.1.
<b><i>timeDomainOffset</i></b>
Offset related to the reference SFN indicated by <i>timeReferenceSFN</i> , see TS 38.321 [3], clause 5.8.2.
<b><i>timeReferenceSFN</i></b>
Indicates SFN used for determination of the offset of a resource in time domain. The UE uses the closest SFN with the indicated number preceding the reception of the configured grant configuration, see TS 38.321 [3], clause 5.8.2. If the field <i>timeReferenceSFN</i> is not present, the reference SFN is 0.
<b><i>transformPrecoder</i></b>
Enables or disables transform precoding for <i>type1</i> and <i>type2</i> . If the field is absent, the UE enables or disables transform precoding in accordance with the field <i>msg3-transformPrecoder</i> in <i>RACH-ConfigCommon</i> , see TS 38.214 [19], clause 6.1.3.
<b><i>uci-OnPUSCH</i></b>
Selection between and configuration of dynamic and semi-static beta-offset. For Type 1 UL data transmission without grant, <i>uci-OnPUSCH</i> should be set to <i>semiStatic</i> .

<b>CG-COT-Sharing field descriptions</b>
<b><i>channelAccessPriority</i></b>
Indicates the Channel Access Priority Class that the gNB can assume when sharing the UE initiated COT (see 37.213 [48], clause 4.1.3).
<b><i>duration</i></b>
Indicates the number of DL transmission slots within UE initiated COT (see 37.213 [48], clause 4.1.3).
<b><i>offset</i></b>
Indicates the number of DL transmission slots from the end of the slot where CG-UCI is detected after which COT sharing can be used (see 37.213 [48], clause 4.1.3).

<b>CG-StartingOffsets field descriptions</b>
<p><b>cg-StartingFullBW-InsideCOT</b> A set of configured grant PUSCH transmission starting offsets which indicates the length of a CP extension of the first symbol that is located before the configured resource when frequency domain resource allocation includes all interlaces in the allocated RB set(s) and the CG PUSCH resource is inside gNB COT (see TS 38.214 [19], clause 6.1.2.3).</p>
<p><b>cg-StartingFullBW-OutsideCOT</b> A set of configured grant PUSCH transmission starting offset indices (see TS 38.211[16], Table 5.3.1-2) which indicates the length of a CP extension of the first symbol that is located before the configured resource when frequency domain resource allocation includes all interlaces in the allocated RB set(s) and the CG PUSCH resource is outside gNB COT (see TS 38.214 [19], clause 6.1.2.3).</p>
<p><b>cg-StartingPartialBW-InsideCOT</b> A set of configured grant PUSCH transmission starting offset index (see TS 38.211[16], Table 5.3.1-2) which indicates the length of a CP extension of the first symbol that is located before the configured resource when frequency domain resource allocation does not include all interlaces in the allocated RB set(s) and the CG PUSCH resource is inside gNB COT (see TS 38.214 [19], clause 6.1.2.3).</p>
<p><b>cg-StartingPartialBW-OutsideCOT</b> A set of configured grant PUSCH transmission starting offset index (see TS 38.211[16], Table 5.3.1-2) which indicates the length of a CP extension of the first symbol that is located before the configured resource when frequency domain resource allocation does not include all interlaces in the allocated RB set(s) and the CG PUSCH resource is outside gNB COT (see TS 38.214 [19], clause 6.1.2.3).</p>

<b>Conditional Presence</b>	<b>Explanation</b>
<i>LCH-BasedPrioritization</i>	This field is optionally present, Need R, if <i>Lch-BasedPrioritization</i> is configured in the MAC entity. It is absent otherwise.
<i>RepTypeB</i>	The field is optionally present if <i>pusch-RepTypeIndicator</i> is set to <i>pusch-RepTypeB</i> , Need S, and absent otherwise.
<i>CG-List</i>	The field is mandatory present when included in <i>configuredGrantConfigToAddModList-r16</i> , otherwise the field is absent.
<i>CG-IndexMAC</i>	The field is mandatory present if at least one configured grant is configured by <i>configuredGrantConfigToAddModList-r16</i> in any BWP of this MAC entity, otherwise it is optionally present, need R.

### – *ConfiguredGrantConfigIndex*

The IE *ConfiguredGrantConfigIndex* is used to indicate the index of one of multiple UL Configured Grant configurations in one BWP.

#### **ConfiguredGrantConfigIndex information element**

```
-- ASN1START
-- TAG-CONFIGUREDGRANTCONFIGINDEX-START

ConfiguredGrantConfigIndex-r16 ::= INTEGER (0.. maxNrofConfiguredGrantConfig-r16-1)

-- TAG-CONFIGUREDGRANTCONFIGINDEX-STOP
-- ASN1STOP
```

### – *ConfiguredGrantConfigIndexMAC*

The IE *ConfiguredGrantConfigIndexMAC* is used to indicate the unique Configured Grant configurations index per MAC entity.

**ConfiguredGrantConfigIndexMAC information element**

```
-- ASN1START
-- TAG-CONFIGUREDGRANTCONFIGINDEXMAC-START

ConfiguredGrantConfigIndexMAC-r16 ::= INTEGER (0.. maxNrofConfiguredGrantConfigMAC-r16-1)

-- TAG-CONFIGUREDGRANTCONFIGINDEXMAC-STOP
-- ASN1STOP
```

– **ConnEstFailureControl**

The IE *ConnEstFailureControl* is used to configure parameters for connection establishment failure control.

**ConnEstFailureControl information element**

```
-- ASN1START
-- TAG-CONNЕСТFAILURECONTROL-START

ConnEstFailureControl ::= SEQUENCE {
    connEstFailCount          ENUMERATED {n1, n2, n3, n4},
    connEstFailOffsetValidity ENUMERATED {s30, s60, s120, s240, s300, s420, s600, s900},
    connEstFailOffset        INTEGER (0..15)                                OPTIONAL -- Need S
}

-- TAG-CONNЕСТFAILURECONTROL-STOP
-- ASN1STOP
```

**ConnEstFailureControl field descriptions**

<b>connEstFailCount</b>
Number of times that the UE detects T300 expiry on the same cell before applying <i>connEstFailOffset</i> .
<b>connEstFailOffset</b>
Parameter "Qoffset <sub>temp</sub> " in TS 38.304 [20]. If the field is absent, the value of infinity shall be used for "Qoffset <sub>temp</sub> ".
<b>connEstFailOffsetValidity</b>
Amount of time that the UE applies <i>connEstFailOffset</i> before removing the offset from evaluation of the cell. Value s30 corresponds to 30 seconds, value s60 corresponds to 60 seconds, and so on.

– **ControlResourceSet**

The IE *ControlResourceSet* is used to configure a time/frequency control resource set (CORESET) in which to search for downlink control information (see TS 38.213 [13], clause 10.1).

**ControlResourceSet** information element

```

-- ASN1START
-- TAG-CONTROLRESOURCESET-START

ControlResourceSet ::=
    controlResourceSetId          SEQUENCE {
        ControlResourceSetId,

        frequencyDomainResources  BIT STRING (SIZE (45)),
        duration                   INTEGER (1..maxCoReSetDuration),
        cce-REG-MappingType       CHOICE {
            interleaved            SEQUENCE {
                reg-BundleSize     ENUMERATED {n2, n3, n6},
                interleaverSize    ENUMERATED {n2, n3, n6},
                shiftIndex         INTEGER(0..maxNrofPhysicalResourceBlocks-1)  OPTIONAL -- Need S
            },
            nonInterleaved        NULL
        },
        precoderGranularity        ENUMERATED {sameAsREG-bundle, allContiguousRBs},
        tci-StatesPDCCH-ToAddList  SEQUENCE(SIZE (1..maxNrofTCI-StatesPDCCH)) OF TCI-StateId OPTIONAL, -- Cond NotSIB1-initialBWP
        tci-StatesPDCCH-ToReleaseList SEQUENCE(SIZE (1..maxNrofTCI-StatesPDCCH)) OF TCI-StateId OPTIONAL, -- Cond NotSIB1-initialBWP
        tci-PresentInDCI          ENUMERATED {enabled} OPTIONAL, -- Need S
        pdcch-DMRS-ScramblingID   INTEGER (0..65535) OPTIONAL, -- Need S
        ...,
        [[
            rb-Offset-r16          INTEGER (0..5) OPTIONAL, -- Need S
            tci-PresentDCI-1-2-r16 INTEGER (1..3) OPTIONAL, -- Need S
            coresetPoolIndex-r16   INTEGER (0..1) OPTIONAL, -- Need S
            controlResourceSetId-v1610 ControlResourceSetId-v1610 OPTIONAL -- Need S
        ]]
    }

-- TAG-CONTROLRESOURCESET-STOP
-- ASN1STOP

```

<b>ControlResourceSet field descriptions</b>
<p><b>cce-REG-MappingType</b> Mapping of Control Channel Elements (CCE) to Resource Element Groups (REG) (see TS 38.211 [16], clauses 7.3.2.2 and 7.4.1.3.2).</p>
<p><b>controlResourceSetId</b> Identifies the instance of the <i>ControlResourceSet</i> IE. Value 0 identifies the common CORESET configured in <i>MIB</i> and in <i>ServingCellConfigCommon</i> (<i>controlResourceSetZero</i>) and is hence not used here in the <i>ControlResourceSet</i> IE. Other values identify CORESETs configured by dedicated signalling or in <i>SIB1</i>. The <i>controlResourceSetId</i> is unique among the BWPs of a serving cell. If the field <i>controlResourceSetId-v1610</i> is present, the UE shall ignore the <i>controlResourceSetId</i> field (without suffix).</p>
<p><b>coresetPoolIndex</b> The index of the CORESET pool for this CORESET as specified in TS 38.213 [13] (clauses 9 and 10) and TS 38.214 [19] (clauses 5.1 and 6.1). If the field is absent, the UE applies the value 0.</p>
<p><b>duration</b> Contiguous time duration of the CORESET in number of symbols (see TS 38.211 [16], clause 7.3.2.2).</p>
<p><b>frequencyDomainResources</b> Frequency domain resources for the CORESET. Each bit corresponds a group of 6 RBs, with grouping starting from the first RB group in the BWP. When at least one search space is configured with <i>freqMonitorLocation-r16</i>, only the first <math>N_{RBG,se10}^{size}</math> bits are valid (see TS 38.213 [13], clause 10.1). The first (left-most / most significant) bit corresponds to the first RB group in the BWP, and so on. A bit that is set to 1 indicates that this RB group belongs to the frequency domain resource of this CORESET. Bits corresponding to a group of RBs not fully contained in the bandwidth part within which the CORESET is configured are set to zero (see TS 38.211 [16], clause 7.3.2.2).</p>
<p><b>interleaverSize</b> Interleaver-size (see TS 38.211 [16], clause 7.3.2.2).</p>
<p><b>pdccch-DMRS-ScramblingID</b> PDCCH DMRS scrambling initialization (see TS 38.211 [16], clause 7.4.1.3.1). When the field is absent the UE applies the value of the <i>physCellId</i> configured for this serving cell.</p>
<p><b>precoderGranularity</b> Precoder granularity in frequency domain (see TS 38.211 [16], clauses 7.3.2.2 and 7.4.1.3.2).</p>
<p><b>rb-Offset</b> Indicates the RB level offset in units of RB from the first RB of the first 6RB group to the first RB of BWP (see 38.213 [13], clause 10.1). When the field is absent, the UE applies the value 0.</p>
<p><b>reg-BundleSize</b> Resource Element Groups (REGs) can be bundled to create REG bundles. This parameter defines the size of such bundles (see TS 38.211 [16], clause 7.3.2.2).</p>
<p><b>shiftIndex</b> When the field is absent the UE applies the value of the <i>physCellId</i> configured for this serving cell (see TS 38.211 [16], clause 7.3.2.2).</p>
<p><b>tci-PresentInDCI</b> This field indicates if TCI field is present or absent in DCI format 1_1. When the field is absent the UE considers the TCI to be absent/disabled. In case of cross carrier scheduling, the network sets this field to enabled for the <i>ControlResourceSet</i> used for cross carrier scheduling in the scheduling cell (see TS 38.214 [19], clause 5.1.5).</p>
<p><b>tci-PresentDCI-1-2</b> Configures the number of bits for "Transmission configuration indicator" in DCI format 1_2. When the field is absent the UE applies the value of 0 bit for the "Transmission configuration indicator" in DCI format 1_2 (see TS 38.212, clause 7.3.1 and TS 38.214, clause 5.1.5).</p>
<p><b>tci-StatesPDCCH-ToAddList</b> A subset of the TCI states defined in <i>pdsch-Config</i> included in the <i>BWP-DownlinkDedicated</i> corresponding to the serving cell and to the DL BWP to which the <i>ControlResourceSet</i> belong to. They are used for providing QCL relationships between the DL RS(s) in one RS Set (TCI-State) and the PDCCH DMRS ports (see TS 38.213 [13], clause 6.). The network configures at most <i>maxNrofTCI-StatesPDCCH</i> entries.</p>

Conditional Presence	Explanation
NotSIB1-initialBWP	The field is absent in SIB1 and in the PDCCH-ConfigCommon of the initial BWP in ServingCellConfigCommon, if SIB1 is broadcasted. Otherwise, it is optionally present, Need N.

### – *ControlResourceSetId*

The *ControlResourceSetId* IE concerns a short identity, used to identify a control resource set within a serving cell. The *ControlResourceSetId* = 0 identifies the ControlResourceSet#0 configured via PBCH (*MIB*) and in *controlResourceSetZero* (*ServingCellConfigCommon*). The ID space is used across the BWPs of a Serving Cell. The number of CORESETs per BWP is limited to 3 (including common and UE-specific CORESETs) in Release 15.

#### **ControlResourceSetId information element**

```
-- ASN1START
-- TAG-CONTROLRESOURCESETID-START

ControlResourceSetId ::=          INTEGER (0..maxNrofControlResourceSets-1)

ControlResourceSetId-r16 ::=      INTEGER (0..maxNrofControlResourceSets-1-r16)

ControlResourceSetId-v1610 ::=    INTEGER (maxNrofControlResourceSets..maxNrofControlResourceSets-1-r16)

-- TAG-CONTROLRESOURCESETID-STOP
-- ASN1STOP
```

### – *ControlResourceSetZero*

The IE *ControlResourceSetZero* is used to configure CORESET#0 of the initial BWP (see TS 38.213 [13], clause 13).

#### **ControlResourceSetZero information element**

```
-- ASN1START
-- TAG-CONTROLRESOURCESETZERO-START

ControlResourceSetZero ::=        INTEGER (0..15)

-- TAG-CONTROLRESOURCESETZERO-STOP
-- ASN1STOP
```

### – *CrossCarrierSchedulingConfig*

The IE *CrossCarrierSchedulingConfig* is used to specify the configuration when the cross-carrier scheduling is used in a cell.

**CrossCarrierSchedulingConfig** information element

```

-- ASN1START
-- TAG-CROSSCARRIERSCHEDULINGCONFIG-START

CrossCarrierSchedulingConfig ::=
  SEQUENCE {
    schedulingCellInfo CHOICE {
      own SEQUENCE {
        cif-Presence BOOLEAN -- Cross carrier scheduling: scheduling cell
      },
      other SEQUENCE {
        schedulingCellId ServCellIndex, -- Cross carrier scheduling: scheduled cell
        cif-InSchedulingCell INTEGER (1..7)
      }
    },
    ...
    [[
      carrierIndicatorSize-r16 SEQUENCE {
        carrierIndicatorSizeDCI-1-2-r16 INTEGER (0..3),
        carrierIndicatorSizeDCI-0-2-r16 INTEGER (0..3)
      } OPTIONAL, -- Cond CIF-PRESENCE
      enableDefaultBeamForCCS-r16 ENUMERATED {enabled} OPTIONAL -- Need S
    ]]
  }

-- TAG-CROSSCARRIERSCHEDULINGCONFIG-STOP
-- ASN1STOP

```

**CrossCarrierSchedulingConfig** field descriptions**carrierIndicatorSizeDCI-0-2, carrierIndicatorSizeDCI-1-2**

Configures the number of bits for the field of carrier indicator in PDCCH DCI format 0\_2/1\_2. The field *carrierIndicatorSizeDCI-0-2* refers to DCI format 0\_2 and the field *carrierIndicatorSizeDCI-1-2* refers to DCI format 1\_2, respectively (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 10.1).

**cif-Presence**

The field is used to indicate whether carrier indicator field is present (value *true*) or not (value *false*) in PDCCH DCI formats, see TS 38.213 [13]. If *cif-Presence* is set to *true*, the CIF value indicating a grant or assignment for this cell is 0.

**cif-InSchedulingCell**

The field indicates the CIF value used in the scheduling cell to indicate a grant or assignment applicable for this cell, see TS 38.213 [13].

**enableDefaultBeamForCCS**

This field indicates whether default beam selection for cross-carrier scheduled PDSCH is enabled, see TS 38.214 [19]. If not present, the default beam selection behaviour is not applied, i.e. Rel-15 behaviour is applied.

**other**

Parameters for cross-carrier scheduling, i.e., a serving cell is scheduled by a PDCCH on another (scheduling) cell. The network configures this field only for SCells.

**own**

Parameters for self-scheduling, i.e., a serving cell is scheduled by its own PDCCH.

**schedulingCellId**

Indicates which cell signals the downlink allocations and uplink grants, if applicable, for the concerned SCell. In case the UE is configured with DC, the scheduling cell is part of the same cell group (i.e. MCG or SCG) as the scheduled cell. If *drx-ConfigSecondaryGroup* is configured in the *MAC-CellGroupConfig* associated with this serving cell, the scheduling cell and the scheduled cell belong to the same Frequency Range.



Conditional Presence	Explanation
<i>CIF-PRESENCE</i>	The field is mandatory present if the <i>cif-Presence</i> is set to <i>true</i> . The field is absent otherwise.

### – *CSI-AperiodicTriggerStateList*

The *CSI-AperiodicTriggerStateList* IE is used to configure the UE with a list of aperiodic trigger states. Each codepoint of the DCI field "CSI request" is associated with one trigger state (see TS 38.321 [3], clause 6.1.3.13). Upon reception of the value associated with a trigger state, the UE will perform measurement of CSI-RS, CSI-IM and/or SSB (reference signals) and aperiodic reporting on L1 according to all entries in the *associatedReportConfigInfoList* for that trigger state.

#### ***CSI-AperiodicTriggerStateList* information element**

```
-- ASN1START
-- TAG-CSI-APERIODICTRIGGERSTATELIST-START

CSI-AperiodicTriggerStateList ::= SEQUENCE (SIZE (1..maxNrOfCSI-AperiodicTriggers)) OF CSI-AperiodicTriggerState

CSI-AperiodicTriggerState ::= SEQUENCE {
    associatedReportConfigInfoList SEQUENCE (SIZE(1..maxNrofReportConfigPerAperiodicTrigger)) OF CSI-AssociatedReportConfigInfo,
    ...
}

CSI-AssociatedReportConfigInfo ::= SEQUENCE {
    reportConfigId CSI-ReportConfigId,
    resourcesForChannel CHOICE {
        nzp-CSI-RS SEQUENCE {
            resourceSet INTEGER (1..maxNrofNZP-CSI-RS-ResourceSetsPerConfig),
            qcl-info SEQUENCE (SIZE(1..maxNrofAP-CSI-RS-ResourcesPerSet)) OF TCI-StateId OPTIONAL -- Cond Aperiodic
        },
        csi-SSB-ResourceSet INTEGER (1..maxNrofCSI-SSB-ResourceSetsPerConfig)
    },
    csi-IM-ResourcesForInterference INTEGER(1..maxNrofCSI-IM-ResourceSetsPerConfig) OPTIONAL, -- Cond CSI-IM-ForInterference
    nzp-CSI-RS-ResourcesForInterference INTEGER (1..maxNrofNZP-CSI-RS-ResourceSetsPerConfig) OPTIONAL, -- Cond NZP-CSI-RS-ForInterference
    ...
}

-- TAG-CSI-APERIODICTRIGGERSTATELIST-STOP
-- ASN1STOP
```

<b>CSI-AssociatedReportConfigInfo field descriptions</b>
<p><b>csi-IM-ResourcesForInterference</b> CSI-IM-ResourceSet for interference measurement. Entry number in csi-IM-ResourceSetList in the CSI-ResourceConfig indicated by <i>csi-IM-ResourcesForInterference</i> in the CSI-ReportConfig indicated by <i>reportConfigId</i> above (value 1 corresponds to the first entry, value 2 to the second entry, and so on). The indicated CSI-IM-ResourceSet should have exactly the same number of resources like the NZP-CSI-RS-ResourceSet indicated in <i>nzp-CSI-RS-ResourcesforChannel</i>.</p>
<p><b>csi-SSB-ResourceSet</b> CSI-SSB-ResourceSet for channel measurements. Entry number in <i>csi-SSB-ResourceSetList</i> in the CSI-ResourceConfig indicated by <i>resourcesForChannelMeasurement</i> in the CSI-ReportConfig indicated by <i>reportConfigId</i> above (value 1 corresponds to the first entry, value 2 to the second entry, and so on).</p>
<p><b>nzp-CSI-RS-ResourcesForInterference</b> NZP-CSI-RS-ResourceSet for interference measurement. Entry number in <i>nzp-CSI-RS-ResourceSetList</i> in the CSI-ResourceConfig indicated by <i>nzp-CSI-RS-ResourcesForInterference</i> in the CSI-ReportConfig indicated by <i>reportConfigId</i> above (value 1 corresponds to the first entry, value 2 to the second entry, and so on).</p>
<p><b>qcl-info</b> List of references to TCI-States for providing the QCL source and QCL type for each NZP-CSI-RS-Resource listed in <i>nzp-CSI-RS-Resources</i> of the NZP-CSI-RS-ResourceSet indicated by <i>nzp-CSI-RS-ResourcesforChannel</i>. Each <i>TCI-StateId</i> refers to the TCI-State which has this value for <i>tci-StateId</i> and is defined in <i>tci-StatesToAddModList</i> in the PDSCH-Config included in the BWP-Downlink corresponding to the serving cell and to the DL BWP to which the <i>resourcesForChannelMeasurement</i> (in the CSI-ReportConfig indicated by <i>reportConfigId</i> above) belong to. First entry in <i>qcl-info-forChannel</i> corresponds to first entry in <i>nzp-CSI-RS-Resources</i> of that NZP-CSI-RS-ResourceSet, second entry in <i>qcl-info-forChannel</i> corresponds to second entry in <i>nzp-CSI-RS-Resources</i>, and so on (see TS 38.214 [19], clause 5.2.1.5.1)</p>
<p><b>reportConfigId</b> The <i>reportConfigId</i> of one of the CSI-ReportConfigToAddMod configured in CSI-MeasConfig</p>
<p><b>resourceSet</b> NZP-CSI-RS-ResourceSet for channel measurements. Entry number in <i>nzp-CSI-RS-ResourceSetList</i> in the CSI-ResourceConfig indicated by <i>resourcesForChannelMeasurement</i> in the CSI-ReportConfig indicated by <i>reportConfigId</i> above (value 1 corresponds to the first entry, value 2 to thesecond entry, and so on).</p>

<b>Conditional Presence</b>	<b>Explanation</b>
<i>Aperiodic</i>	The field is mandatory present if the NZP-CSI-RS-Resources in the associated <i>resourceSet</i> have the resourceType aperiodic. The field is absent otherwise.
<i>CSI-IM-ForInterference</i>	This field is mandatory present if the CSI-ReportConfig identified by <i>reportConfigId</i> is configured with <i>csi-IM-ResourcesForInterference</i> ; otherwise it is absent.
<i>NZP-CSI-RS-ForInterference</i>	This field is mandatory present if the CSI-ReportConfig identified by <i>reportConfigId</i> is configured with <i>nzp-CSI-RS-ResourcesForInterference</i> ; otherwise it is absent.

## – CSI-FrequencyOccupation

The IE *CSI-FrequencyOccupation* is used to configure the frequency domain occupation of a channel state information measurement resource (e.g. *NZP-CSI-RS-Resource*, *CSI-IM-Resource*).

### **CSI-FrequencyOccupation information element**

```
-- ASN1START
-- TAG-CSI-FREQUENCYOCCUPATION-START

CSI-FrequencyOccupation ::= SEQUENCE {
    startingRB          INTEGER (0..maxNrofPhysicalResourceBlocks-1),
    nrofRBs            INTEGER (24..maxNrofPhysicalResourceBlocksPlus1),
    ...
}
```

```

}
-- TAG-CSI-FREQUENCYOCCUPATION-STOP
-- ASN1STOP

```

### **CSI-FrequencyOccupation field descriptions**

#### **nrofRBs**

Number of PRBs across which this CSI resource spans. Only multiples of 4 are allowed. The smallest configurable number is the minimum of 24 and the width of the associated BWP. If the configured value is larger than the width of the corresponding BWP, the UE shall assume that the actual CSI-RS bandwidth is equal to the width of the BWP.

#### **startingRB**

PRB where this CSI resource starts in relation to common resource block #0 (CRB#0) on the common resource block grid. Only multiples of 4 are allowed (0, 4, ...)

## – CSI-IM-Resource

The IE *CSI-IM-Resource* is used to configure one CSI Interference Management (IM) resource.

### **CSI-IM-Resource information element**

```

-- ASN1START
-- TAG-CSI-IM-RESOURCE-START

CSI-IM-Resource ::=
  csi-IM-ResourceId          SEQUENCE {
    csi-IM-ResourceElementPattern CHOICE {
      pattern0 SEQUENCE {
        subcarrierLocation-p0 ENUMERATED { s0, s2, s4, s6, s8, s10 },
        symbolLocation-p0     INTEGER (0..12)
      },
      pattern1 SEQUENCE {
        subcarrierLocation-p1 ENUMERATED { s0, s4, s8 },
        symbolLocation-p1     INTEGER (0..13)
      }
    }
  }
  freqBand                   CSI-FrequencyOccupation          OPTIONAL, -- Need M
  periodicityAndOffset      CSI-ResourcePeriodicityAndOffset OPTIONAL, -- Need M
  ...                        CSI-ResourcePeriodicityAndOffset OPTIONAL, -- Cond PeriodicOrSemiPersistent
}

-- TAG-CSI-IM-RESOURCE-STOP
-- ASN1STOP

```

<b>CSI-IM-Resource field descriptions</b>
<b>csi-IM-ResourceElementPattern</b> The resource element pattern (Pattern0 (2,2) or Pattern1 (4,1)) with corresponding parameters (see TS 38.214 [19], clause 5.2.2.4)
<b>freqBand</b> Frequency-occupancy of CSI-IM (see TS 38.214 [19], clause 5.2.2.4)
<b>periodicityAndOffset</b> Periodicity and slot offset for periodic/semi-persistent CSI-IM. Network always configures the UE with a value for this field for periodic and semi-persistent CSI-IM-Resources (as indicated in CSI-ResourceConfig). A change of configuration between periodic or semi-persistent and aperiodic for a CSI-IM-Resource is not supported without a release and add.
<b>subcarrierLocation-p0</b> OFDM subcarrier occupancy of the CSI-IM resource for Pattern0 (see TS 38.214 [19], clause 5.2.2.4)
<b>subcarrierLocation-p1</b> OFDM subcarrier occupancy of the CSI-IM resource for Pattern1 (see TS 38.214 [19], clause 5.2.2.4)
<b>symbolLocation-p0</b> OFDM symbol location of the CSI-IM resource for Pattern0 (see TS 38.214 [19], clause 5.2.2.4)
<b>symbolLocation-p1</b> OFDM symbol location of the CSI-IM resource for Pattern1 (see TS 38.214 [19], clause 5.2.2.4)

<b>Conditional Presence</b>	<b>Explanation</b>
<i>PeriodicOrSemiPersistent</i>	The field is optionally present, Need M, for periodic and semi-persistent CSI-IM-Resources (as indicated in CSI-ResourceConfig). The field is absent otherwise.

### – *CSI-IM-ResourceId*

The IE *CSI-IM-ResourceId* is used to identify one *CSI-IM-Resource*.

#### **CSI-IM-ResourceId information element**

```
-- ASN1START
-- TAG-CSI-IM-RESOURCEID-START

CSI-IM-ResourceId ::=                INTEGER (0..maxNrofCSI-IM-Resources-1)

-- TAG-CSI-IM-RESOURCEID-STOP
-- ASN1STOP
```

### – *CSI-IM-ResourceSet*

The IE *CSI-IM-ResourceSet* is used to configure a set of one or more CSI Interference Management (IM) resources (their IDs) and set-specific parameters.

#### **CSI-IM-ResourceSet information element**

```
-- ASN1START
```

```

-- TAG-CSI-IM-RESOURCESET-START
CSI-IM-ResourceSet ::=
    csi-IM-ResourceSetId      SEQUENCE {
        csi-IM-ResourceSetId,
        csi-IM-Resources     SEQUENCE (SIZE (1..maxNrofCSI-IM-ResourcesPerSet)) OF CSI-IM-ResourceId,
        ...
    }
-- TAG-CSI-IM-RESOURCESET-STOP
-- ASN1STOP

```

#### **CSI-IM-ResourceSet field descriptions**

##### **csi-IM-Resources**

CSI-IM-Resources associated with this CSI-IM-ResourceSet (see TS 38.214 [19], clause 5.2).

### – CSI-IM-ResourceSetId

The IE *CSI-IM-ResourceSetId* is used to identify *CSI-IM-ResourceSets*.

#### **CSI-IM-ResourceSetId information element**

```

-- ASN1START
-- TAG-CSI-IM-RESOURCESETID-START
CSI-IM-ResourceSetId ::=
    INTEGER (0..maxNrofCSI-IM-ResourceSets-1)
-- TAG-CSI-IM-RESOURCESETID-STOP
-- ASN1STOP

```

### – CSI-MeasConfig

The IE *CSI-MeasConfig* is used to configure CSI-RS (reference signals) belonging to the serving cell in which *CSI-MeasConfig* is included, channel state information reports to be transmitted on PUCCH on the serving cell in which *CSI-MeasConfig* is included and channel state information reports on PUSCH triggered by DCI received on the serving cell in which *CSI-MeasConfig* is included. See also TS 38.214 [19], clause 5.2.

#### **CSI-MeasConfig information element**

```

-- ASN1START
-- TAG-CSI-MEASCONFIG-START
CSI-MeasConfig ::=
    SEQUENCE {
        nzp-CSI-RS-ResourceToAddModList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-Resources)) OF NZP-CSI-RS-Resource OPTIONAL, -- Need N
        nzp-CSI-RS-ResourceToReleaseList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-Resources)) OF NZP-CSI-RS-ResourceId OPTIONAL, -- Need N
        nzp-CSI-RS-ResourceSetToAddModList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourceSets)) OF NZP-CSI-RS-ResourceSet OPTIONAL, -- Need N
        nzp-CSI-RS-ResourceSetToReleaseList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourceSets)) OF NZP-CSI-RS-ResourceSetId
    }

```

```

csi-IM-ResourceToAddModList      SEQUENCE (SIZE (1..maxNrofCSI-IM-Resources)) OF CSI-IM-Resource      OPTIONAL, -- Need N
csi-IM-ResourceToReleaseList     SEQUENCE (SIZE (1..maxNrofCSI-IM-Resources)) OF CSI-IM-ResourceId     OPTIONAL, -- Need N
csi-IM-ResourceSetToAddModList   SEQUENCE (SIZE (1..maxNrofCSI-IM-ResourceSets)) OF CSI-IM-ResourceSet  OPTIONAL, -- Need N
csi-IM-ResourceSetToReleaseList  SEQUENCE (SIZE (1..maxNrofCSI-IM-ResourceSets)) OF CSI-IM-ResourceSetId  OPTIONAL, -- Need N
csi-SSB-ResourceSetToAddModList  SEQUENCE (SIZE (1..maxNrofCSI-SSB-ResourceSets)) OF CSI-SSB-ResourceSet  OPTIONAL, -- Need N
csi-SSB-ResourceSetToReleaseList SEQUENCE (SIZE (1..maxNrofCSI-SSB-ResourceSets)) OF CSI-SSB-ResourceSetId  OPTIONAL, -- Need N
csi-ResourceConfigToAddModList   SEQUENCE (SIZE (1..maxNrofCSI-ResourceConfigurations)) OF CSI-ResourceConfig  OPTIONAL, -- Need N
csi-ResourceConfigToReleaseList  SEQUENCE (SIZE (1..maxNrofCSI-ResourceConfigurations)) OF CSI-ResourceConfigId  OPTIONAL, -- Need N
csi-ReportConfigToAddModList     SEQUENCE (SIZE (1..maxNrofCSI-ReportConfigurations)) OF CSI-ReportConfig  OPTIONAL, -- Need N
csi-ReportConfigToReleaseList    SEQUENCE (SIZE (1..maxNrofCSI-ReportConfigurations)) OF CSI-ReportConfigId  OPTIONAL, -- Need N

reportTriggerSize                INTEGER (0..6)                                                           OPTIONAL, -- Need N
aperiodicTriggerStateList        SetupRelease { CSI-AperiodicTriggerStateList }                        OPTIONAL, -- Need M
semiPersistentOnPUSCH-TriggerStateList  SetupRelease { CSI-SemiPersistentOnPUSCH-TriggerStateList }        OPTIONAL, -- Need M
...
[[
reportTriggerSizeDCI-0-2-r16      INTEGER (0..6)                                                           OPTIONAL -- Need R
]]
}

-- TAG-CSI-MEASCONFIG-STOP
-- ASN1STOP

```

#### **CSI-MeasConfig field descriptions**

<b><i>aperiodicTriggerStateList</i></b>
Contains trigger states for dynamically selecting one or more aperiodic and semi-persistent reporting configurations and/or triggering one or more aperiodic CSI-RS resource sets for channel and/or interference measurement (see TS 38.214 [19], clause 5.2.1).
<b><i>csi-IM-ResourceSetToAddModList</i></b>
Pool of <i>CSI-IM-ResourceSet</i> which can be referred to from <i>CSI-ResourceConfig</i> or from MAC CEs.
<b><i>csi-IM-ResourceToAddModList</i></b>
Pool of <i>CSI-IM-Resource</i> which can be referred to from <i>CSI-IM-ResourceSet</i> .
<b><i>csi-ReportConfigToAddModList</i></b>
Configured CSI report settings as specified in TS 38.214 [19] clause 5.2.1.1.
<b><i>csi-ResourceConfigToAddModList</i></b>
Configured CSI resource settings as specified in TS 38.214 [19] clause 5.2.1.2.
<b><i>csi-SSB-ResourceSetToAddModList</i></b>
Pool of <i>CSI-SSB-ResourceSet</i> which can be referred to from <i>CSI-ResourceConfig</i> .
<b><i>nzp-CSI-RS-ResourceSetToAddModList</i></b>
Pool of <i>NZP-CSI-RS-ResourceSet</i> which can be referred to from <i>CSI-ResourceConfig</i> or from MAC CEs.
<b><i>nzp-CSI-RS-ResourceToAddModList</i></b>
Pool of <i>NZP-CSI-RS-Resource</i> which can be referred to from <i>NZP-CSI-RS-ResourceSet</i> .
<b><i>reportTriggerSize, reportTriggerSizeDCI-0-2</i></b>
Size of CSI request field in DCI (bits) (see TS 38.214 [19], clause 5.2.1.5.1). The field <i>reportTriggerSize</i> applies to DCI format 0_1 and the field <i>reportTriggerSizeDCI-0-2</i> applies to DCI format 0_2 (see TS 38.214 [19], clause 5.2.1.5.1).

## – CSI-ReportConfig

The IE *CSI-ReportConfig* is used to configure a periodic or semi-persistent report sent on PUCCH on the cell in which the *CSI-ReportConfig* is included, or to configure a semi-persistent or aperiodic report sent on PUSCH triggered by DCI received on the cell in which the *CSI-ReportConfig* is included (in this case, the cell on which the report is sent is determined by the received DCI). See TS 38.214 [19], clause 5.2.1.

### CSI-ReportConfig information element

```

-- ASN1START
-- TAG-CSI-REPORTCONFIG-START

CSI-ReportConfig ::=
    reportConfigId          SEQUENCE {
    carrier                  CSI-ReportConfigId,
                           ServCellIndex          OPTIONAL,    -- Need S
    resourcesForChannelMeasurement
    csi-IM-ResourcesForInterference
    nzp-CSI-RS-ResourcesForInterference
    reportConfigType        CHOICE {
        periodic            SEQUENCE {
            reportSlotConfig
                           CSI-ReportPeriodicityAndOffset,
            pucch-CSI-ResourceList
                           SEQUENCE (SIZE (1..maxNrofBWPs)) OF PUCCH-CSI-Resource
        },
        semiPersistentOnPUCCH
                           SEQUENCE {
            reportSlotConfig
                           CSI-ReportPeriodicityAndOffset,
            pucch-CSI-ResourceList
                           SEQUENCE (SIZE (1..maxNrofBWPs)) OF PUCCH-CSI-Resource
        },
        semiPersistentOnPUSCH
                           SEQUENCE {
            reportSlotConfig
                           ENUMERATED {s15, s110, s120, s140, s180, s1160, s1320},
            reportSlotOffsetList
                           SEQUENCE (SIZE (1..maxNrofUL-Allocations)) OF INTEGER(0..32),
            p0alpha          P0-PUSCH-AlphaSetId
        },
        aperiodic          SEQUENCE {
            reportSlotOffsetList
                           SEQUENCE (SIZE (1..maxNrofUL-Allocations)) OF INTEGER(0..32)
        }
    },
    reportQuantity          CHOICE {
        none                NULL,
        cri-RI-PMI-CQI      NULL,
        cri-RI-il           NULL,
        cri-RI-il-CQI       SEQUENCE {
            pdsch-BundleSizeForCSI
                           ENUMERATED {n2, n4}
                           OPTIONAL    -- Need S
        },
        cri-RI-CQI          NULL,
        cri-RSRP            NULL,
        ssb-Index-RSRP      NULL,
        cri-RI-LI-PMI-CQI   NULL
    },
    reportFreqConfiguration SEQUENCE {
        cqi-FormatIndicator  ENUMERATED { widebandCQI, subbandCQI }
                           OPTIONAL,    -- Need R
        pmi-FormatIndicator  ENUMERATED { widebandPMI, subbandPMI }
                           OPTIONAL,    -- Need R
        csi-ReportingBand    CHOICE {
            subbands3        BIT STRING(SIZE(3)),

```

```

subbands4          BIT STRING(SIZE(4)),
subbands5          BIT STRING(SIZE(5)),
subbands6          BIT STRING(SIZE(6)),
subbands7          BIT STRING(SIZE(7)),
subbands8          BIT STRING(SIZE(8)),
subbands9          BIT STRING(SIZE(9)),
subbands10         BIT STRING(SIZE(10)),
subbands11         BIT STRING(SIZE(11)),
subbands12         BIT STRING(SIZE(12)),
subbands13         BIT STRING(SIZE(13)),
subbands14         BIT STRING(SIZE(14)),
subbands15         BIT STRING(SIZE(15)),
subbands16         BIT STRING(SIZE(16)),
subbands17         BIT STRING(SIZE(17)),
subbands18         BIT STRING(SIZE(18)),
...
subbands19-v1530   BIT STRING(SIZE(19))
} OPTIONAL -- Need S

} OPTIONAL, -- Need R
timeRestrictionForChannelMeasurements ENUMERATED {configured, notConfigured},
timeRestrictionForInterferenceMeasurements ENUMERATED {configured, notConfigured},
codebookConfig CodebookConfig OPTIONAL, -- Need R
dummy ENUMERATED {n1, n2} OPTIONAL, -- Need R
groupBasedBeamReporting CHOICE {
  enabled NULL,
  disabled SEQUENCE {
    nrofReportedRS ENUMERATED {n1, n2, n3, n4} OPTIONAL -- Need S
  }
},
cqi-Table ENUMERATED {table1, table2, table3, spare1} OPTIONAL, -- Need R
subbandSize ENUMERATED {value1, value2},
non-PMI-PortIndication SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerConfig)) OF PortIndexFor8Ranks OPTIONAL, -- Need R
...
[[
semiPersistentOnPUSCH-v1530 SEQUENCE {
  reportSlotConfig-v1530 ENUMERATED {s14, s18, s116}
}
]],
[[
semiPersistentOnPUSCH-v1610 SEQUENCE {
  reportSlotOffsetListDCI-0-2-r16 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32) OPTIONAL, -- Need R
  reportSlotOffsetListDCI-0-1-r16 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32) OPTIONAL, -- Need R
}
aperiodic-v1610 SEQUENCE {
  reportSlotOffsetListDCI-0-2-r16 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32) OPTIONAL, -- Need R
  reportSlotOffsetListDCI-0-1-r16 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32) OPTIONAL, -- Need R
}
reportQuantity-r16 CHOICE {
  cri-SINR-r16 NULL,
  ssb-Index-SINR-r16 NULL
}
codebookConfig-r16 CodebookConfig-r16 OPTIONAL, -- Need R
]]

```



```

}

CSI-ReportPeriodicityAndOffset ::= CHOICE {
    slots4          INTEGER(0..3),
    slots5          INTEGER(0..4),
    slots8          INTEGER(0..7),
    slots10         INTEGER(0..9),
    slots16         INTEGER(0..15),
    slots20         INTEGER(0..19),
    slots40         INTEGER(0..39),
    slots80         INTEGER(0..79),
    slots160        INTEGER(0..159),
    slots320        INTEGER(0..319)
}

PUCCH-CSI-Resource ::= SEQUENCE {
    uplinkBandwidthPartId
    pucch-Resource
}

PortIndexFor8Ranks ::= CHOICE {
    portIndex8
        SEQUENCE {
            PortIndex8
                SEQUENCE(SIZE(2)) OF PortIndex8
                SEQUENCE(SIZE(3)) OF PortIndex8
                SEQUENCE(SIZE(4)) OF PortIndex8
                SEQUENCE(SIZE(5)) OF PortIndex8
                SEQUENCE(SIZE(6)) OF PortIndex8
                SEQUENCE(SIZE(7)) OF PortIndex8
                SEQUENCE(SIZE(8)) OF PortIndex8
                OPTIONAL, -- Need R
                OPTIONAL, -- Need R
                OPTIONAL, -- Need R
                OPTIONAL, -- Need R
                OPTIONAL, -- Need R
                OPTIONAL, -- Need R
                OPTIONAL, -- Need R
                OPTIONAL, -- Need R
            },
        portIndex4
            SEQUENCE {
                PortIndex4
                SEQUENCE(SIZE(2)) OF PortIndex4
                SEQUENCE(SIZE(3)) OF PortIndex4
                SEQUENCE(SIZE(4)) OF PortIndex4
                OPTIONAL, -- Need R
                OPTIONAL, -- Need R
                OPTIONAL, -- Need R
                OPTIONAL, -- Need R
            },
        portIndex2
            SEQUENCE {
                PortIndex2
                SEQUENCE(SIZE(2)) OF PortIndex2
                OPTIONAL, -- Need R
                OPTIONAL, -- Need R
            },
        portIndex1
            NULL
    }

PortIndex8 ::= INTEGER (0..7)
PortIndex4 ::= INTEGER (0..3)
PortIndex2 ::= INTEGER (0..1)

-- TAG-CSI-REPORTCONFIG-STOP
-- ASN1STOP

```

<b>CSI-ReportConfig field descriptions</b>
<p><b>carrier</b> Indicates in which serving cell the <i>CSI-ResourceConfig</i> indicated below are to be found. If the field is absent, the resources are on the same serving cell as this report configuration.</p>
<p><b>codebookConfig</b> Codebook configuration for Type-1 or Type-2 including codebook subset restriction. Network does not configure <i>codebookConfig</i> and <i>codebookConfig-r16</i> simultaneously to a UE</p>
<p><b>cqi-FormatIndicator</b> Indicates whether the UE shall report a single (wideband) or multiple (subband) CQI. (see TS 38.214 [19], clause 5.2.1.4).</p>
<p><b>cqi-Table</b> Which CQI table to use for CQI calculation (see TS 38.214 [19], clause 5.2.2.1).</p>
<p><b>csi-IM-ResourcesForInterference</b> CSI IM resources for interference measurement. <i>csi-ResourceConfigId</i> of a <i>CSI-ResourceConfig</i> included in the configuration of the serving cell indicated with the field "carrier" above. The <i>CSI-ResourceConfig</i> indicated here contains only CSI-IM resources. The <i>bwpld</i> in that <i>CSI-ResourceConfig</i> is the same value as the <i>bwpld</i> in the <i>CSI-ResourceConfig</i> indicated by <i>resourcesForChannelMeasurement</i>.</p>
<p><b>csi-ReportingBand</b> Indicates a contiguous or non-contiguous subset of subbands in the bandwidth part which CSI shall be reported for. Each bit in the bit-string represents one subband. The right-most bit in the bit string represents the lowest subband in the BWP. The choice determines the number of subbands (subbands3 for 3 subbands, subbands4 for 4 subbands, and so on) (see TS 38.214 [19], clause 5.2.1.4). This field is absent if there are less than 24 PRBs (no sub band) and present otherwise, the number of sub bands can be from 3 (24 PRBs, sub band size 8) to 18 (72 PRBs, sub band size 4).</p>
<p><b>dummy</b> This field is not used in the specification. If received it shall be ignored by the UE.</p>
<p><b>groupBasedBeamReporting</b> Turning on/off group beam based reporting (see TS 38.214 [19], clause 5.2.1.4).</p>
<p><b>non-PMI-PortIndication</b> Port indication for RI/CQI calculation. For each CSI-RS resource in the linked ResourceConfig for channel measurement, a port indication for each rank R, indicating which R ports to use. Applicable only for non-PMI feedback (see TS 38.214 [19], clause 5.2.1.4.2). The first entry in <i>non-PMI-PortIndication</i> corresponds to the NZP-CSI-RS-Resource indicated by the first entry in <i>nzp-CSI-RS-Resources</i> in the <i>NZP-CSI-RS-ResourceSet</i> indicated in the first entry of <i>nzp-CSI-RS-ResourceSetList</i> of the <i>CSI-ResourceConfig</i> whose <i>CSI-ResourceConfigId</i> is indicated in a <i>CSI-MeasId</i> together with the above <i>CSI-ReportConfigId</i>; the second entry in <i>non-PMI-PortIndication</i> corresponds to the NZP-CSI-RS-Resource indicated by the second entry in <i>nzp-CSI-RS-Resources</i> in the <i>NZP-CSI-RS-ResourceSet</i> indicated in the first entry of <i>nzp-CSI-RS-ResourceSetList</i> of the same <i>CSI-ResourceConfig</i>, and so on until the NZP-CSI-RS-Resource indicated by the last entry in <i>nzp-CSI-RS-Resources</i> in the in the <i>NZP-CSI-RS-ResourceSet</i> indicated in the first entry of <i>nzp-CSI-RS-ResourceSetList</i> of the same <i>CSI-ResourceConfig</i>. Then the next entry corresponds to the NZP-CSI-RS-Resource indicated by the first entry in <i>nzp-CSI-RS-Resources</i> in the <i>NZP-CSI-RS-ResourceSet</i> indicated in the second entry of <i>nzp-CSI-RS-ResourceSetList</i> of the same <i>CSI-ResourceConfig</i> and so on.</p>
<p><b>nrofReportedRS</b> The number (N) of measured RS resources to be reported per report setting in a non-group-based report. <math>N \leq N_{max}</math>, where <math>N_{max}</math> is either 2 or 4 depending on UE capability. (see TS 38.214 [19], clause 5.2.1.4) When the field is absent the UE applies the value 1.</p>
<p><b>nzp-CSI-RS-ResourcesForInterference</b> NZP CSI RS resources for interference measurement. <i>csi-ResourceConfigId</i> of a <i>CSI-ResourceConfig</i> included in the configuration of the serving cell indicated with the field "carrier" above. The <i>CSI-ResourceConfig</i> indicated here contains only NZP-CSI-RS resources. The <i>bwpld</i> in that <i>CSI-ResourceConfig</i> is the same value as the <i>bwpld</i> in the <i>CSI-ResourceConfig</i> indicated by <i>resourcesForChannelMeasurement</i>.</p>
<p><b>p0alpha</b> Index of the p0-alpha set determining the power control for this CSI report transmission (see TS 38.214 [19], clause 6.2.1.2).</p>
<p><b>pdsch-BundleSizeForCSI</b> PRB bundling size to assume for CQI calculation when <i>reportQuantity</i> is CRI/RI/i1/CQI. If the field is absent, the UE assumes that no PRB bundling is applied (see TS 38.214 [19], clause 5.2.1.4.2).</p>

<b><i>pmi-FormatIndicator</i></b> Indicates whether the UE shall report a single (wideband) or multiple (subband) PMI. (see TS 38.214 [19], clause 5.2.1.4).
<b><i>pucch-CSI-ResourceList</i></b> Indicates which PUCCH resource to use for reporting on PUCCH.
<b><i>reportConfigType</i></b> Time domain behavior of reporting configuration.
<b><i>reportFreqConfiguration</i></b> Reporting configuration in the frequency domain. (see TS 38.214 [19], clause 5.2.1.4).
<b><i>reportQuantity</i></b> The CSI related quantities to report. see TS 38.214 [19], clause 5.2.1. If the field <i>reportQuantity-r16</i> is present, UE shall ignore <i>reportQuantity</i> (without suffix).
<b><i>reportSlotConfig</i></b> Periodicity and slot offset (see TS 38.214 [19], clause 5.2.1.4). If the field <i>reportSlotConfig-v1530</i> is present, the UE shall ignore the value provided in <i>reportSlotConfig</i> (without suffix).
<b><i>reportSlotOffsetList, reportSlotOffsetListDCI-0-1, reportSlotOffsetListDCI-0-2</i></b> Timing offset Y for semi persistent reporting using PUSCH. This field lists the allowed offset values. This list must have the same number of entries as the <i>pusch-TimeDomainAllocationList</i> in <i>PUSCH-Config</i> . A particular value is indicated in DCI. The network indicates in the DCI field of the UL grant, which of the configured report slot offsets the UE shall apply. The DCI value 0 corresponds to the first report slot offset in this list, the DCI value 1 corresponds to the second report slot offset in this list, and so on. The first report is transmitted in slot n+Y, second report in n+Y+P, where P is the configured periodicity. Timing offset Y for aperiodic reporting using PUSCH. This field lists the allowed offset values. This list must have the same number of entries as the <i>pusch-TimeDomainAllocationList</i> in <i>PUSCH-Config</i> . A particular value is indicated in DCI. The network indicates in the DCI field of the UL grant, which of the configured report slot offsets the UE shall apply. The DCI value 0 corresponds to the first report slot offset in this list, the DCI value 1 corresponds to the second report slot offset in this list, and so on (see TS 38.214 [19], clause 6.1.2.1). The field <i>reportSlotOffsetList</i> applies to DCI format 0_0, the field <i>reportSlotOffsetListDCI-0-1</i> applies to DCI format 0_1 and the field <i>reportSlotOffsetListDCI-0-2</i> applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.2.1).
<b><i>resourcesForChannelMeasurement</i></b> Resources for channel measurement. <i>csi-ResourceConfigId</i> of a <i>CSI-ResourceConfig</i> included in the configuration of the serving cell indicated with the field "carrier" above. The <i>CSI-ResourceConfig</i> indicated here contains only NZP-CSI-RS resources and/or SSB resources. This <i>CSI-ReportConfig</i> is associated with the DL BWP indicated by <i>bwp-Id</i> in that <i>CSI-ResourceConfig</i> .
<b><i>subbandSize</i></b> Indicates one out of two possible BWP-dependent values for the subband size as indicated in TS 38.214 [19], table 5.2.1.4-2 . If <i>csi-ReportingBand</i> is absent, the UE shall ignore this field.
<b><i>timeRestrictionForChannelMeasurements</i></b> Time domain measurement restriction for the channel (signal) measurements (see TS 38.214 [19], clause 5.2.1.1).
<b><i>timeRestrictionForInterferenceMeasurements</i></b> Time domain measurement restriction for interference measurements (see TS 38.214 [19], clause 5.2.1.1).

<b><i>PortIndexFor8Ranks</i> field descriptions</b>
<b><i>portIndex8</i></b> Port-Index configuration for up to rank 8. If present, the network configures port indexes for at least one of the ranks.
<b><i>portIndex4</i></b> Port-Index configuration for up to rank 4. If present, the network configures port indexes for at least one of the ranks.
<b><i>portIndex2</i></b> Port-Index configuration for up to rank 2. If present, the network configures port indexes for at least one of the ranks.
<b><i>portIndex1</i></b> Port-Index configuration for rank 1.

**PUCCH-CSI-Resource field descriptions*****pucch-Resource***

PUCCH resource for the associated uplink BWP. Only PUCCH-Resource of format 2, 3 and 4 is supported. The actual PUCCH-Resource is configured in *PUCCH-Config* and referred to by its ID. When two *PUCCH-Config* are configured within *PUCCH-ConfigurationList*, *PUCCH-ResourceId* in a *PUCCH-CSI-Resource* refers to a PUCCH-Resource in the *PUCCH-Config* used for HARQ-ACK with low priority.

– ***CSI-ReportConfigId***

The IE *CSI-ReportConfigId* is used to identify one *CSI-ReportConfig*.

***CSI-ReportConfigId* information element**

```
-- ASN1START
-- TAG-CSI-REPORTCONFIGID-START

CSI-ReportConfigId ::=                INTEGER (0..maxNrofCSI-ReportConfigurations-1)

-- TAG-CSI-REPORTCONFIGID-STOP
-- ASN1STOP
```

– ***CSI-ResourceConfig***

The IE *CSI-ResourceConfig* defines a group of one or more *NZP-CSI-RS-ResourceSet*, *CSI-IM-ResourceSet* and/or *CSI-SSB-ResourceSet*.

***CSI-ResourceConfig* information element**

```
-- ASN1START
-- TAG-CSI-RESOURCECONFIG-START

CSI-ResourceConfig ::=                SEQUENCE {
    csi-ResourceConfigId                CSI-ResourceConfigId,
    csi-RS-ResourceSetList              CHOICE {
        nzp-CSI-RS-SSB                  SEQUENCE {
            nzp-CSI-RS-ResourceSetList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourceSetsPerConfig)) OF NZP-CSI-RS-ResourceSetId
                                                OPTIONAL, -- Need R
        },
        csi-SSB-ResourceSetList         SEQUENCE (SIZE (1..maxNrofCSI-SSB-ResourceSetsPerConfig)) OF CSI-SSB-ResourceSetId
                                                OPTIONAL, -- Need R
    },
    csi-IM-ResourceSetList              SEQUENCE (SIZE (1..maxNrofCSI-IM-ResourceSetsPerConfig)) OF CSI-IM-ResourceSetId
},

    bwp-Id                             BWP-Id,
    resourceType                         ENUMERATED { aperiodic, semiPersistent, periodic },
    ...
}

-- TAG-CSI-RESOURCECONFIG-STOP
-- ASN1STOP
```

<b>CSI-ResourceConfig field descriptions</b>
<b>bwp-Id</b> The DL BWP which the CSI-RS associated with this <i>CSI-ResourceConfig</i> are located in (see TS 38.214 [19], clause 5.2.1.2).
<b>csi-IM-ResourceSetList</b> List of references to CSI-IM resources used for beam measurement and reporting in a CSI-RS resource set. Contains up to <i>maxNrofCSI-IM-ResourceSetsPerConfig</i> resource sets if <i>resourceType</i> is 'aperiodic' and 1 otherwise (see TS 38.214 [19], clause 5.2.1.2).
<b>csi-ResourceConfigId</b> Used in <i>CSI-ReportConfig</i> to refer to an instance of <i>CSI-ResourceConfig</i> .
<b>csi-SSB-ResourceSetList</b> List of references to SSB resources used for beam measurement and reporting in a CSI-RS resource set (see TS 38.214 [19], clause 5.2.1.2).
<b>nzp-CSI-RS-ResourceSetList</b> List of references to NZP CSI-RS resources used for beam measurement and reporting in a CSI-RS resource set. Contains up to <i>maxNrofNZP-CSI-RS-ResourceSetsPerConfig</i> resource sets if <i>resourceType</i> is 'aperiodic' and 1 otherwise (see TS 38.214 [19], clause 5.2.1.2).
<b>resourceType</b> Time domain behavior of resource configuration (see TS 38.214 [19], clause 5.2.1.2). It does not apply to resources provided in the <i>csi-SSB-ResourceSetList</i> .

– **CSI-ResourceConfigId**

The IE *CSI-ResourceConfigId* is used to identify a *CSI-ResourceConfig*.

**CSI-ResourceConfigId information element**

```
-- ASN1START
-- TAG-CSI-RESOURCECONFIGID-START

CSI-ResourceConfigId ::=          INTEGER (0..maxNrofCSI-ResourceConfigurations-1)

-- TAG-CSI-RESOURCECONFIGID-STOP
-- ASN1STOP
```

– **CSI-ResourcePeriodicityAndOffset**

The IE *CSI-ResourcePeriodicityAndOffset* is used to configure a periodicity and a corresponding offset for periodic and semi-persistent CSI resources, and for periodic and semi-persistent reporting on PUCCH. both, the periodicity and the offset are given in number of slots. The periodicity value *slots4* corresponds to 4 slots, value *slots5* corresponds to 5 slots, and so on.

**CSI-ResourcePeriodicityAndOffset information element**

```
-- ASN1START
-- TAG-CSI-RESOURCEPERIODICITYANDOFFSET-START

CSI-ResourcePeriodicityAndOffset ::= CHOICE {
```

```

slots4          INTEGER (0..3),
slots5          INTEGER (0..4),
slots8          INTEGER (0..7),
slots10         INTEGER (0..9),
slots16         INTEGER (0..15),
slots20         INTEGER (0..19),
slots32         INTEGER (0..31),
slots40         INTEGER (0..39),
slots64         INTEGER (0..63),
slots80         INTEGER (0..79),
slots160        INTEGER (0..159),
slots320        INTEGER (0..319),
slots640        INTEGER (0..639)
}

-- TAG-CSI-RESOURCEPERIODICITYANDOFFSET-STOP
-- ASN1STOP

```

## – CSI-RS-ResourceConfigMobility

The IE *CSI-RS-ResourceConfigMobility* is used to configure CSI-RS based RRM measurements.

### CSI-RS-ResourceConfigMobility information element

```

-- ASN1START
-- TAG-CSI-RS-RESOURCECONFIGMOBILITY-START

CSI-RS-ResourceConfigMobility ::= SEQUENCE {
  subcarrierSpacing          SubcarrierSpacing,
  csi-RS-CellList-Mobility   SEQUENCE (SIZE (1..maxNrofCSI-RS-CellsRRM)) OF CSI-RS-CellMobility,
  ...,
  [[
  refServCellIndex          ServCellIndex                               OPTIONAL -- Need S
  ]]
}

CSI-RS-CellMobility ::= SEQUENCE {
  cellId                    PhysCellId,
  csi-rs-MeasurementBW      SEQUENCE {
    nrofPRBs                ENUMERATED { size24, size48, size96, size192, size264},
    startPRB                INTEGER(0..2169)
  },
  density                   ENUMERATED {d1,d3}                               OPTIONAL, -- Need R
  csi-rs-ResourceList-Mobility SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesRRM)) OF CSI-RS-Resource-Mobility
}

CSI-RS-Resource-Mobility ::= SEQUENCE {
  csi-RS-Index              CSI-RS-Index,
  slotConfig                CHOICE {

```

```

ms4          INTEGER (0..31),
ms5          INTEGER (0..39),
ms10         INTEGER (0..79),
ms20         INTEGER (0..159),
ms40         INTEGER (0..319)
},
associatedSSB SEQUENCE {
  ssb-Index   SSB-Index,
  isQuasiColocated BOOLEAN
}
frequencyDomainAllocation CHOICE {
  row1        BIT STRING (SIZE (4)),
  row2        BIT STRING (SIZE (12))
},
firstOFDMSymbolInTimeDomain INTEGER (0..13),
sequenceGenerationConfig    INTEGER (0..1023),
...
}

CSI-RS-Index ::= INTEGER (0..maxNrofCSI-RS-ResourcesRRM-1)

-- TAG-CSI-RS-RESOURCECONFIGMOBILITY-STOP
-- ASN1STOP

```

OPTIONAL, -- Need R

#### CSI-RS-CellMobility field descriptions

##### **csi-rs-ResourceList-Mobility**

List of CSI-RS resources for mobility. The maximum number of CSI-RS resources that can be configured per *measObjectNR* depends on the configuration of *associatedSSB* (see TS 38.214 [19], clause 5.1.6.1.3).

##### **density**

Frequency domain density for the 1-port CSI-RS for L3 mobility. See TS 38.211 [16], clause 7.4.1.

##### **nrofPRBs**

Allowed size of the measurement BW in PRBs. See TS 38.211 [16], clause 7.4.1.

##### **startPRB**

Starting PRB index of the measurement bandwidth. See TS 38.211 [16], clause 7.4.1.

#### CSI-RS-ResourceConfigMobility field descriptions

##### **csi-RS-CellList-Mobility**

List of cells for CSI-RS based RRM measurements.

##### **refServCellIndex**

Indicates the serving cell providing the timing reference for CSI-RS resources without *associatedSSB*. The field may be present only if there is at least one CSI-RS resource configured without *associatedSSB*. If this field is absent, the UE shall use the timing of the PCell for measurements on the CSI-RS resources without *associatedSSB*. The CSI-RS resources and the serving cell indicated by *refServCellIndex* for timing reference should be located in the same band.

##### **subcarrierSpacing**

Subcarrier spacing of CSI-RS. Only the values 15, 30 kHz or 60 kHz (FR1), and 60 or 120 kHz (FR2) are applicable.

<b>CSI-RS-Resource-Mobility field descriptions</b>
<p><b>associatedSSB</b> If this field is present, the UE may base the timing of the CSI-RS resource indicated in <i>CSI-RS-Resource-Mobility</i> on the timing of the cell indicated by the <i>cellId</i> in the <i>CSI-RS-CellMobility</i>. In this case, the UE is not required to monitor that CSI-RS resource if the UE cannot detect the SS/PBCH block indicated by this <i>associatedSSB</i> and <i>cellId</i>. If this field is absent, the UE shall base the timing of the CSI-RS resource indicated in <i>CSI-RS-Resource-Mobility</i> on the timing of the serving cell indicated by <i>refServCellIndex</i>. In this case, the UE is required to measure the CSI-RS resource even if SS/PBCH block(s) with <i>cellId</i> in the <i>CSI-RS-CellMobility</i> are not detected. CSI-RS resources with and without <i>associatedSSB</i> may be configured in accordance with the rules in TS 38.214 [19], clause 5.1.6.1.3.</p>
<p><b>csi-RS-Index</b> CSI-RS resource index associated to the CSI-RS resource to be measured (and used for reporting).</p>
<p><b>firstOFDMSymbolInTimeDomain</b> Time domain allocation within a physical resource block. The field indicates the first OFDM symbol in the PRB used for CSI-RS, see TS 38.211 [16], clause 7.4.1.5.3. Value 2 is supported only when <i>dmrs-TypeA-Position</i> equals <i>pos3</i>.</p>
<p><b>frequencyDomainAllocation</b> Frequency domain allocation within a physical resource block in accordance with TS 38.211 [16], clause 7.4.1.5.3 including table 7.4.1.5.2-1. The number of bits that may be set to one depend on the chosen row in that table.</p>
<p><b>isQuasiColocated</b> Indicates that the CSI-RS resource is quasi co-located with the associated SS/PBCH block, see TS 38.214 [19], clause 5.1.6.1.3.</p>
<p><b>sequenceGenerationConfig</b> Scrambling ID for CSI-RS (see TS 38.211 [16], clause 7.4.1.5.2).</p>
<p><b>slotConfig</b> Indicates the CSI-RS periodicity (in milliseconds) and for each periodicity the offset (in number of slots). When <i>subcarrierSpacingCSI-RS</i> is set to <i>kHz15</i>, the maximum offset values for periodicities <i>ms4/ms5/ms10/ms20/ms40</i> are 3/4/9/19/39 slots. When <i>subcarrierSpacingCSI-RS</i> is set to <i>kHz30</i>, the maximum offset values for periodicities <i>ms4/ms5/ms10/ms20/ms40</i> are 7/9/19/39/79 slots. When <i>subcarrierSpacingCSI-RS</i> is set to <i>kHz60</i>, the maximum offset values for periodicities <i>ms4/ms5/ms10/ms20/ms40</i> are 15/19/39/79/159 slots. When <i>subcarrierSpacingCSI-RS</i> is set <i>kHz120</i>, the maximum offset values for periodicities <i>ms4/ms5/ms10/ms20/ms40</i> are 31/39/79/159/319 slots.</p>

## – CSI-RS-ResourceMapping

The IE *CSI-RS-ResourceMapping* is used to configure the resource element mapping of a CSI-RS resource in time- and frequency domain.

### **CSI-RS-ResourceMapping information element**

```

-- ASN1START
-- TAG-CSI-RS-RESOURCEMAPPING-START

CSI-RS-ResourceMapping ::=
    frequencyDomainAllocation
        row1
        row2
        row4
        other
    },
    nrofPorts
    firstOFDMSymbolInTimeDomain
    firstOFDMSymbolInTimeDomain2
    cdm-Type
    density
    dot5
SEQUENCE {
    CHOICE {
        BIT STRING (SIZE (4)),
        BIT STRING (SIZE (12)),
        BIT STRING (SIZE (3)),
        BIT STRING (SIZE (6))
    },
    ENUMERATED {p1,p2,p4,p8,p12,p16,p24,p32},
    INTEGER (0..13),
    INTEGER (2..12)
    OPTIONAL, -- Need R
    ENUMERATED {noCDM, fd-CDM2, cdm4-FD2-TD2, cdm8-FD2-TD4},
    CHOICE {
        ENUMERATED {evenPRBs, oddPRBs},

```



```

        one          NULL,
        three       NULL,
        spare       NULL
    },
    freqBand        CSI-FrequencyOccupation,
    ...
}

-- TAG-CSI-RS-RESOURCEMAPPING-STOP
-- ASN1STOP

```

<b>CSI-RS-ResourceMapping field descriptions</b>
<b>cdm-Type</b> CDM type (see TS 38.214 [19], clause 5.2.2.3.1).
<b>density</b> Density of CSI-RS resource measured in RE/port/PRB (see TS 38.211 [16], clause 7.4.1.5.3). Values 0.5 ( <i>dot5</i> ), 1 ( <i>one</i> ) and 3 ( <i>three</i> ) are allowed for X=1, values 0.5 ( <i>dot5</i> ) and 1 ( <i>one</i> ) are allowed for X=2, 16, 24 and 32, value 1 ( <i>one</i> ) is allowed for X=4, 8, 12. For density = 1/2, includes 1-bit indication for RB level comb offset indicating whether odd or even RBs are occupied by CSI-RS.
<b>firstOFDMSymbolInTimeDomain2</b> Time domain allocation within a physical resource block. See TS 38.211 [16], clause 7.4.1.5.3.
<b>firstOFDMSymbolInTimeDomain</b> Time domain allocation within a physical resource block. The field indicates the first OFDM symbol in the PRB used for CSI-RS. See TS 38.211 [16], clause 7.4.1.5.3. Value 2 is supported only when <i>dmrs-TypeA-Position</i> equals <i>pos3</i> .
<b>freqBand</b> Wideband or partial band CSI-RS, (see TS 38.214 [19], clause 5.2.2.3.1).
<b>frequencyDomainAllocation</b> Frequency domain allocation within a physical resource block in accordance with TS 38.211 [16], clause 7.4.1.5.3. The applicable row number in table 7.4.1.5.3-1 is determined by the <i>frequencyDomainAllocation</i> for rows 1, 2 and 4, and for other rows by matching the values in the column Ports, Density and CDMtype in table 7.4.1.5.3-1 with the values of <i>nrofPorts</i> , <i>cdm-Type</i> and <i>density</i> below and, when more than one row has the 3 values matching, by selecting the row where the column (k bar, l bar) in table 7.4.1.5.3-1 has indexes for k ranging from 0 to 2*n-1 where n is the number of bits set to 1 in <i>frequencyDomainAllocation</i> .
<b>nrofPorts</b> Number of ports (see TS 38.214 [19], clause 5.2.2.3.1).

## – *CSI-SemiPersistentOnPUSCH-TriggerStateList*

The *CSI-SemiPersistentOnPUSCH-TriggerStateList* IE is used to configure the UE with list of trigger states for semi-persistent reporting of channel state information on L1. See also TS 38.214 [19], clause 5.2.

### **CSI-SemiPersistentOnPUSCH-TriggerStateList information element**

```

-- ASN1START
-- TAG-CSI-SEMIPERSISTENTONPUSCHTRIGGERSTATELIST-START

CSI-SemiPersistentOnPUSCH-TriggerStateList ::= SEQUENCE(SIZE (1..maxNrOfSemiPersistentPUSCH-Triggers)) OF CSI-SemiPersistentOnPUSCH-TriggerState

CSI-SemiPersistentOnPUSCH-TriggerState ::= SEQUENCE {

```

```

        associatedReportConfigInfo          CSI-ReportConfigId,
        ...
    }
-- TAG-CSI-SEMIPERSISTENTONPUSCHTRIGGERSTATELIST-STOP
-- ASN1STOP

```

### – *CSI-SSB-ResourceSet*

The IE *CSI-SSB-ResourceSet* is used to configure one SS/PBCH block resource set which refers to SS/PBCH as indicated in *ServingCellConfigCommon*.

#### **CSI-SSB-ResourceSet information element**

```

-- ASN1START
-- TAG-CSI-SSB-RESOURCESET-START

CSI-SSB-ResourceSet ::=
    SEQUENCE {
        csi-SSB-ResourceSetId          CSI-SSB-ResourceSetId,
        csi-SSB-ResourceList          SEQUENCE (SIZE(1..maxNrofCSI-SSB-ResourcePerSet)) OF SSB-Index,
        ...
    }
-- TAG-CSI-SSB-RESOURCESET-STOP
-- ASN1STOP

```

### – *CSI-SSB-ResourceSetId*

The IE *CSI-SSB-ResourceSetId* is used to identify one SS/PBCH block resource set.

#### **CSI-SSB-ResourceId information element**

```

-- ASN1START
-- TAG-CSI-SSB-RESOURCESETID-START

CSI-SSB-ResourceSetId ::=
    INTEGER (0..maxNrofCSI-SSB-ResourceSets-1)
-- TAG-CSI-SSB-RESOURCESETID-STOP
-- ASN1STOP

```

### – *DedicatedNAS-Message*

The IE *DedicatedNAS-Message* is used to transfer UE specific NAS layer information between the 5GC CN and the UE. The RRC layer is transparent for this information.

**DedicatedNAS-Message information element**

```

-- ASN1START
-- TAG-DEDICATED-NAS-MESSAGE-START

DedicatedNAS-Message ::=          OCTET STRING

-- TAG-DEDICATED-NAS-MESSAGE-STOP
-- ASN1STOP

```

– **DMRS-DownlinkConfig**

The IE *DMRS-DownlinkConfig* is used to configure downlink demodulation reference signals for PDSCH.

**DMRS-DownlinkConfig information element**

```

-- ASN1START
-- TAG-DMRS-DOWNLINKCONFIG-START

DMRS-DownlinkConfig ::=          SEQUENCE {
  dmrs-Type                ENUMERATED {type2}                OPTIONAL, -- Need S
  dmrs-AdditionalPosition  ENUMERATED {pos0, pos1, pos3}      OPTIONAL, -- Need S
  maxLength                ENUMERATED {len2}                OPTIONAL, -- Need S
  scramblingID0            INTEGER (0..65535)                OPTIONAL, -- Need S
  scramblingID1            INTEGER (0..65535)                OPTIONAL, -- Need S
  phaseTrackingRS         SetupRelease { PTRS-DownlinkConfig } OPTIONAL, -- Need M
  ...
  [[
  dmrs-Downlink-r16       ENUMERATED {enabled}              OPTIONAL -- Need R
  ]]
}

-- TAG-DMRS-DOWNLINKCONFIG-STOP
-- ASN1STOP

```

<b>DMRS-DownlinkConfig field descriptions</b>	
<b>dmrs-AdditionalPosition</b>	Position for additional DM-RS in DL, see Tables 7.4.1.1.2-3 and 7.4.1.1.2-4 in TS 38.211 [16]. If the field is absent, the UE applies the value pos2. See also clause 7.4.1.1.2 for additional constraints on how the network may set this field depending on the setting of other fields.
<b>dmrs-Downlink</b>	This field indicates whether low PAPR DMRS is used, as specified in TS38.211 [16], clause 7.4.1.1.1.
<b>dmrs-Type</b>	Selection of the DMRS type to be used for DL (see TS 38.211 [16], clause 7.4.1.1.1). If the field is absent, the UE uses DMRS type 1.
<b>maxLength</b>	The maximum number of OFDM symbols for DL front loaded DMRS. <i>len1</i> corresponds to value 1. <i>len2</i> corresponds to value 2. If the field is absent, the UE applies value <i>len1</i> . If set to <i>len2</i> , the UE determines the actual number of DM-RS symbols by the associated DCI. (see TS 38.211 [16], clause 7.4.1.1.2).
<b>phaseTrackingRS</b>	Configures downlink PTRS. If the field is not configured, the UE assumes that downlink PTRS are absent. See TS 38.214 [19] clause 5.1.6.3.
<b>scramblingID0</b>	DL DMRS scrambling initialization (see TS 38.211 [16], clause 7.4.1.1.1). When the field is absent the UE applies the value <i>physCellId</i> configured for this serving cell.
<b>scramblingID1</b>	DL DMRS scrambling initialization (see TS 38.211 [16], clause 7.4.1.1.1). When the field is absent the UE applies the value <i>physCellId</i> configured for this serving cell.

## – DMRS-UplinkConfig

The IE *DMRS-UplinkConfig* is used to configure uplink demodulation reference signals for PUSCH.

### DMRS-UplinkConfig information element

```

-- ASN1START
-- TAG-DMRS-UPLINKCONFIG-START

DMRS-UplinkConfig ::=
    SEQUENCE {
        dmrs-Type                ENUMERATED {type2}                OPTIONAL, -- Need S
        dmrs-AdditionalPosition  ENUMERATED {pos0, pos1, pos3}    OPTIONAL, -- Need S
        phaseTrackingRS          SetupRelease { PTRS-UplinkConfig } OPTIONAL, -- Need M
        maxLength                ENUMERATED {len2}                OPTIONAL, -- Need S
        transformPrecodingDisabled
            SEQUENCE {
                scramblingID0    INTEGER (0..65535)                OPTIONAL, -- Need S
                scramblingID1    INTEGER (0..65535)                OPTIONAL, -- Need S
                ...
            }
        [[
            dmrs-Uplink-r16      ENUMERATED {enabled}              OPTIONAL, -- Need R
        ]]
    }
    OPTIONAL, -- Need R
    transformPrecodingEnabled
        SEQUENCE {
            nPUSCH-Identity      INTEGER(0..1007)                OPTIONAL, -- Need S
            sequenceGroupHopping ENUMERATED {disabled}            OPTIONAL, -- Need S
            sequenceHopping      ENUMERATED {enabled}              OPTIONAL, -- Need S
            ...
        }
        [[
            dmrs-UplinkTransformPrecoding-r16 SetupRelease {DMRS-UplinkTransformPrecoding-r16} OPTIONAL, -- Need M
        ]]
    ]]
```

```
    }  
    ...  
}  
  
DMRS-UplinkTransformPrecoding-r16 ::= SEQUENCE {  
    pi2BPSK-ScramblingID0    INTEGER(0..65535)    OPTIONAL, -- Need S  
    pi2BPSK-ScramblingID1    INTEGER(0..65535)    OPTIONAL, -- Need S  
}  
  
-- TAG-DMRS-UPLINKCONFIG-STOP  
-- ASN1STOP
```

<b>DMRS-UplinkConfig field descriptions</b>
<p><b>dmrs-AdditionalPosition</b> Position for additional DM-RS in UL (see TS 38.211 [16], clause 6.4.1.1.3). If the field is absent, the UE applies the value pos2. See also clause 6.4.1.1.3 for additional constraints on how the network may set this field depending on the setting of other fields.</p>
<p><b>dmrs-Type</b> Selection of the DMRS type to be used for UL (see TS 38.211 [16], clause 6.4.1.1.3) If the field is absent, the UE uses DMRS type 1.</p>
<p><b>dmrs-Uplink</b> This field indicates whether low PAPR DMRS is used, as specified in TS38.211 [16], clause 6.4.1.1.1.1.</p>
<p><b>dmrs-UplinkTransformPrecoding</b> This field indicates whether low PAPR DMRS is used for PUSCH with pi/2 BPSK modulation, as specified in TS38.211 [16], clause 6.4.1.1.1.2. The network configures this field only if <i>tp-pi2BPSK</i> is configured in <i>PUSCH-Config</i>.</p>
<p><b>maxLength</b> The maximum number of OFDM symbols for UL front loaded DMRS. <i>len1</i> corresponds to value 1. <i>len2</i> corresponds to value 2. If the field is absent, the UE applies value <i>len1</i>. If set to <i>len2</i>, the UE determines the actual number of DM-RS symbols by the associated DCI. (see TS 38.211 [16], clause 6.4.1.1.3).</p>
<p><b>nPUSCH-Identity</b> Parameter: <math>N_{ID}^{(PUSCH)}</math> for DFT-s-OFDM DMRS. If the value is absent or released, the UE uses the value Physical cell ID (<i>physCellId</i>). See TS 38.211 [16].</p>
<p><b>phaseTrackingRS</b> Configures uplink PTRS (see TS 38.211 [16]).</p>
<p><b>pi2BPSK-ScramblingID0, pi2BPSK-ScramblingID1</b> UL DMRS scrambling initialization for pi/2 BPSK DMRS for PUSCH (see TS 38.211 [16], Clause 6.4.1.1.2). When the field is absent the UE applies the value Physical cell ID (<i>physCellId</i>) of the serving cell.</p>
<p><b>scramblingID0</b> UL DMRS scrambling initialization for CP-OFDM (see TS 38.211 [16], clause 6.4.1.1.1.1). When the field is absent the UE applies the value Physical cell ID (<i>physCellId</i>).</p>
<p><b>scramblingID1</b> UL DMRS scrambling initialization for CP-OFDM. (see TS 38.211 [16], clause 6.4.1.1.1.1). When the field is absent the UE applies the value Physical cell ID (<i>physCellId</i>).</p>
<p><b>sequenceGroupHopping</b> For DMRS transmission with transform precoder the NW may configure group hopping by the cell-specific parameter <i>groupHoppingEnabledTransformPrecoding</i> in <i>PUSCH-ConfigCommon</i>. In this case, the NW may include this UE specific field to disable group hopping for PUSCH transmission except for Msg3, i.e., to override the configuration in <i>PUSCH-ConfigCommon</i> (see TS 38.211 [16]). If the field is absent, the UE uses the same hopping mode as for Msg3.</p>
<p><b>sequenceHopping</b> Determines if sequence hopping is enabled for DMRS transmission with transform precoder for PUSCH transmission other than Msg3 (sequence hopping is always disabled for Msg3). If the field is absent, the UE uses the same hopping mode as for msg3. The network does not configure simultaneous group hopping and sequence hopping. See TS 38.211 [16], clause 6.4.1.1.1.2.</p>
<p><b>transformPrecodingDisabled</b> DMRS related parameters for Cyclic Prefix OFDM.</p>
<p><b>transformPrecodingEnabled</b> DMRS related parameters for DFT-s-OFDM (Transform Precoding).</p>

– **DownlinkConfigCommon**

The IE *DownlinkConfigCommon* provides common downlink parameters of a cell.

**DownlinkConfigCommon information element**

-- ASN1START

```

-- TAG-DOWNLINKCONFIGCOMMON-START
DownlinkConfigCommon ::= SEQUENCE {
    frequencyInfoDL          FrequencyInfoDL          OPTIONAL, -- Cond InterFreqHOAndServCellAdd
    initialDownlinkBWP      BWP-DownlinkCommon      OPTIONAL, -- Cond ServCellAdd
    ...
}
-- TAG-DOWNLINKCONFIGCOMMON-STOP
-- ASN1STOP

```

#### **DownlinkConfigCommon field descriptions**

##### **frequencyInfoDL**

Basic parameters of a downlink carrier and transmission thereon.

##### **initialDownlinkBWP**

The initial downlink BWP configuration for a serving cell. The network configures the *locationAndBandwidth* so that the initial downlink BWP contains the entire CORESET#0 of this serving cell in the frequency domain.

Conditional Presence	Explanation
<i>InterFreqHOAndServCellAdd</i>	This field is mandatory present for inter-frequency handover, and upon serving cell (PSCell/SCell) addition. Otherwise, the field is optionally present, Need M.
<i>ServCellAdd</i>	This field is mandatory present upon serving cell addition (for PSCell and SCell) and upon handover from E-UTRA to NR. It is optionally present, Need M otherwise.

## – DownlinkConfigCommonSIB

The IE *DownlinkConfigCommonSIB* provides common downlink parameters of a cell.

#### **DownlinkConfigCommonSIB information element**

```

-- ASN1START
-- TAG-DOWNLINKCONFIGCOMMONSIB-START
DownlinkConfigCommonSIB ::= SEQUENCE {
    frequencyInfoDL          FrequencyInfoDL-SIB,
    initialDownlinkBWP      BWP-DownlinkCommon,
    bcch-Config              BCCH-Config,
    pcch-Config              PCCH-Config,
    ...
}
BCCH-Config ::= SEQUENCE {
    modificationPeriodCoeff  ENUMERATED {n2, n4, n8, n16},
    ...
}

```

```

PCCH-Config ::= SEQUENCE {
  defaultPagingCycle          PagingCycle,
  nAndPagingFrameOffset      CHOICE {
    oneT                       NULL,
    halfT                      INTEGER (0..1),
    quarterT                   INTEGER (0..3),
    oneEighthT                 INTEGER (0..7),
    oneSixteenthT              INTEGER (0..15)
  },
  ns                          ENUMERATED {four, two, one},
  firstPDCCH-MonitoringOccasionOfPO CHOICE {
    sCS15KHzZoneT              SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..139),
    sCS30KHzZoneT-SCS15KHzhalfT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..279),
    sCS60KHzZoneT-SCS30KHzhalfT-SCS15KHzquarterT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..559),
    sCS120KHzZoneT-SCS60KHzhalfT-SCS30KHzquarterT-SCS15KHzZoneEighthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..1119),
    sCS120KHzhalfT-SCS60KHzquarterT-SCS30KHzZoneEighthT-SCS15KHzZoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..2239),
    sCS120KHzquarterT-SCS60KHzZoneEighthT-SCS30KHzZoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..4479),
    sCS120KHzZoneEighthT-SCS60KHzZoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..8959),
    sCS120KHzZoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..17919)
  } OPTIONAL, -- Need R
  ...
  [[
  nrofPDCCH-MonitoringOccasionPerSSB-InPO-r16 INTEGER (2..4) OPTIONAL -- Cond SharedSpectrum2
  ]]
}

-- TAG-DOWNLINKCONFIGCOMMONSIB-STOP
-- ASN1STOP

```

<b>DownlinkConfigCommonSIB field descriptions</b>	
<b>bcch-Config</b>	The modification period related configuration.
<b>frequencyInfoDL-SIB</b>	Basic parameters of a downlink carrier and transmission thereon.
<b>initialDownlinkBWP</b>	The initial downlink BWP configuration for a PCell. The network configures the <i>locationAndBandwidth</i> so that the initial downlink BWP contains the entire CORESET#0 of this serving cell in the frequency domain. The UE applies the <i>locationAndBandwidth</i> upon reception of this field (e.g. to determine the frequency position of signals described in relation to this <i>locationAndBandwidth</i> ) but it keeps CORESET#0 until after reception of <i>RRCSetup/RRCResume/RRCReestablishment</i> .
<b>nrofPDCCH-MonitoringOccasionPerSSB-InPO</b>	The number of PDCCH monitoring occasions corresponding to an SSB within a Paging Occasion, see TS 38.304 [20], clause 7.1.
<b>pcch-Config</b>	The paging related configuration.



<b>BCCH-Config field descriptions</b>
<p><b>modificationPeriodCoeff</b> Actual modification period, expressed in number of radio frames <math>m = \text{modificationPeriodCoeff} * \text{defaultPagingCycle}</math>, see clause 5.2.2.2.2. <math>n2</math> corresponds to value 2, <math>n4</math> corresponds to value 4, and so on.</p>

<b>PCCH-Config field descriptions</b>
<p><b>defaultPagingCycle</b> Default paging cycle, used to derive 'T' in TS 38.304 [20]. Value <math>rf32</math> corresponds to 32 radio frames, value <math>rf64</math> corresponds to 64 radio frames and so on.</p>
<p><b>firstPDCCH-MonitoringOccasionOfPO</b> Points out the first PDCCH monitoring occasion for paging of each PO of the PF, see TS 38.304 [20].</p>
<p><b>nAndPagingFrameOffset</b> Used to derive the number of total paging frames in T (corresponding to parameter N in TS 38.304 [20]) and paging frame offset (corresponding to parameter PF_offset in TS 38.304 [20]). A value of <math>oneSixteenthT</math> corresponds to <math>T / 16</math>, a value of <math>oneEighthT</math> corresponds to <math>T / 8</math>, and so on. If <math>\text{pagingSearchSpace}</math> is set to zero and if SS/PBCH block and CORESET multiplexing pattern is 2 or 3 (as specified in TS 38.213 [13]):</p> <ul style="list-style-type: none"> <li>- for <math>\text{ssb-periodicityServingCell}</math> of 5 or 10 ms, N can be set to one of <math>\{oneT, halfT, quarterT, oneEighthT, oneSixteenthT\}</math></li> <li>- for <math>\text{ssb-periodicityServingCell}</math> of 20 ms, N can be set to one of <math>\{halfT, quarterT, oneEighthT, oneSixteenthT\}</math></li> <li>- for <math>\text{ssb-periodicityServingCell}</math> of 40 ms, N can be set to one of <math>\{quarterT, oneEighthT, oneSixteenthT\}</math></li> <li>- for <math>\text{ssb-periodicityServingCell}</math> of 80 ms, N can be set to one of <math>\{oneEighthT, oneSixteenthT\}</math></li> <li>- for <math>\text{ssb-periodicityServingCell}</math> of 160 ms, N can be set to <math>oneSixteenthT</math></li> </ul> <p>If <math>\text{pagingSearchSpace}</math> is set to zero and if SS/PBCH block and CORESET multiplexing pattern is 1 (as specified in TS 38.213 [13]), N can be set to one of <math>\{halfT, quarterT, oneEighthT, oneSixteenthT\}</math> If <math>\text{pagingSearchSpace}</math> is not set to zero, N can be configured to one of <math>\{oneT, halfT, quarterT, oneEighthT, oneSixteenthT\}</math></p>
<p><b>ns</b> Number of paging occasions per paging frame.</p>

<b>Conditional Presence</b>	<b>Explanation</b>
<i>SharedSpectrum2</i>	The field is optional present, Need R, if this cell operates with shared spectrum channel access. Otherwise, it is absent, Need R.

## – DownlinkPreemption

The IE *DownlinkPreemption* is used to configure the UE to monitor PDCCH for the INT-RNTI (interruption).

### **DownlinkPreemption information element**

```
-- ASN1START
-- TAG-DOWNLINKPREEMPTION-START

DownlinkPreemption ::=
    int-RNTI                SEQUENCE {
        int-RNTI            RNTI-Value,
        timeFrequencySet    ENUMERATED {set0, set1},
        dci-PayloadSize     INTEGER (0..maxINT-DCI-PayloadSize),
        int-ConfigurationPerServingCell SEQUENCE (SIZE (1..maxNrofServingCells)) OF INT-ConfigurationPerServingCell,
        ...
    }
```

```

}
INT-ConfigurationPerServingCell ::= SEQUENCE {
    servingCellId          ServCellIndex,
    positionInDCI          INTEGER (0..maxINT-DCI-PayloadSize-1)
}
-- TAG-DOWNLINKPREEMPTION-STOP
-- ASN1STOP

```

#### **DownlinkPreemption field descriptions**

**dci-PayloadSize**

Total length of the DCI payload scrambled with INT-RNTI (see TS 38.213 [13], clause 11.2).

**int-ConfigurationPerServingCell**

Indicates (per serving cell) the position of the 14 bit INT values inside the DCI payload (see TS 38.213 [13], clause 11.2).

**int-RNTI**

RNTI used for indication pre-emption in DL (see TS 38.213 [13], clause 10).

**timeFrequencySet**

Set selection for DL-preemption indication (see TS 38.213 [13], clause 11.2) The set determines how the UE interprets the DL preemption DCI payload.

#### **INT-ConfigurationPerServingCell field descriptions**

**positionInDCI**

Starting position (in number of bit) of the 14 bit INT value applicable for this serving cell (*servingCellId*) within the DCI payload (see TS 38.213 [13], clause 11.2). Must be multiples of 14 (bit).

### – **DRB-Identity**

The IE *DRB-Identity* is used to identify a DRB used by a UE.

#### **DRB-Identity information element**

```

-- ASN1START
-- TAG-DRB-IDENTITY-START

DRB-Identity ::=
    INTEGER (1..32)

-- TAG-DRB-IDENTITY-STOP
-- ASN1STOP

```

### – **DRX-Config**

The IE *DRX-Config* is used to configure DRX related parameters.

**DRX-Config information element**

```

-- ASN1START
-- TAG-DRX-CONFIG-START

DRX-Config ::=
  drx-onDurationTimer          SEQUENCE {
                                CHOICE {
                                  subMilliseconds INTEGER (1..31),
                                  milliseconds    ENUMERATED {
                                    ms1, ms2, ms3, ms4, ms5, ms6, ms8, ms10, ms20, ms30, ms40, ms50, ms60,
                                    ms80, ms100, ms200, ms300, ms400, ms500, ms600, ms800, ms1000, ms1200,
                                    ms1600, spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 }
                                },
                                drx-InactivityTimer          ENUMERATED {
                                  ms0, ms1, ms2, ms3, ms4, ms5, ms6, ms8, ms10, ms20, ms30, ms40, ms50, ms60, ms80,
                                  ms100, ms200, ms300, ms500, ms750, ms1280, ms1920, ms2560, spare9, spare8,
                                  spare7, spare6, spare5, spare4, spare3, spare2, spare1},
                                drx-HARQ-RTT-TimerDL        INTEGER (0..56),
                                drx-HARQ-RTT-TimerUL        INTEGER (0..56),
                                drx-RetransmissionTimerDL    ENUMERATED {
                                  sl0, sl1, sl2, sl4, sl6, sl8, sl16, sl24, sl33, sl40, sl64, sl80, sl96, sl112, sl128,
                                  sl160, sl320, spare15, spare14, spare13, spare12, spare11, spare10, spare9,
                                  spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1},
                                drx-RetransmissionTimerUL    ENUMERATED {
                                  sl0, sl1, sl2, sl4, sl6, sl8, sl16, sl24, sl33, sl40, sl64, sl80, sl96, sl112, sl128,
                                  sl160, sl320, spare15, spare14, spare13, spare12, spare11, spare10, spare9,
                                  spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 },
                                drx-LongCycleStartOffset     CHOICE {
                                  ms10                INTEGER(0..9),
                                  ms20                INTEGER(0..19),
                                  ms32                INTEGER(0..31),
                                  ms40                INTEGER(0..39),
                                  ms60                INTEGER(0..59),
                                  ms64                INTEGER(0..63),
                                  ms70                INTEGER(0..69),
                                  ms80                INTEGER(0..79),
                                  ms128               INTEGER(0..127),
                                  ms160               INTEGER(0..159),
                                  ms256               INTEGER(0..255),
                                  ms320               INTEGER(0..319),
                                  ms512               INTEGER(0..511),
                                  ms640               INTEGER(0..639),
                                  ms1024              INTEGER(0..1023),
                                  ms1280              INTEGER(0..1279),
                                  ms2048              INTEGER(0..2047),
                                  ms2560              INTEGER(0..2559),
                                  ms5120              INTEGER(0..5119),
                                  ms10240             INTEGER(0..10239)
                                },
                                shortDRX                SEQUENCE {
                                  drx-ShortCycle       ENUMERATED {
                                    ms2, ms3, ms4, ms5, ms6, ms7, ms8, ms10, ms14, ms16, ms20, ms30, ms32,
                                    ms35, ms40, ms64, ms80, ms128, ms160, ms256, ms320, ms512, ms640, spare9,
                                    spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 },
                                }
  }

```

```

    drx-ShortCycleTimer          INTEGER (1..16)
  }
  drx-SlotOffset                INTEGER (0..31)
}
-- TAG-DRX-CONFIG-STOP
-- ASN1STOP

```

<b>DRX-Config field descriptions</b>
<b>drx-HARQ-RTT-TimerDL</b> Value in number of symbols of the BWP where the transport block was received.
<b>drx-HARQ-RTT-TimerUL</b> Value in number of symbols of the BWP where the transport block was transmitted.
<b>drx-InactivityTimer</b> Value in multiple integers of 1 ms. <i>ms0</i> corresponds to 0, <i>ms1</i> corresponds to 1 ms, <i>ms2</i> corresponds to 2 ms, and so on.
<b>drx-LongCycleStartOffset</b> <i>drx-LongCycle</i> in ms and <i>drx-StartOffset</i> in multiples of 1 ms. If <i>drx-ShortCycle</i> is configured, the value of <i>drx-LongCycle</i> shall be a multiple of the <i>drx-ShortCycle</i> value.
<b>drx-onDurationTimer</b> Value in multiples of 1/32 ms (subMilliSeconds) or in ms (milliSecond). For the latter, value <i>ms1</i> corresponds to 1 ms, value <i>ms2</i> corresponds to 2 ms, and so on.
<b>drx-RetransmissionTimerDL</b> Value in number of slot lengths of the BWP where the transport block was received. value <i>s0</i> corresponds to 0 slots, <i>s1</i> corresponds to 1 slot, <i>s2</i> corresponds to 2 slots, and so on.
<b>drx-RetransmissionTimerUL</b> Value in number of slot lengths of the BWP where the transport block was transmitted. <i>s0</i> corresponds to 0 slots, <i>s1</i> corresponds to 1 slot, <i>s2</i> corresponds to 2 slots, and so on.
<b>drx-ShortCycleTimer</b> Value in multiples of <i>drx-ShortCycle</i> . A value of 1 corresponds to <i>drx-ShortCycle</i> , a value of 2 corresponds to 2 * <i>drx-ShortCycle</i> and so on.
<b>drx-ShortCycle</b> Value in ms. <i>ms1</i> corresponds to 1 ms, <i>ms2</i> corresponds to 2 ms, and so on.
<b>drx-SlotOffset</b> Value in 1/32 ms. Value 0 corresponds to 0 ms, value 1 corresponds to 1/32 ms, value 2 corresponds to 2/32 ms, and so on.

## – DRX-ConfigSecondaryGroup

The IE *DRX-ConfigSecondaryGroup* is used to configure DRX related parameters for the second DRX group as specified in TS 38.321 [3].

### DRX-ConfigSecondaryGroup information element

```

-- ASN1START
-- TAG-DRX-CONFIGSECONDARYGROUP-START

DRX-ConfigSecondaryGroup ::= SEQUENCE {
    drx-onDurationTimer      CHOICE {
        subMilliSeconds     INTEGER (1..31),
        milliSeconds        ENUMERATED {
            ms1, ms2, ms3, ms4, ms5, ms6, ms8, ms10, ms20, ms30, ms40, ms50, ms60,

```

```

ms80, ms100, ms200, ms300, ms400, ms500, ms600, ms800, ms1000, ms1200,
ms1600, spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 }
    },
drx-InactivityTimer      ENUMERATED {
ms0, ms1, ms2, ms3, ms4, ms5, ms6, ms8, ms10, ms20, ms30, ms40, ms50, ms60, ms80,
ms100, ms200, ms300, ms500, ms750, ms1280, ms1920, ms2560, spare9, spare8,
spare7, spare6, spare5, spare4, spare3, spare2, spare1}
}

-- TAG-DRX-CONFIGSECONDARYGROUP-STOP
-- ASN1STOP

```

#### **DRX-ConfigSecondaryGroup field descriptions**

##### ***drx-InactivityTimer***

Value in multiple integers of 1 ms. *ms0* corresponds to 0, *ms1* corresponds to 1 ms, *ms2* corresponds to 2 ms, and so on, as specified in TS 38.321 [3]. The network configures a *drx-InactivityTimer* value for the second DRX group that is smaller than the *drx-InactivityTimer* configured for the default DRX group in IE *DRX-Config*.

##### ***drx-onDurationTimer***

Value in multiples of 1/32 ms (subMilliSeconds) or in ms (milliSecond). For the latter, value *ms1* corresponds to 1 ms, value *ms2* corresponds to 2 ms, and so on, as specified in TS 38.321 [3]. The network configures a *drx-onDurationTimer* value for the second DRX group that is smaller than the *drx-onDurationTimer* configured for the default DRX group in IE *DRX-Config*.

#### – ***FilterCoefficient***

The IE *FilterCoefficient* specifies the measurement filtering coefficient. Value *fc0* corresponds to  $k = 0$ , *fc1* corresponds to  $k = 1$ , and so on.

#### ***FilterCoefficient* information element**

```

-- ASN1START
-- TAG-FILTERCOEFFICIENT-START

FilterCoefficient ::=      ENUMERATED { fc0, fc1, fc2, fc3, fc4, fc5, fc6, fc7, fc8, fc9, fc11, fc13, fc15, fc17, fc19, spare1, ...}

-- TAG-FILTERCOEFFICIENT-STOP
-- ASN1STOP

```

#### – ***FreqBandIndicatorNR***

The IE *FreqBandIndicatorNR* is used to convey an NR frequency band number as defined in TS 38.101-1 [15] and TS 38.101-2 [39].

#### ***FreqBandIndicatorNR* information element**

```

-- ASN1START
-- TAG-FREQBANDINDICATORNR-START

```

```
FreqBandIndicatorNR ::= INTEGER (1..1024)
```

```
-- TAG-FREQBANDINDICATORNR-STOP
-- ASN1STOP
```

## – FrequencyInfoDL

The IE *FrequencyInfoDL* provides basic parameters of a downlink carrier and transmission thereon.

### FrequencyInfoDL information element

```
-- ASN1START
-- TAG-FREQUENCYINFODL-START
```

```
FrequencyInfoDL ::= SEQUENCE {
  absoluteFrequencySSB ARFCN-ValueNR OPTIONAL, -- Cond SpCellAdd
  frequencyBandList MultiFrequencyBandListNR,
  absoluteFrequencyPointA ARFCN-ValueNR,
  scs-SpecificCarrierList SEQUENCE (SIZE (1..maxSCSs)) OF SCS-SpecificCarrier,
  ...
}
```

```
-- TAG-FREQUENCYINFODL-STOP
-- ASN1STOP
```

#### FrequencyInfoDL field descriptions

##### **absoluteFrequencyPointA**

Absolute frequency position of the reference resource block (Common RB 0). Its lowest subcarrier is also known as Point A (see TS 38.211 [16], clause 4.4.4.2). Note that the lower edge of the actual carrier is not defined by this field but rather in the *scs-SpecificCarrierList*.

##### **absoluteFrequencySSB**

Frequency of the SSB to be used for this serving cell. SSB related parameters (e.g. SSB index) provided for a serving cell refer to this SSB frequency unless mentioned otherwise. The cell-defining SSB of the PCell is always on the sync raster. Frequencies are considered to be on the sync raster if they are also identifiable with a GSCN value (see TS 38.101-1 [15]). If the field is absent, the SSB related parameters should be absent, e.g. *ssb-PositionsInBurst*, *ssb-periodicityServingCell* and *subcarrierSpacing* in *ServingCellConfigCommon* IE. If the field is absent, the UE obtains timing reference from the SpCell. This is only supported in case the SCell is in the same frequency band as the SpCell.

##### **frequencyBandList**

List containing only one frequency band to which this carrier(s) belongs. Multiple values are not supported.

##### **scs-SpecificCarrierList**

A set of carriers for different subcarrier spacings (numerologies). Defined in relation to Point A. The network configures a *scs-SpecificCarrier* at least for each numerology (SCS) that is used e.g. in a BWP (see TS 38.211 [16], clause 5.3).

Conditional Presence	Explanation
<i>SpCellAdd</i>	The field is mandatory present if this <i>FrequencyInfoDL</i> is for SpCell. Otherwise the field is optionally present, Need S.

## – *FrequencyInfoDL-SIB*

The IE *FrequencyInfoDL-SIB* provides basic parameters of a downlink carrier and transmission thereon.

### ***FrequencyInfoDL-SIB* information element**

```
-- ASN1START
-- TAG-FREQUENCYINFODL-SIB-START

FrequencyInfoDL-SIB ::=
    frequencyBandList      MultiFrequencyBandListNR-SIB,
    offsetToPointA         INTEGER (0..2199),
    scs-SpecificCarrierList SEQUENCE (SIZE (1..maxSCSs)) OF SCS-SpecificCarrier
}

-- TAG-FREQUENCYINFODL-SIB-STOP
-- ASN1STOP
```

### ***FrequencyInfoDL-SIB* field descriptions**

#### ***offsetToPointA***

Represents the offset to Point A as defined in TS 38.211 [16], clause 4.4.4.2.

#### ***frequencyBandList***

List of one or multiple frequency bands to which this carrier(s) belongs.

#### ***scs-SpecificCarrierList***

A set of carriers for different subcarrier spacings (numerologies). Defined in relation to Point A (see TS 38.211 [16], clause 5.3). The network configures this for all SCSs that are used in DL BWPs in this serving cell.

## – *FrequencyInfoUL*

The IE *FrequencyInfoUL* provides basic parameters of an uplink carrier and transmission thereon.

### ***FrequencyInfoUL* information element**

```
-- ASN1START
-- TAG-FREQUENCYINFOUL-START

FrequencyInfoUL ::=
    frequencyBandList      MultiFrequencyBandListNR                               OPTIONAL, -- Cond FDD-OrSUL
    absoluteFrequencyPointA ARFCN-ValueNR                                       OPTIONAL, -- Cond FDD-OrSUL
    scs-SpecificCarrierList SEQUENCE (SIZE (1..maxSCSs)) OF SCS-SpecificCarrier,
    additionalSpectrumEmission AdditionalSpectrumEmission                       OPTIONAL, -- Need S
    p-Max                  P-Max                                                 OPTIONAL, -- Need S
    frequencyShift7p5khz  ENUMERATED {true}                                     OPTIONAL, -- Cond FDD-TDD-OrSUL-Optional
    ...
}

-- TAG-FREQUENCYINFOUL-STOP
```

-- ASN1STOP

<i>FrequencyInfoUL</i> field descriptions
<p><b>absoluteFrequencyPointA</b> Absolute frequency of the reference resource block (Common RB 0). Its lowest subcarrier is also known as Point A. Note that the lower edge of the actual carrier is not defined by this field but rather in the <i>scs-SpecificCarrierList</i> (see TS 38.211 [16], clause 4.4.4.2).</p>
<p><b>additionalSpectrumEmission</b> The additional spectrum emission requirements to be applied by the UE on this uplink. If the field is absent, the UE uses value 0 for the <i>additionalSpectrumEmission</i> (see TS 38.101-1 [15], table 6.2.3.1-1A, and TS 38.101-2 [39], table 6.2.3.1-2).</p>
<p><b>frequencyBandList</b> List containing only one frequency band to which this carrier(s) belongs. Multiple values are not supported.</p>
<p><b>frequencyShift7p5khz</b> Enable the NR UL transmission with a 7.5 kHz shift to the LTE raster. If the field is absent, the frequency shift is disabled.</p>
<p><b>p-Max</b> Maximum transmit power allowed in this serving cell. The maximum transmit power that the UE may use on this serving cell may be additionally limited by <i>p-NR-FR1</i> (configured for the cell group) and by <i>p-UE-FR1</i> (configured total for all serving cells operating on FR1). If absent, the UE applies the maximum power according to TS 38.101-1 [15]. Value in dBm.</p>
<p><b>scs-SpecificCarrierList</b> A set of carriers for different subcarrier spacings (numerologies). Defined in relation to Point A. The network configures a <i>scs-SpecificCarrier</i> at least for each numerology (SCS) that is used e.g. in a BWP (see TS 38.211 [16], clause 5.3).</p>

Conditional Presence	Explanation
<i>FDD-OrSUL</i>	The field is mandatory present if this <i>FrequencyInfoUL</i> is for the paired UL for a DL (defined in a <i>FrequencyInfoDL</i> ) or if this <i>FrequencyInfoUL</i> is for a supplementary uplink (SUL). It is absent, Need R, otherwise (if this <i>FrequencyInfoUL</i> is for an unpaired UL (TDD)).
<i>FDD-TDD-OrSUL-Optional</i>	The field is optionally present, Need R, if this <i>FrequencyInfoUL</i> is for the paired UL for a DL (defined in a <i>FrequencyInfoDL</i> ), or if this <i>FrequencyInfoUL</i> is for an unpaired UL (TDD) in certain bands (as defined in clause 5.4.2.1 of TS 38.101-1 and in clause 5.4.2.1 of TS 38.104 [12]), or if this <i>FrequencyInfoUL</i> is for a supplementary uplink (SUL). It is absent, Need R, otherwise.

– *FrequencyInfoUL-SIB*

The IE *FrequencyInfoUL-SIB* provides basic parameters of an uplink carrier and transmission thereon.

***FrequencyInfoUL-SIB* information element**

-- ASN1START  
-- TAG-FREQUENCYINFOUL-SIB-START

```

FrequencyInfoUL-SIB ::=
    frequencyBandList           SEQUENCE {
        MultiFrequencyBandListNR-SIB
        ARFCN-ValueNR           OPTIONAL, -- Cond FDD-OrSUL
        scs-SpecificCarrierList SEQUENCE (SIZE (1..maxSCSs)) OF SCS-SpecificCarrier,
        p-Max                   OPTIONAL, -- Need S
    }
    
```



```

    frequencyShift7p5khz      ENUMERATED {true}          OPTIONAL,    -- Cond FDD-TDD-OrSUL-Optional
    ...
}
-- TAG-FREQUENCYINFOUL-SIB-STOP
-- ASN1STOP

```

<b>FrequencyInfoUL-SIB field descriptions</b>
<p><b>absoluteFrequencyPointA</b>                      Absolute frequency of the reference resource block (Common RB 0). Its lowest subcarrier is also known as Point A. Note that the lower edge of the actual carrier is not defined by this field but rather in the <i>scs-SpecificCarrierList</i> (see TS 38.211 [16], clause 4.4.4.2).</p>
<p><b>frequencyBandList</b>                      Provides the frequency band indicator and a list of <i>additionalPmax</i> and <i>additionalSpectrumEmission</i> values as defined in TS 38.101-1 [15], table 6.2.3.1-1, and TS 38.101-2 [39], table 6.2.3.1-2. The UE shall apply the first listed band which it supports in the <i>frequencyBandList</i> field.</p>
<p><b>frequencyShift7p5khz</b>                      Enable the NR UL transmission with a 7.5 kHz shift to the LTE raster. If the field is absent, the frequency shift is disabled.</p>
<p><b>p-Max</b>                      Value in dBm applicable for the cell. If absent the UE applies the maximum power according to TS 38.101-1 [15] in case of an FR1 cell or TS 38.101-2 [39] in case of an FR2 cell. In this release of the specification, if p-Max is present on a carrier frequency in FR2, the UE shall ignore the field and applies the maximum power according to TS 38.101-2 [39].</p>
<p><b>scs-SpecificCarrierList</b>                      A set of carriers for different subcarrier spacings (numerologies). Defined in relation to Point A (see TS 38.211 [16], clause 5.3). The network configures this for all SCSs that are used in UL BWPs configured in this serving cell.</p>

<b>Conditional Presence</b>	<b>Explanation</b>
<i>FDD-OrSUL</i>	The field is mandatory present if this <i>FrequencyInfoUL-SIB</i> is for the paired UL for a DL (defined in a <i>FrequencyInfoDL-SIB</i> ) or if this <i>FrequencyInfoUL-SIB</i> is for a supplementary uplink (SUL). It is absent otherwise (if this <i>FrequencyInfoUL-SIB</i> is for an unpaired UL (TDD)).
<i>FDD-TDD-OrSUL-Optional</i>	The field is optionally present, Need R, if this <i>FrequencyInfoUL-SIB</i> is for the paired UL for a DL (defined in a <i>FrequencyInfoDL-SIB</i> ), or if this <i>FrequencyInfoUL-SIB</i> is for an unpaired UL (TDD) in certain bands (as defined in clause 5.4.2.1 of TS 38.101-1 and in clause 5.4.2.1 of TS 38.104 [12]), or if this <i>FrequencyInfoUL-SIB</i> is for a supplementary uplink (SUL). It is absent otherwise.

– **HighSpeedConfig**

The IE *HighSpeedConfig* is used to configure parameters for high speed scenarios.

**HighSpeedConfig information element**

```

-- ASN1START
-- TAG-HIGHSPEEDCONFIG-START

HighSpeedConfig-r16 ::= SEQUENCE {
    highSpeedMeasFlag-r16    ENUMERATED {true}          OPTIONAL,    -- Need R

```

```

    highSpeedDemodFlag-r16  ENUMERATED {true}      OPTIONAL,  -- Need R
    ...
}
-- TAG-HIGHSPEEDCONFIG-STOP
-- ASN1STOP

```

#### **HighSpeedConfig field descriptions**

##### **highSpeedMeasFlag-r16**

If the field is present, the UE shall apply the enhanced RRM requirements to support high speed up to 500 km/h as specified in TS 38.133 [14].

##### **highSpeedDemodFlag-r16**

If the field is present, the UE shall apply the enhanced demodulation processing for HST-SFN joint transmission scheme with velocity up to 500km/h as specified in TS 38.101-4 [59].

## – *Hysteresis*

The IE *Hysteresis* is a parameter used within the entry and leave condition of an event triggered reporting condition. The actual value is field value \* 0.5 dB.

#### **Hysteresis information element**

```

-- ASN1START
-- TAG-HYSTERESIS-START

Hysteresis ::=
                INTEGER (0..30)

-- TAG-HYSTERESIS-STOP
-- ASN1STOP

```

## – *InvalidSymbolPattern*

The IE *InvalidSymbolPattern* is used to configure one invalid symbol pattern for PUSCH transmission repetition type B applicable for both DCI format 0\_1 and 0\_2, see TS 38.214 [19], clause 6.1.

#### **InvalidSymbolPattern information element**

```

-- ASN1START
-- TAG-INVALIDSYMBOLPATTERN-START

InvalidSymbolPattern-r16 ::=
    SEQUENCE {
        symbols-r16          CHOICE {
            oneSlot          BIT STRING (SIZE (14)),
            twoSlots         BIT STRING (SIZE (28))
        },
        periodicityAndPattern-r16 CHOICE {
            n2               BIT STRING (SIZE (2)),
            n4               BIT STRING (SIZE (4)),
            n5               BIT STRING (SIZE (5)),
        }
    }

```

```

n8          BIT STRING (SIZE (8)),
n10         BIT STRING (SIZE (10)),
n20         BIT STRING (SIZE (20)),
n40         BIT STRING (SIZE (40))
}
...
}
-- TAG-INVALIDSYMBOLPATTERN-STOP
-- ASN1STOP
OPTIONAL, -- Need M

```

#### *InvalidSymbolPattern* field descriptions

##### ***periodicityAndPattern***

A time domain repetition pattern at which the pattern. This slot pattern repeats itself continuously. When the field is not configured, the UE uses the value n1 (see TS 38.214 [19], clause 6.1).

##### ***symbols***

A symbol level bitmap in time domain (see TS 38.214[19], clause 6.1).

## – *I-RNTI-Value*

The IE *I-RNTI-Value* is used to identify the suspended UE context of a UE in RRC\_INACTIVE.

#### ***I-RNTI-Value* information element**

```

-- ASN1START
-- TAG-I-RNTI-VALUE-START

I-RNTI-Value ::= BIT STRING (SIZE(40))

-- TAG-I-RNTI-VALUE-STOP
-- ASN1STOP

```

## – *LBT-FailureRecoveryConfig*

The IE *LBT-FailureRecoveryConfig-r16* is used to configure the parameters used for detection of consistent uplink LBT failures for operation with shared spectrum channel access, as specified in TS 38.321 [3].

#### ***LBT-FailureRecoveryConfig* information element**

```

-- ASN1START
-- TAG-LBT-FAILURERECOVERYCONFIG-START

LBT-FailureRecoveryConfig-r16 ::= SEQUENCE {
  lbt-FailureInstanceMaxCount-r16  ENUMERATED {n4, n8, n16, n32, n64, n128},
  lbt-FailureDetectionTimer-r16    ENUMERATED {ms10, ms20, ms40, ms80, ms160, ms320},

```

```

}
...
-- TAG-LBT-FAILURERECOVERYCONFIG-STOP
-- ASN1STOP

```

#### ***LBT-FailureRecoveryConfig* field descriptions**

##### ***lbt-FailureDetectionTimer***

Timer for consistent uplink LBT failure detection (see TS 38.321 [3]). Value *ms10* corresponds to 10 ms, value *ms20* corresponds to 20 ms, and so on.

##### ***lbt-FailureInstanceMaxCount***

This field determines after how many consistent uplink LBT failure events the UE triggers uplink LBT failure recovery (see TS 38.321 [3]). Value *n4* corresponds to 4, value *n8* corresponds to 8, and so on.

## – *LocationInfo*

The IE *LocationInfo* is used to transfer available detailed location information, Bluetooth, WLAN and sensor available measurement results at the UE.

#### ***LocationInfo* information element**

```

-- ASN1START
-- TAG-LOCATIONINFO-START

LocationInfo-r16 ::= SEQUENCE {
    commonLocationInfo-r16      CommonLocationInfo-r16      OPTIONAL,
    bt-LocationInfo-r16        LogMeasResultListBT-r16      OPTIONAL,
    wlan-LocationInfo-r16     LogMeasResultListWLAN-r16     OPTIONAL,
    sensor-LocationInfo-r16    Sensor-LocationInfo-r16     OPTIONAL,
    ...
}

-- TAG-LOCATIONINFO-STOP
-- ASN1STOP

```

## – *LocationMeasurementInfo*

The IE *LocationMeasurementInfo* defines the information sent by the UE to the network to assist with the configuration of measurement gaps for location related measurements.

#### ***LocationMeasurementInfo* information element**

```

-- ASN1START
-- TAG-LOCATIONMEASUREMENTINFO-START

LocationMeasurementInfo ::= CHOICE {
    eutra-RSTD      EUTRA-RSTD-InfoList,
    ...
}

```

```
    eutra-FineTimingDetection    NULL,
    nr-PRS-Measurement-r16       NR-PRS-MeasurementInfoList-r16
}

EUTRA-RSTD-InfoList ::= SEQUENCE (SIZE (1..maxInterRAT-RSTD-Freq)) OF EUTRA-RSTD-Info

EUTRA-RSTD-Info ::= SEQUENCE {
    carrierFreq                ARFCN-ValueEUTRA,
    measPRS-Offset              INTEGER (0..39),
    ...
}

NR-PRS-MeasurementInfoList-r16 ::= SEQUENCE (SIZE (1..maxFreqLayers)) OF NR-PRS-MeasurementInfo-r16

NR-PRS-MeasurementInfo-r16 ::= SEQUENCE {
    dl-PRS-PointA-r16          ARFCN-ValueNR,
    nr-MeasPRS-RepetitionAndOffset-r16 CHOICE {
        ms20-r16                INTEGER (0..19),
        ms40-r16                INTEGER (0..39),
        ms80-r16                INTEGER (0..79),
        ms160-r16               INTEGER (0..159),
        ...
    },
    nr-MeasPRS-length-r16      ENUMERATED {ms1dot5, ms3, ms3dot5, ms4, ms5dot5, ms6, ms10, ms20},
    ...
}

-- TAG-LOCATIONMEASUREMENTINFO-STOP
-- ASN1STOP
```



```
[[
  allowedCG-List-r16          SEQUENCE (SIZE (0.. maxNrofConfiguredGrantConfigMAC-r16-1)) OF ConfiguredGrantConfigIndexMAC-r16
                                OPTIONAL, -- Need S
  allowedPHY-PriorityIndex-r16  ENUMERATED {p0, p1}
                                OPTIONAL   -- Need S
]]
}
...
[[
  channelAccessPriority-r16     INTEGER (1..4)
                                OPTIONAL, -- Need R
  bitRateMultiplier-r16       ENUMERATED {x40, x70, x100, x200}
                                OPTIONAL   -- Need R
]]
}

-- TAG-LOGICALCHANNELCONFIG-STOP
-- ASN1STOP
```

<b>LogicalChannelConfig field descriptions</b>
<p><b>allowedCG-List</b> This restriction applies only when the UL grant is a configured grant. If present, UL MAC SDUs from this logical channel can only be mapped to the indicated configured grant configuration. If the size of the sequence is zero, then UL MAC SDUs from this logical channel cannot be mapped to any configured grant configurations. If the field is not present, UL MAC SDUs from this logical channel can be mapped to any configured grant configurations. Corresponds to "allowedCG-List" as specified in TS 38.321 [3].</p>
<p><b>allowedPHY-PriorityIndex</b> This restriction applies only when the UL grant is a dynamic grant. If the field is present and the dynamic grant has a PHY-priority index, UL MAC SDUs from this logical channel can only be mapped to the dynamic grants indicating PHY-priority index equal to the values configured by this field. If the field is present and the dynamic grant does not have a PHY-priority index, UL MAC SDUs from this logical channel can only be mapped to this dynamic grant if the value of the field is <i>p0</i>, see TS 38.213 [13], clause 9. If the field is not present, UL MAC SDUs from this logical channel can be mapped to any dynamic grants. Corresponds to "allowedPHY-PriorityIndex" as specified in TS 38.321 [3].</p>
<p><b>allowedSCS-List</b> If present, UL MAC SDUs from this logical channel can only be mapped to the indicated numerology. Otherwise, UL MAC SDUs from this logical channel can be mapped to any configured numerology. Only the values 15/30/60 kHz (for FR1) and 60/120 kHz (for FR2) are applicable. Corresponds to 'allowedSCS-List' as specified in TS 38.321 [3].</p>
<p><b>allowedServingCells</b> If present, UL MAC SDUs from this logical channel can only be mapped to the serving cells indicated in this list. Otherwise, UL MAC SDUs from this logical channel can be mapped to any configured serving cell of this cell group. Corresponds to 'allowedServingCells' in TS 38.321 [3].</p>
<p><b>bitRateMultiplier</b> Bit rate multiplier for recommended bit rate MAC CE as specified in TS 38.321 [3]. Value <i>x40</i> indicates bit rate multiplier 40, value <i>x60</i> indicates bit rate multiplier 60 and so on.</p>
<p><b>bitRateQueryProhibitTimer</b> The timer is used for bit rate recommendation query in TS 38.321 [3], in seconds. Value <i>s0</i> means 0 s, <i>s0dot4</i> means 0.4 s and so on.</p>
<p><b>bucketSizeDuration</b> Value in ms. <i>ms5</i> corresponds to 5 ms, value <i>ms10</i> corresponds to 10 ms, and so on.</p>
<p><b>channelAccessPriority</b> Indicates the Channel Access Priority Class (CAPC), as specified in TS 38.300 [2], to be used on uplink transmissions for operation with shared spectrum channel access. The network configures this field only for SRB2 and DRBs.</p>
<p><b>configuredGrantType1Allowed</b> If present, UL MAC SDUs from this logical channel can be transmitted on a configured grant type 1. Corresponds to 'configuredGrantType1Allowed' in TS 38.321 [3].</p>
<p><b>logicalChannelGroup</b> ID of the logical channel group, as specified in TS 38.321 [3], which the logical channel belongs to.</p>
<p><b>logicalChannelSR-Mask</b> Controls SR triggering when a configured uplink grant of <i>type1</i> or <i>type2</i> is configured. <i>true</i> indicates that SR masking is configured for this logical channel as specified in TS 38.321 [3].</p>
<p><b>logicalChannelSR-DelayTimerApplied</b> Indicates whether to apply the delay timer for SR transmission for this logical channel. Set to <i>false</i> if <i>logicalChannelSR-DelayTimer</i> is not included in <i>BSR-Config</i>.</p>
<p><b>maxPUSCH-Duration</b> If present, UL MAC SDUs from this logical channel can only be transmitted using uplink grants that result in a PUSCH duration shorter than or equal to the duration indicated by this field. Otherwise, UL MAC SDUs from this logical channel can be transmitted using an uplink grant resulting in any PUSCH duration. Corresponds to "maxPUSCH-Duration" in TS 38.321 [3]. The PUSCH duration is calculated based on the same length of all symbols, and the shortest length applies if the symbol lengths are different.</p>
<p><b>priority</b> Logical channel priority, as specified in TS 38.321 [3].</p>
<p><b>prioritisedBitRate</b> Value in kiloBytes/s. Value <i>kBps0</i> corresponds to 0 kiloBytes/s, value <i>kBps8</i> corresponds to 8 kiloBytes/s, value <i>kBps16</i> corresponds to 16 kiloBytes/s, and so on. For SRBs, the value can only be set to <i>infinity</i>.</p>
<p><b>schedulingRequestId</b> If present, it indicates the scheduling request configuration applicable for this logical channel, as specified in TS 38.321 [3].</p>



Conditional Presence	Explanation
<i>PDCP-CAD</i> duplication	The field is mandatory present if the DRB/SRB associated with this logical channel is configured with PDCP CA duplication in UL (i.e. the PDCP entity is associated with multiple RLC entities belonging to the same cell group). Otherwise the field is optionally present, need R.
<i>UL</i>	The field is mandatory present for a logical channel with uplink if it serves DRB. It is optionally present, Need R, for a logical channel with uplink if it serves an SRB. Otherwise it is absent.

### – *LogicalChannelIdentity*

The IE *LogicalChannelIdentity* is used to identify one logical channel (*LogicalChannelConfig*) and the corresponding RLC bearer (*RLC-BearerConfig*).

#### **LogicalChannelIdentity** information element

```
-- ASN1START
-- TAG-LOGICALCHANNELIDENTITY-START

LogicalChannelIdentity ::=          INTEGER (1..maxLC-ID)

-- TAG-LOGICALCHANNELIDENTITY-STOP
-- ASN1STOP
```

### – *MAC-CellGroupConfig*

The IE *MAC-CellGroupConfig* is used to configure MAC parameters for a cell group, including DRX.

#### **MAC-CellGroupConfig** information element

```
-- ASN1START
-- TAG-MAC-CELLGROUPCONFIG-START

MAC-CellGroupConfig ::=          SEQUENCE {
  drx-Config                      SetupRelease { DRX-Config }          OPTIONAL,  -- Need M
  schedulingRequestConfig         SchedulingRequestConfig          OPTIONAL,  -- Need M
  bsr-Config                      BSR-Config                          OPTIONAL,  -- Need M
  tag-Config                      TAG-Config                          OPTIONAL,  -- Need M
  phr-Config                      SetupRelease { PHR-Config }          OPTIONAL,  -- Need M
  skipUplinkTxDynamic            BOOLEAN,
  . . .
  [[
  csi-Mask                        BOOLEAN                                OPTIONAL,  -- Need M
  dataInactivityTimer            SetupRelease { DataInactivityTimer }  OPTIONAL,  -- Cond MCG-Only
  ]],
  [[
  usePreBSR-r16                  ENUMERATED {true}                    OPTIONAL,  -- Need R
  ]]
```

```

schedulingRequestID-LBT-SCell-r16  SchedulingRequestId          OPTIONAL, -- Need R
lch-BasedPrioritization-r16        ENUMERATED {enabled}          OPTIONAL, -- Need R
schedulingRequestID-BFR-SCell-r16  SchedulingRequestId          OPTIONAL, -- Need R
drx-ConfigSecondaryGroup-r16      SetupRelease { DRX-ConfigSecondaryGroup } OPTIONAL, -- Need M
}}
}

DataInactivityTimer ::=          ENUMERATED {s1, s2, s3, s5, s7, s10, s15, s20, s40, s50, s60, s80, s100, s120, s150, s180}

-- TAG-MAC-CELLGROUPCONFIG-STOP
-- ASN1STOP

```

### MAC-CellGroupConfig field descriptions

<b>usePreBSR</b>	If set to true, the MAC entity of the IAB-MT may use the Pre-emptive BSR.
<b>csi-Mask</b>	If set to true, the UE limits CSI reports to the on-duration period of the DRX cycle, see TS 38.321 [3].
<b>dataInactivityTimer</b>	Releases the RRC connection upon data inactivity as specified in clause 5.3.8.5 and in TS 38.321 [3]. Value <i>s1</i> corresponds to 1 second, value <i>s2</i> corresponds to 2 seconds, and so on.
<b>drx-Config</b>	Used to configure DRX as specified in TS 38.321 [3].
<b>drx-ConfigSecondaryGroup</b>	Used to configure DRX related parameters for the second DRX group as specified in TS 38.321 [3]. The network does not configure secondary DRX group with DCP simultaneously nor secondary DRX group with a dormant BWP simultaneously.
<b>lch-BasedPrioritization</b>	If this field is present, the corresponding MAC entity of the UE is configured with prioritization between overlapping grants and between scheduling request and overlapping grants based on LCH priority, see TS 38.321 [3].
<b>schedulingRequestID-BFR-SCell</b>	Indicates the scheduling request configuration applicable for BFR on SCell, as specified in TS 38.321 [3].
<b>schedulingRequestID-LBT-SCell</b>	Indicates the scheduling request configuration applicable for consistent uplink LBT recovery on SCell, as specified in TS 38.321 [3].
<b>skipUplinkTxDynamic</b>	If set to <i>true</i> , the UE skips UL transmissions as described in TS 38.321 [3].
<b>tag-Config</b>	The field is used to configure parameters for a time-alignment group. The field is not present if any DAPS bearer is configured.

Conditional Presence	Explanation
<i>MCG-Only</i>	This field is optionally present, Need M, for the <i>MAC-CellGroupConfig</i> of the MCG. It is absent otherwise.

### – MeasConfig

The IE *MeasConfig* specifies measurements to be performed by the UE, and covers intra-frequency, inter-frequency and inter-RAT mobility as well as configuration of measurement gaps.

**MeasConfig** information element

```

-- ASN1START
-- TAG-MEASCONFIG-START

MeasConfig ::=
    measObjectToRemoveList      SEQUENCE {
        MeasObjectToRemoveList  OPTIONAL, -- Need N
        measObjectToAddModList  MeasObjectToAddModList  OPTIONAL, -- Need N
        reportConfigToRemoveList ReportConfigToRemoveList  OPTIONAL, -- Need N
        reportConfigToAddModList ReportConfigToAddModList  OPTIONAL, -- Need N
        measIdToRemoveList      MeasIdToRemoveList          OPTIONAL, -- Need N
        measIdToAddModList      MeasIdToAddModList          OPTIONAL, -- Need N
        s-MeasureConfig         CHOICE {
            ssb-RSRP            RSRP-Range,
            csi-RSRP            RSRP-Range
        }
        quantityConfig          QuantityConfig              OPTIONAL, -- Need M
        measGapConfig           MeasGapConfig              OPTIONAL, -- Need M
        measGapSharingConfig    MeasGapSharingConfig       OPTIONAL, -- Need M
        ...,
        [[
            interFrequencyConfig-NoGap-r16  ENUMERATED {true}  OPTIONAL -- Need R
        ]]
    }

MeasObjectToRemoveList ::= SEQUENCE (SIZE (1..maxNrofObjectId)) OF MeasObjectId
MeasIdToRemoveList ::= SEQUENCE (SIZE (1..maxNrofMeasId)) OF MeasId
ReportConfigToRemoveList ::= SEQUENCE (SIZE (1..maxReportConfigId)) OF ReportConfigId

-- TAG-MEASCONFIG-STOP
-- ASN1STOP

```

<i>MeasConfig</i> field descriptions
<b><i>interFrequencyConfig-NoGap-r16</i></b> If the field is set to true, UE is configured to perform SSB based inter-frequency measurement without measurement gaps when the inter-frequency SSB is completely contained in the active DL BWP of the UE, as specified in TS 38.133 [14], clause 9.3. Otherwise, the SSB based inter-frequency measurement is performed within measurement gaps.
<b><i>measGapConfig</i></b> Used to setup and release measurement gaps in NR.
<b><i>measIdToAddModList</i></b> List of measurement identities to add and/or modify.
<b><i>measIdToRemoveList</i></b> List of measurement identities to remove.
<b><i>measObjectToAddModList</i></b> List of measurement objects to add and/or modify.
<b><i>measObjectToRemoveList</i></b> List of measurement objects to remove.
<b><i>reportConfigToAddModList</i></b> List of measurement reporting configurations to add and/or modify.
<b><i>reportConfigToRemoveList</i></b> List of measurement reporting configurations to remove.
<b><i>s-MeasureConfig</i></b> Threshold for NR SpCell RSRP measurement controlling when the UE is required to perform measurements on non-serving cells. Choice of <i>ssb-RSRP</i> corresponds to cell RSRP based on SS/PBCH block and choice of <i>csi-RSRP</i> corresponds to cell RSRP of CSI-RS.
<b><i>measGapSharingConfig</i></b> Specifies the measurement gap sharing scheme and controls setup/ release of measurement gap sharing.

## – *MeasGapConfig*

The IE *MeasGapConfig* specifies the measurement gap configuration and controls setup/release of measurement gaps.

### *MeasGapConfig* information element

```

-- ASN1START
-- TAG-MEASGAPCONFIG-START

MeasGapConfig ::=
    SEQUENCE {
        gapFR2          SetupRelease { GapConfig }          OPTIONAL,  -- Need M
        ...
        [
            gapFR1      SetupRelease { GapConfig }          OPTIONAL,  -- Need M
            gapUE        SetupRelease { GapConfig }          OPTIONAL,  -- Need M
        ]
    }

GapConfig ::=
    SEQUENCE {
        gapOffset      INTEGER (0..159),
        mgl             ENUMERATED {ms1dot5, ms3, ms3dot5, ms4, ms5dot5, ms6},
    }

```

```

    mgrp          ENUMERATED {ms20, ms40, ms80, ms160},
    mgta          ENUMERATED {ms0, ms0dot25, ms0dot5},
    . . . ,
    [[
    refServCellIndicator          ENUMERATED {pCell, pSCell, mcg-FR2}          OPTIONAL  -- Cond NEDCorNRDC
    ]],
    [[
    refFR2ServCellAsyncCA-r16    ServCellIndex          OPTIONAL,  -- Cond AsyncCA
    mgl-r16                      ENUMERATED {ms10, ms20}          OPTIONAL  -- Cond PRS
    ]]
}

-- TAG-MEASGAPCONFIG-STOP
-- ASN1STOP

```

### MeasGapConfig field descriptions

#### gapFR1

Indicates measurement gap configuration that applies to FR1 only. In (NG)EN-DC, *gapFR1* cannot be set up by NR RRC (i.e. only LTE RRC can configure FR1 measurement gap). In NE-DC, *gapFR1* can only be set up by NR RRC (i.e. LTE RRC cannot configure FR1 gap). In NR-DC, *gapFR1* can only be set up in the *measConfig* associated with MCG. *gapFR1* can not be configured together with *gapUE*. The applicability of the FR1 measurement gap is according to Table 9.1.2-2 and Table 9.1.2-3 in TS 38.133 [14].

#### gapFR2

Indicates measurement gap configuration applies to FR2 only. In (NG)EN-DC or NE-DC, *gapFR2* can only be set up by NR RRC (i.e. LTE RRC cannot configure FR2 gap). In NR-DC, *gapFR2* can only be set up in the *measConfig* associated with MCG. *gapFR2* cannot be configured together with *gapUE*. The applicability of the FR2 measurement gap is according to Table 9.1.2-2 and Table 9.1.2-3 in TS 38.133 [14].

#### gapUE

Indicates measurement gap configuration that applies to all frequencies (FR1 and FR2). In (NG)EN-DC, *gapUE* cannot be set up by NR RRC (i.e. only LTE RRC can configure per UE measurement gap). In NE-DC, *gapUE* can only be set up by NR RRC (i.e. LTE RRC cannot configure per UE gap). In NR-DC, *gapUE* can only be set up in the *measConfig* associated with MCG. If *gapUE* is configured, then neither *gapFR1* nor *gapFR2* can be configured. The applicability of the per UE measurement gap is according to Table 9.1.2-2 and Table 9.1.2-3 in TS 38.133 [14].

#### gapOffset

Value *gapOffset* is the gap offset of the gap pattern with MGRP indicated in the field *mgrp*. The value range is from 0 to *mgrp*-1.

#### mgl

Value *mgl* is the measurement gap length in ms of the measurement gap. The measurement gap length is according to in Table 9.1.2-1 in TS 38.133 [14]. Value *ms1dot5* corresponds to 1.5 ms, *ms3* corresponds to 3 ms and so on. If *mgl-r16* is signalled, UE shall use *mgl-r16* (with suffix) and ignore the *mgl* (without suffix).

#### mgrp

Value *mgrp* is measurement gap repetition period in (ms) of the measurement gap. The measurement gap repetition period is according to Table 9.1.2-1 in TS 38.133 [14].

#### mgta

Value *mgta* is the measurement gap timing advance in ms. The applicability of the measurement gap timing advance is according to clause 9.1.2 of TS 38.133 [14]. Value *ms0* corresponds to 0 ms, *ms0dot25* corresponds to 0.25 ms and *ms0dot5* corresponds to 0.5 ms. For FR2, the network only configures 0 ms and 0.25 ms.

#### refFR2ServCellAsyncCA

Indicates the FR2 serving cell identifier whose SFN and subframe is used for FR2 gap calculation for this gap pattern with asynchronous CA involving FR2 carrier(s).

#### refServCellIndicator

Indicates the serving cell whose SFN and subframe are used for gap calculation for this gap pattern. Value pCell corresponds to the PCell, pSCell corresponds to the PSCell, and mcg-FR2 corresponds to a serving cell on FR2 frequency in MCG.

Conditional Presence	Explanation
<i>AsyncCA</i>	This field is mandatory present when configuring FR2 gap pattern to UE in: - (NG)EN-DC or NR SA with asynchronous CA involving FR2 carrier(s); - NE-DC or NR-DC with asynchronous CA involving FR2 carrier(s), if the field <i>refServCellIndicator</i> is set to <i>mcg-FR2</i> . In case the gap pattern to UE in NE-DC and NR-DC is already configured and the serving cell used for the gap calculation corresponds to a serving cell on FR2 frequency in MCG, then the field is optionally present, need M. Otherwise, it is absent, Need R.
<i>NEDCorNRDC</i>	This field is mandatory present when configuring gap pattern to UE in NE-DC or NR-DC. In case the gap pattern to UE in NE-DC and NR-DC is already configured, then the field is absent, need M. Otherwise, it is absent.
<i>PRS</i>	This field is optionally present, Need R, when configuring gap pattern to UE for measurements of DL-PRS configured via LPP (TS 37.355 [49]). Otherwise, it is absent.

### – *MeasGapSharingConfig*

The IE *MeasGapSharingConfig* specifies the measurement gap sharing scheme and controls setup/ release of measurement gap sharing.

#### ***MeasGapSharingConfig* information element**

```

-- ASN1START
-- TAG-MEASGAPSHARINGCONFIG-START

MeasGapSharingConfig ::=          SEQUENCE {
    gapSharingFR2                  SetupRelease { MeasGapSharingScheme }    OPTIONAL,    -- Need M
    ...,
    [
        gapSharingFR1              SetupRelease { MeasGapSharingScheme }    OPTIONAL,    --Need M
        gapSharingUE               SetupRelease { MeasGapSharingScheme }    OPTIONAL     --Need M
    ]
}

MeasGapSharingScheme ::=          ENUMERATED {scheme00, scheme01, scheme10, scheme11}

-- TAG-MEASGAPSHARINGCONFIG-STOP
-- ASN1STOP

```

<b>MeasGapSharingConfig field descriptions</b>
<p><b>gapSharingFR1</b> Indicates the measurement gap sharing scheme that applies to the gap set for FR1 only. In (NG)EN-DC, <i>gapSharingFR1</i> cannot be set up by NR RRC (i.e. only LTE RRC can configure FR1 gap sharing). In NE-DC, <i>gapSharingFR1</i> can only be set up by NR RRC (i.e. LTE RRC cannot configure FR1 gap sharing). In NR-DC, <i>gapSharingFR1</i> can only be set up in the <i>measConfig</i> associated with MCG. <i>gapSharingFR1</i> can not be configured together with <i>gapSharingUE</i>. For the applicability of the different gap sharing schemes, see TS 38.133 [14]. Value <i>scheme00</i> corresponds to scheme "00", value <i>scheme01</i> corresponds to scheme "01", and so on.</p>
<p><b>gapSharingFR2</b> Indicates the measurement gap sharing scheme that applies to the gap set for FR2 only. In (NG)EN-DC or NE-DC, <i>gapSharingFR2</i> can only be set up by NR RRC (i.e. LTE RRC cannot configure FR2 gap sharing). In NR-DC, <i>gapSharingFR2</i> can only be set up by MCG in the <i>measConfig</i> associated with MCG. <i>gapSharingFR2</i> cannot be configured together with <i>gapSharingUE</i>. For applicability of the different gap sharing schemes, see TS 38.133 [14]. Value <i>scheme00</i> corresponds to scheme "00", value <i>scheme01</i> corresponds to scheme "01", and so on.</p>
<p><b>gapSharingUE</b> Indicates the measurement gap sharing scheme that applies to the gap set per UE. In (NG)EN-DC, <i>gapSharingUE</i> cannot be set up by NR RRC (i.e. only LTE RRC can configure per UE gap sharing). In NE-DC, <i>gapSharingUE</i> can only be set up by NR RRC (i.e. LTE RRC cannot configure per UE gap sharing). In NR-DC, <i>gapSharingUE</i> can only be set up in the <i>measConfig</i> associated with MCG. If <i>gapSharingUE</i> is configured, then neither <i>gapSharingFR1</i> nor <i>gapSharingFR2</i> can be configured. For the applicability of the different gap sharing schemes, see TS 38.133 [14]. Value <i>scheme00</i> corresponds to scheme "00", value <i>scheme01</i> corresponds to scheme "01", and so on.</p>

## – *MeasId*

The IE *MeasId* is used to identify a measurement configuration, i.e., linking of a measurement object and a reporting configuration.

### **MeasId information element**

```
-- ASN1START
-- TAG-MEASID-START

MeasId ::=                               INTEGER (1..maxNrofMeasId)

-- TAG-MEASID-STOP
-- ASN1STOP
```

## – *MeasIdleConfig*

The IE *MeasIdleConfig* is used to convey information to UE about measurements requested to be done while in RRC\_IDLE or RRC\_INACTIVE.

### **MeasIdleConfig information element**

```
-- ASN1START
-- TAG-MEASIDLECONFIG-START

MeasIdleConfigSIB-r16 ::= SEQUENCE {
    measIdleCarrierListNR-r16    SEQUENCE (SIZE (1..maxFreqIdle-r16)) OF MeasIdleCarrierNR-r16    OPTIONAL, -- Need S
    measIdleCarrierListEUTRA-r16 SEQUENCE (SIZE (1..maxFreqIdle-r16)) OF MeasIdleCarrierEUTRA-r16   OPTIONAL, -- Need S
    ...
}
```

```

MeasIdleConfigDedicated-r16 ::= SEQUENCE {
    measIdleCarrierListNR-r16      SEQUENCE (SIZE (1..maxFreqIdle-r16)) OF MeasIdleCarrierNR-r16      OPTIONAL,    -- Need N
    measIdleCarrierListEUTRA-r16   SEQUENCE (SIZE (1..maxFreqIdle-r16)) OF MeasIdleCarrierEUTRA-r16   OPTIONAL,    -- Need N
    measIdleDuration-r16          ENUMERATED {sec10, sec30, sec60, sec120, sec180, sec240, sec300, spare},
    validityAreaList-r16         ValidityAreaList-r16                                          OPTIONAL,    -- Need N
    ...
}

ValidityAreaList-r16 ::= SEQUENCE (SIZE (1..maxFreqIdle-r16)) OF ValidityArea-r16

ValidityArea-r16 ::=
    SEQUENCE {
        carrierFreq-r16          ARFCN-ValueNR,
        validityCellList-r16     ValidityCellList                                          OPTIONAL    -- Need N
    }

ValidityCellList ::= SEQUENCE (SIZE (1.. maxCellMeasIdle-r16)) OF PCI-Range

MeasIdleCarrierNR-r16 ::=
    SEQUENCE {
        carrierFreq-r16          ARFCN-ValueNR,
        ssbSubcarrierSpacing-r16 SubcarrierSpacing,
        frequencyBandList       MultiFrequencyBandListNR                                          OPTIONAL,    -- Need R
        measCellListNR-r16      CellListNR-r16                                          OPTIONAL,    -- Need R
        reportQuantities-r16    ENUMERATED {rsrp, rsrq, both},
        qualityThreshold-r16    SEQUENCE {
            idlerSRP-Threshold-NR-r16  RSRP-Range                                          OPTIONAL,    -- Need R
            idlerSRQ-Threshold-NR-r16  RSRQ-Range                                          OPTIONAL,    -- Need R
        }
        ssb-MeasConfig-r16      SEQUENCE {
            nrofSS-BlocksToAverage-r16 INTEGER (2..maxNrofSS-BlocksToAverage)          OPTIONAL,    -- Need S
            absThreshSS-BlocksConsolidation-r16 ThresholdNR                                          OPTIONAL,    -- Need S
            smtc-r16             SSB-MTC                                          OPTIONAL,    -- Need S
            ssb-ToMeasure-r16    SSB-ToMeasure                                          OPTIONAL,    -- Need S
            deriveSSB-IndexFromCell-r16 BOOLEAN,
            ss-RSSI-Measurement-r16 SS-RSSI-Measurement                                          OPTIONAL,    -- Need S
        }
        beamMeasConfigIdle-r16   BeamMeasConfigIdle-NR-r16                                          OPTIONAL,    -- Need R
        ...
    }

MeasIdleCarrierEUTRA-r16 ::=
    SEQUENCE {
        carrierFreqEUTRA-r16     ARFCN-ValueEUTRA,
        allowedMeasBandwidth-r16 EUTRA-AllowedMeasBandwidth,
        measCellListEUTRA-r16    CellListEUTRA-r16                                          OPTIONAL,    -- Need R
        reportQuantitiesEUTRA-r16 ENUMERATED {rsrp, rsrq, both},
        qualityThresholdEUTRA-r16 SEQUENCE {
            idlerSRP-Threshold-EUTRA-r16 RSRP-RangeEUTRA                                          OPTIONAL,    -- Need R
            idlerSRQ-Threshold-EUTRA-r16 RSRQ-RangeEUTRA-r16                                          OPTIONAL,    -- Need R
        }
        ...
    }

CellListNR-r16 ::=
    SEQUENCE (SIZE (1..maxCellMeasIdle-r16)) OF PCI-Range

```



```
CellListEUTRA-r16 ::= SEQUENCE (SIZE (1..maxCellMeasIdle-r16)) OF EUTRA-PhysCellIdRange

BeamMeasConfigIdle-NR-r16 ::= SEQUENCE {
    reportQuantityRS-Indexes-r16      ENUMERATED {rsrp, rsrq, both},
    maxNrofRS-IndexesToReport-r16    INTEGER (1.. maxNrofIndexesToReport),
    includeBeamMeasurements-r16     BOOLEAN
}

RSRQ-RangeEUTRA-r16 ::= INTEGER (-30..46)

-- TAG-MEASIDLECONFIG-STOP
-- ASN1STOP
```

<b><i>MeasIdleConfig</i></b> field descriptions
<b><i>absThreshSS-BlocksConsolidation</i></b> Threshold for consolidation of L1 measurements per RS index.
<b><i>beamMeasConfigIdle</i></b> Indicates the beam level measurement configuration.
<b><i>carrierFreq</i></b> Indicates the NR carrier frequency to be used for measurements during RRC_IDLE or RRC_INACTIVE.
<b><i>carrierFreqEUTRA</i></b> Indicates the E-UTRA carrier frequency to be used for measurements during RRC_IDLE or RRC_INACTIVE.
<b><i>deriveSSB-IndexFromCell</i></b> This field indicates whether the UE may use the timing of any detected cell on that frequency to derive the SSB index of all neighbour cells on that frequency. If this field is set to true, the UE assumes SFN and frame boundary alignment across cells on the neighbor frequency as specified in TS 38.133 [14].
<b><i>frequencyBandList</i></b> Indicates the list of frequency bands for which the NR idle/inactive measurement parameters apply. The UE shall select the first listed band which it supports in the frequencyBandList field to represent the NR neighbour carrier frequency.
<b><i>includeBeamMeasurements</i></b> Indicates whether or not the UE shall include beam measurements in the NR idle/inactive measurement results.
<b><i>maxNrofRS-IndexesToReport</i></b> Max number of beam indices to include in the idle/inactive measurement result.
<b><i>measCellListEUTRA</i></b> Indicates the list of E-UTRA cells which the UE is requested to measure and report for idle/inactive measurements.
<b><i>measCellListNR</i></b> Indicates the list of NR cells which the UE is requested to measure and report for idle/inactive measurements.
<b><i>measIdleCarrierListEUTRA</i></b> Indicates the E-UTRA carriers to be measured during RRC_IDLE or RRC_INACTIVE.
<b><i>measIdleCarrierListNR</i></b> Indicates the NR carriers to be measured during RRC_IDLE or RRC_INACTIVE.
<b><i>measIdleDuration</i></b> Indicates the duration for performing idle/inactive measurements while in RRC_IDLE or RRC_INACTIVE. Value sec10 correspond to 10 seconds, value sec30 to 30 seconds and so on.
<b><i>nrofSS-BlocksToAverage</i></b> Number of SS blocks to average for cell measurement derivation.
<b><i>qualityThreshold</i></b> Indicates the quality thresholds for reporting the measured cells for idle/inactive NR measurements.
<b><i>qualityThresholdEUTRA</i></b> Indicates the quality thresholds for reporting the measured cells for idle/inactive E-UTRA measurements.
<b><i>reportQuantities</i></b> Indicates which measurement quantities UE is requested to report in the idle/inactive measurement report.
<b><i>reportQuantitiesEUTRA</i></b> Indicates which E-UTRA measurement quantities the UE is requested to report in the idle/inactive measurement report.
<b><i>reportQuantityRS-Indexes</i></b> Indicates which measurement information per beam index the UE shall include in the NR idle/inactive measurement results.
<b><i>smtc</i></b> Indicates the measurement timing configuration for inter-frequency measurement. If this field is absent in <i>VarMeasIdleConfig</i> , the UE assumes that SSB periodicity is 5 ms in this frequency.

<b>ssbSubcarrierSpacing</b> Indicates subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable.
<b>ssb-ToMeasure</b> The set of SS blocks to be measured within the SMTC measurement duration (see TS 38.215 [9]). When the field is absent in <i>VarMeasIdleConfig</i> , the UE measures on all SS-blocks.
<b>ss-RSSI-Measurement</b> Indicates the SSB-based RSSI measurement configuration. If the field is absent in <i>VarMeasIdleConfig</i> , the UE behaviour is defined in TS 38.215 [89], clause 5.1.3.
<b>validityAreaList</b> Indicates the list of frequencies and optionally, for each frequency, a list of cells within which the UE is required to perform measurements while in RRC_IDLE and RRC_INACTIVE.

### – *MeasIdToAddModList*

The IE *MeasIdToAddModList* concerns a list of measurement identities to add or modify, with for each entry the *measId*, the associated *measObjectId* and the associated *reportConfigId*.

#### ***MeasIdToAddModList* information element**

```
-- ASN1START
-- TAG-MEASIDTOADDMODLIST-START

MeasIdToAddModList ::=
    SEQUENCE (SIZE (1..maxNrofMeasId)) OF MeasIdToAddMod

MeasIdToAddMod ::=
    SEQUENCE {
        measId
            MeasId,
        measObjectId
            MeasObjectId,
        reportConfigId
            ReportConfigId
    }

-- TAG-MEASIDTOADDMODLIST-STOP
-- ASN1STOP
```

### – *MeasObjectCLI*

The IE *MeasObjectCLI* specifies information applicable for SRS-RSRP measurements and/or CLI-RSSI measurements.

#### ***MeasObjectCLI* information element**

```
-- ASN1START
-- TAG-MEASOBJECTCLI-START

MeasObjectCLI-r16 ::=
    SEQUENCE {
        cli-ResourceConfig-r16
            CLI-ResourceConfig-r16,
        ...
    }

-- TAG-MEASOBJECTCLI-STOP
-- ASN1STOP
```

```

CLI-ResourceConfig-r16 ::= SEQUENCE {
    srs-ResourceConfig-r16          SetupRelease { SRS-ResourceListConfigCLI-r16 }          OPTIONAL,  -- Need M
    rssi-ResourceConfig-r16        SetupRelease { RSSI-ResourceListConfigCLI-r16 }    OPTIONAL,  -- Need M
}

SRS-ResourceListConfigCLI-r16 ::= SEQUENCE (SIZE (1.. maxNrofCLI-SRS-Resources-r16)) OF SRS-ResourceConfigCLI-r16

RSSI-ResourceListConfigCLI-r16 ::= SEQUENCE (SIZE (1.. maxNrofCLI-RSSI-Resources-r16)) OF RSSI-ResourceConfigCLI-r16

SRS-ResourceConfigCLI-r16 ::= SEQUENCE {
    srs-Resource-r16                SRS-Resource,
    srs-SCS-r16                      SubcarrierSpacing,
    refServCellIndex-r16             ServCellIndex                                OPTIONAL,  -- Need S
    refBWP-r16                       BWP-Id,
    ...
}

RSSI-ResourceConfigCLI-r16 ::= SEQUENCE {
    rssi-ResourceId-r16              RSSI-ResourceId-r16,
    rssi-SCS-r16                      SubcarrierSpacing,
    startPRB-r16                      INTEGER (0..2169),
    nrofPRBs-r16                       INTEGER (4..maxNrofPhysicalResourceBlocksPlus1),
    startPosition-r16                  INTEGER (0..13),
    nrofSymbols-r16                    INTEGER (1..14),
    rssi-PeriodicityAndOffset-r16     RSSI-PeriodicityAndOffset-r16,
    refServCellIndex-r16              ServCellIndex                                OPTIONAL,  -- Need S
    ...
}

RSSI-ResourceId-r16 ::= INTEGER (0.. maxNrofCLI-RSSI-Resources-r16-1)

RSSI-PeriodicityAndOffset-r16 ::= CHOICE {
    s110                                INTEGER(0..9),
    s120                                INTEGER(0..19),
    s140                                INTEGER(0..39),
    s180                                INTEGER(0..79),
    s1160                                INTEGER(0..159),
    s1320                                INTEGER(0..319),
    s1640                                INTEGER(0..639),
    ...
}

-- TAG-MEASOBJECTCLI-STOP
-- ASN1STOP

```

<b>CLI-ResourceConfig field descriptions</b>
<b>srs-ResourceConfig</b> SRS resources to be used for CLI measurements.
<b>rssi-ResourceConfig</b> CLI-RSSI resources to be used for CLI measurements.

<b>MeasObjectCLI field descriptions</b>
<p><b>cli-ResourceConfig</b> SRS and/or CLI-RSSI resource configuration for CLI measurement.</p>
<b>SRS-ResourceConfigCLI field descriptions</b>
<p><b>refBWP</b> DL BWP id that is used to derive the reference point of the SRS resource (see TS 38.211[16], clause 6.4.1.4.3)</p>
<p><b>refServCellIndex</b> The index of the reference serving cell that the <i>refBWP</i> belongs to. If this field is absent, the reference serving cell is PCell.</p>
<p><b>srs-SCS</b> Subcarrier spacing for SRS. Only the values 15, 30 kHz or 60 kHz (FR1), and 60 or 120 kHz (FR2) are applicable.</p>
<b>RSSI-ResourceConfigCLI field descriptions</b>
<p><b>nrofPRBs</b> Allowed size of the measurement BW. Only multiples of 4 are allowed. The smallest configurable number is the minimum of 4 and the width of the active DL BWP. If the configured value is larger than the width of the active DL BWP, the UE shall assume that the actual CLI-RSSI resource bandwidth is within the active DL BWP.</p>
<p><b>nrofSymbols</b> Within a slot that is configured for CLI-RSSI measurement (see slotConfiguration), the UE measures the RSSI from <i>startPosition</i> to <i>startPosition</i> + <i>nrofSymbols</i> - 1. The configured CLI-RSSI resource does not exceed the slot boundary of the reference SCS. If the SCS of configured DL BWP(s) is larger than the reference SCS, network configures <i>startPosition</i> and <i>nrofSymbols</i> such that the configured CLI-RSSI resource not to exceed the slot boundary corresponding to the configured BWP SCS. If the reference SCS is larger than SCS of configured DL BWP(s), network ensures <i>startPosition</i> and <i>nrofSymbols</i> are integer multiple of reference SCS divided by configured BWP SCS.</p>
<p><b>refServCellIndex</b> The index of the reference serving cell. Frequency reference point of the RSSI resource is subcarrier 0 of CRB0 of the reference serving cell. If this field is absent, the reference serving cell is PCell.</p>
<p><b>rssi-PeriodicityAndOffset</b> Periodicity and slot offset for this CLI-RSSI resource. All values are in "number of slots". Value <i>s/1</i> corresponds to a periodicity of 1 slot, value <i>s/2</i> corresponds to a periodicity of 2 slots, and so on. For each periodicity the corresponding offset is given in number of slots.</p>
<p><b>rssi-scs</b> Reference subcarrier spacing for CLI-RSSI measurement. Only the values 15, 30 kHz or 60 kHz (FR1), and 60 or 120 kHz (FR2) are applicable. UE performs CLI-RSSI measurement with the SCS of the active bandwidth part within the configured CLI-RSSI resource in the active BWP regardless of the reference SCS of the measurement resource.</p>
<p><b>startPosition</b> OFDM symbol location of the CLI-RSSI resource within a slot.</p>
<p><b>startPRB</b> Starting PRB index of the measurement bandwidth. For the case where the reference subcarrier spacing is smaller than subcarrier spacing of active DL BWP(s), network configures <i>startPRB</i> and <i>nrofPRBs</i> are as a multiple of active BW SCS divided by reference SCS.</p>

– **MeasObjectEUTRA**

The IE *MeasObjectEUTRA* specifies information applicable for E-UTRA cells.

**MeasObjectEUTRA** information element

```

-- ASN1START
-- TAG-MEASOBJECTEUTRA-START

MeasObjectEUTRA ::=
    carrierFreq                ARFCN-ValueEUTRA,
    allowedMeasBandwidth       EUTRA-AllowedMeasBandwidth,
    cellsToRemoveListEUTRAN    EUTRA-CellIndexList                OPTIONAL,    -- Need N
    cellsToAddModListEUTRAN    SEQUENCE (SIZE (1..maxCellMeasEUTRA)) OF EUTRA-Cell    OPTIONAL,    -- Need N
    blackCellsToRemoveListEUTRAN EUTRA-CellIndexList                OPTIONAL,    -- Need N
    blackCellsToAddModListEUTRAN SEQUENCE (SIZE (1..maxCellMeasEUTRA)) OF EUTRA-BlackCell    OPTIONAL,    -- Need N
    eutra-PresenceAntennaPort1 EUTRA-PresenceAntennaPort1,
    eutra-Q-OffsetRange        EUTRA-Q-OffsetRange                OPTIONAL,    -- Need R
    widebandRSRQ-Meas          BOOLEAN,
    ...
}

EUTRA-CellIndexList ::=
    SEQUENCE (SIZE (1..maxCellMeasEUTRA)) OF EUTRA-CellIndex

EUTRA-CellIndex ::=
    INTEGER (1..maxCellMeasEUTRA)

EUTRA-Cell ::=
    cellIndexEUTRA            EUTRA-CellIndex,
    physCellId                EUTRA-PhysCellId,
    cellIndividualOffset      EUTRA-Q-OffsetRange
}

EUTRA-BlackCell ::=
    cellIndexEUTRA            EUTRA-CellIndex,
    physCellIdRange           EUTRA-PhysCellIdRange
}

-- TAG-MEASOBJECTEUTRA-STOP
-- ASN1STOP

```

**EUTRAN-BlackCell** field descriptions**cellIndexEUTRA**

Entry index in the cell list.

**physicalCellIdRange**

Physical cell identity or a range of physical cell identities.

<b>EUTRAN-Cell field descriptions</b>
<b>physicalCellId</b> Physical cell identity of a cell in the cell list.
<b>cellIndividualOffset</b> Cell individual offset applicable to a specific cell. Value <i>dB-24</i> corresponds to -24 dB, <i>dB-22</i> corresponds to -22 dB and so on.

<b>MeasObjectEUTRA field descriptions</b>
<b>allowedMeasBandwidth</b> The maximum allowed measurement bandwidth on a carrier frequency as defined by the parameter Transmission Bandwidth Configuration "N <sub>RB</sub> " TS 36.104 [33].
<b>blackCellsToAddModListEUTRAN</b> List of cells to add/ modify in the black list of cells.
<b>blackCellsToRemoveListEUTRAN</b> List of cells to remove from the black list of cells.
<b>carrierFreq</b> Identifies E-UTRA carrier frequency for which this configuration is valid. Network does not configure more than one <i>MeasObjectEUTRA</i> for the same physical frequency, regardless of the E-ARFCN used to indicate this.
<b>cellsToAddModListEUTRAN</b> List of cells to add/ modify in the cell list.
<b>cellsToRemoveListEUTRAN</b> List of cells to remove from the cell list.
<b>eutra-PresenceAntennaPort1</b> When set to <i>true</i> , the UE may assume that at least two cell-specific antenna ports are used in all neighbouring cells.
<b>eutra-Q-OffsetRange</b> Used to indicate a cell, or frequency specific offset to be applied when evaluating triggering conditions for measurement reporting. The value is in dB. Value <i>dB-24</i> corresponds to -24 dB, value <i>dB-22</i> corresponds to -22 dB and so on.
<b>widebandRSRQ-Meas</b> If set to <i>true</i> , the UE shall, when performing RSRQ measurements, use a wider bandwidth in accordance with TS 36.133 [40]. The network may set the field to <i>true</i> if the measurement bandwidth indicated by <i>allowedMeasBandwidth</i> is 50 resource blocks or larger; otherwise the network sets this field to <i>false</i> .

– **MeasObjectId**

The IE *MeasObjectId* used to identify a measurement object configuration.

**MeasObjectId information element**

```
-- ASN1START
-- TAG-MEASOBJECTID-START

MeasObjectId ::=
    INTEGER (1..maxNrofObjectId)

-- TAG-MEASOBJECTID-STOP
-- ASN1STOP
```

## – MeasObjectNR

The IE *MeasObjectNR* specifies information applicable for SS/PBCH block(s) intra/inter-frequency measurements and/or CSI-RS intra/inter-frequency measurements.

### *MeasObjectNR* information element

```

-- ASN1START
-- TAG-MEASOBJECTNR-START

MeasObjectNR ::=
    ssbFrequency                SEQUENCE {
        ARFCN-ValueNR           OPTIONAL, -- Cond SSBorAssociatedSSB
    ssbSubcarrierSpacing        SubcarrierSpacing        OPTIONAL, -- Cond SSBorAssociatedSSB
    smtc1                        SSB-MTC                OPTIONAL, -- Cond SSBorAssociatedSSB
    smtc2                        SSB-MTC2               OPTIONAL, -- Cond IntraFreqConnected
    refFreqCSI-RS               ARFCN-ValueNR           OPTIONAL, -- Cond CSI-RS
    referenceSignalConfig       ReferenceSignalConfig,
    absThreshSS-BlocksConsolidation ThresholdNR        OPTIONAL, -- Need R
    absThreshCSI-RS-Consolidation ThresholdNR        OPTIONAL, -- Need R
    nrofSS-BlocksToAverage      INTEGER (2..maxNrofSS-BlocksToAverage) OPTIONAL, -- Need R
    nrofCSI-RS-ResourcesToAverage INTEGER (2..maxNrofCSI-RS-ResourcesToAverage) OPTIONAL, -- Need R
    quantityConfigIndex         INTEGER (1..maxNrofQuantityConfig),
    offsetMO                    Q-OffsetRangeList,
    cellsToRemoveList           PCI-List                OPTIONAL, -- Need N
    cellsToAddModList           CellsToAddModList        OPTIONAL, -- Need N
    blackCellsToRemoveList      PCI-RangeIndexList       OPTIONAL, -- Need N
    blackCellsToAddModList      SEQUENCE (SIZE (1..maxNrofPCI-Ranges)) OF PCI-RangeElement OPTIONAL, -- Need N
    whiteCellsToRemoveList      PCI-RangeIndexList       OPTIONAL, -- Need N
    whiteCellsToAddModList      SEQUENCE (SIZE (1..maxNrofPCI-Ranges)) OF PCI-RangeElement OPTIONAL, -- Need N
    ...,
    [[
    freqBandIndicatorNR         FreqBandIndicatorNR        OPTIONAL, -- Need R
    measCycleSCell              ENUMERATED {sf160, sf256, sf320, sf512, sf640, sf1024, sf1280} OPTIONAL, -- Need R
    ]],
    [[
    smtc3list-r16               SSB-MTC3List-r16          OPTIONAL, -- Need R
    rmtc-Config-r16             SetupRelease {RMTC-Config-r16}    OPTIONAL, -- Need M
    t312-r16                     SetupRelease { T312-r16 }          OPTIONAL, -- Need M
    ]]
}

SSB-MTC3List-r16 ::=
    SEQUENCE (SIZE(1..4)) OF SSB-MTC3-r16

T312-r16 ::=
    ENUMERATED { ms0, ms50, ms100, ms200, ms300, ms400, ms500, ms1000}

ReferenceSignalConfig ::=
    SEQUENCE {
        ssb-ConfigMobility      SSB-ConfigMobility        OPTIONAL, -- Need M
        csi-rs-ResourceConfigMobility SetupRelease { CSI-RS-ResourceConfigMobility } OPTIONAL, -- Need M
    }

SSB-ConfigMobility ::=
    SEQUENCE {
        ssb-ToMeasure           SetupRelease { SSB-ToMeasure }    OPTIONAL, -- Need M
        deriveSSB-IndexFromCell BOOLEAN,
        ss-RSSI-Measurement      SS-RSSI-Measurement        OPTIONAL, -- Need M
    }

```



```

...
[[
  ssb-PositionQCL-Common-r16          SSB-PositionQCL-Relation-r16          OPTIONAL,  -- Cond SharedSpectrum
  ssb-PositionQCL-CellsToAddModList-r16  SSB-PositionQCL-CellsToAddModList-r16  OPTIONAL,  -- Need N
  ssb-PositionQCL-CellsToRemoveList-r16  PCI-List                                OPTIONAL,  -- Need N
]]
}

Q-OffsetRangeList ::=
  rsrpOffsetSSB          Q-OffsetRange          DEFAULT dB0,
  rsrqOffsetSSB          Q-OffsetRange          DEFAULT dB0,
  sinrOffsetSSB          Q-OffsetRange          DEFAULT dB0,
  rsrpOffsetCSI-RS       Q-OffsetRange          DEFAULT dB0,
  rsrqOffsetCSI-RS       Q-OffsetRange          DEFAULT dB0,
  sinrOffsetCSI-RS       Q-OffsetRange          DEFAULT dB0
}

ThresholdNR ::=
  thresholdRSRP          RSRP-Range          OPTIONAL,  -- Need R
  thresholdRSRQ          RSRQ-Range          OPTIONAL,  -- Need R
  thresholdSINR          SINR-Range          OPTIONAL,  -- Need R
}

CellsToAddModList ::=
  SEQUENCE (SIZE (1..maxNrofCellMeas)) OF CellsToAddMod

CellsToAddMod ::=
  SEQUENCE {
    physCellId            PhysCellId,
    cellIndividualOffset   Q-OffsetRangeList
  }

RMTC-Config-r16 ::=
  SEQUENCE {
    rmtc-Periodicity-r16  ENUMERATED {ms40, ms80, ms160, ms320, ms640},
    rmtc-SubframeOffset-r16  INTEGER(0..639)          OPTIONAL,  -- Need M
    measDurationSymbols-r16  ENUMERATED {sym1, sym14or12, sym28or24, sym42or36, sym70or60},
    rmtc-Frequency-r16       ARFCN-ValueNR,
    ref-SCS-CP-r16          ENUMERATED {kHz15, kHz30, kHz60-NCP, kHz60-ECP},
    ...
  }

SSB-PositionQCL-CellsToAddModList-r16 ::= SEQUENCE (SIZE (1..maxNrofCellMeas)) OF SSB-PositionQCL-CellsToAddMod-r16

SSB-PositionQCL-CellsToAddMod-r16 ::= SEQUENCE {
  physCellId-r16          PhysCellId,
  ssb-PositionQCL-r16     SSB-PositionQCL-Relation-r16
}

-- TAG-MEASOBJECTNR-STOP
-- ASN1STOP

```

<i>CellsToAddMod</i> field descriptions
<b><i>cellIndividualOffset</i></b> Cell individual offsets applicable to a specific cell.
<b><i>physCellId</i></b> Physical cell identity of a cell in the cell list.

<b>MeasObjectNR field descriptions</b>
<p><b>absThreshCSI-RS-Consolidation</b> Absolute threshold for the consolidation of measurement results per CSI-RS resource(s) from L1 filter(s). The field is used for the derivation of cell measurement results as described in 5.5.3.3 and the reporting of beam measurement information per CSI-RS resource as described in 5.5.5.2.</p>
<p><b>absThreshSS-BlocksConsolidation</b> Absolute threshold for the consolidation of measurement results per SS/PBCH block(s) from L1 filter(s). The field is used for the derivation of cell measurement results as described in 5.5.3.3 and the reporting of beam measurement information per SS/PBCH block index as described in 5.5.5.2.</p>
<p><b>blackCellsToAddModList</b> List of cells to add/modify in the black list of cells. It applies only to SSB resources.</p>
<p><b>blackCellsToRemoveList</b> List of cells to remove from the black list of cells.</p>
<p><b>cellsToAddModList</b> List of cells to add/modify in the cell list.</p>
<p><b>cellsToRemoveList</b> List of cells to remove from the cell list.</p>
<p><b>freqBandIndicatorNR</b> The frequency band in which the SSB and/or CSI-RS indicated in this <i>MeasObjectNR</i> are located and according to which the UE shall perform the RRM measurements. This field is always provided when the network configures measurements with this <i>MeasObjectNR</i>.</p>
<p><b>measCycleSCell</b> The parameter is used only when an SCell is configured on the frequency indicated by the <i>measObjectNR</i> and is in deactivated state, see TS 38.133 [14]. gNB configures the parameter whenever an SCell is configured on the frequency indicated by the <i>measObjectNR</i>, but the field may also be signalled when an SCell is not configured. Value <i>sf160</i> corresponds to 160 sub-frames, value <i>sf256</i> corresponds to 256 sub-frames and so on.</p>
<p><b>nrofCSI-RS-ResourcesToAverage</b> Indicates the maximum number of measurement results per beam based on CSI-RS resources to be averaged. The same value applies for each detected cell associated with this <i>MeasObjectNR</i>.</p>
<p><b>nrofSS-BlocksToAverage</b> Indicates the maximum number of measurement results per beam based on SS/PBCH blocks to be averaged. The same value applies for each detected cell associated with this <i>MeasObjectNR</i>.</p>
<p><b>offsetMO</b> Offset values applicable to all measured cells with reference signal(s) indicated in this <i>MeasObjectNR</i>.</p>
<p><b>quantityConfigIndex</b> Indicates the <i>n</i>-th element of <i>quantityConfigNR-List</i> provided in <i>MeasConfig</i>.</p>
<p><b>referenceSignalConfig</b> RS configuration for SS/PBCH block and CSI-RS.</p>
<p><b>refFreqCSI-RS</b> Point A which is used for mapping of CSI-RS to physical resources according to TS 38.211 [16] clause 7.4.1.5.3.</p>
<p><b>smtc1</b> Primary measurement timing configuration. (see clause 5.5.2.10).</p>
<p><b>smtc2</b> Secondary measurement timing configuration for SS corresponding to this <i>MeasObjectNR</i> with PCI listed in <i>pci-List</i>. For these SS, the periodicity is indicated by <i>periodicity</i> in <i>smtc2</i> and the timing offset is equal to the offset indicated in <i>periodicityAndOffset</i> modulo <i>periodicity</i>. <i>periodicity</i> in <i>smtc2</i> can only be set to a value strictly shorter than the periodicity indicated by <i>periodicityAndOffset</i> in <i>smtc1</i> (e.g. if <i>periodicityAndOffset</i> indicates <i>sf10</i>, <i>periodicity</i> can only be set of <i>sf5</i>, if <i>periodicityAndOffset</i> indicates <i>sf5</i>, <i>smtc2</i> cannot be configured).</p>
<p><b>smtc3list</b> Measurement timing configuration list for SS corresponding to IAB-MT. This is used for the IAB-node's discovery of other IAB-nodes and the IAB-Donor-DUs.</p>

<b>ssbFrequency</b>
Indicates the frequency of the SS associated to this <i>MeasObjectNR</i> . For operation with shared spectrum channel access, this field is a $k \cdot 30$ kHz shift from the sync raster where $k = 0, 1, 2$ , and so on if the <i>reportType</i> within the corresponding <i>ReportConfigNR</i> is set to <i>reportCGI</i> (see TS 38.211 [16], clause 7.4.3.1). Frequencies are considered to be on the sync raster if they are also identifiable with a GSCN value (see TS 38.101-1 [15]).
<b>ssb-PositionQCL-Common</b>
Indicates the QCL relationship between SS/PBCH blocks for all measured cells as specified in TS 38.213 [13], clause 4.1.
<b>ssbSubcarrierSpacing</b>
Subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable.
<b>t312</b>
The value of timer T312. Value ms0 represents 0 ms, ms50 represents 50 ms and so on.
<b>whiteCellsToAddModList</b>
List of cells to add/modify in the white list of cells. It applies only to SSB resources.
<b>whiteCellsToRemoveList</b>
List of cells to remove from the white list of cells.

<b>RMTC-Config field descriptions</b>
<b>measDurationSymbols</b>
Number of consecutive symbols for which the Physical Layer reports samples of RSSI (see TS 38.215 [9], clause 5.1.21). Value <i>sym1</i> corresponds to one symbol, <i>sym14or12</i> corresponds to 14 symbols of the reference numerology for NCP and 12 symbols for ECP, and so on.
<b>ref-SCS-CP</b>
Indicates a reference subcarrier spacing and cyclic prefix to be used for RSSI measurements (see TS 38.215 [9]). Value kHz15 corresponds to 15kHz, kHz30 corresponds to 30 kHz, value kHz60-NCP corresponds to 60 kHz using normal cyclic prefix (NCP), and kHz60-ECP corresponds to 60 kHz using extended cyclic prefix (ECP).
<b>rmtc-Frequency</b>
Indicates the center frequency of the measured bandwidth (see TS 38.215 [9], clause 5.1.21).
<b>rmtc-Periodicity</b>
Indicates the RSSI measurement timing configuration (RMTC) periodicity (see TS 38.215 [9], clause 5.1.21).
<b>rmtc-SubframeOffset</b>
Indicates the RSSI measurement timing configuration (RMTC) subframe offset for this frequency (see TS 38.215 [9], clause 5.1.21). For inter-frequency measurements, this field is optional present and if it is not configured, the UE chooses a random value as <i>rmtc-SubframeOffset</i> for <i>measDurationSymbols</i> which shall be selected to be between 0 and the configured <i>rmtc-Periodicity</i> with equal probability.

<b>ReferenceSignalConfig field descriptions</b>
<b>csi-rs-ResourceConfigMobility</b>
CSI-RS resources to be used for CSI-RS based RRM measurements.
<b>ssb-ConfigMobility</b>
SSB configuration for mobility (nominal SSBs, timing configuration).

**SSB-ConfigMobility field descriptions****deriveSSB-IndexFromCell**

If this field is set to *true*, UE assumes SFN and frame boundary alignment across cells on the same frequency carrier as specified in TS 38.133 [14]. Hence, if the UE is configured with a serving cell for which (*absoluteFrequencySSB*, *subcarrierSpacing*) in *ServingCellConfigCommon* is equal to (*ssbFrequency*, *ssbSubcarrierSpacing*) in this *MeasObjectNR*, this field indicates whether the UE can utilize the timing of this serving cell to derive the index of SS block transmitted by neighbour cell. Otherwise, this field indicates whether the UE may use the timing of any detected cell on that target frequency to derive the SSB index of all neighbour cells on that frequency.

**ssb-ToMeasure**

The set of SS blocks to be measured within the SMTC measurement duration. The first/leftmost bit corresponds to SS/PBCH block index 0, the second bit corresponds to SS/PBCH block index 1, and so on. Value 0 in the bitmap indicates that the corresponding SS/PBCH block is not to be measured while value 1 indicates that the corresponding SS/PBCH block is to be measured (see TS 38.215 [9]). When the field is not configured the UE measures on all SS blocks. Regardless of the value of this field, SS/PBCH blocks outside of the applicable *smtc* are not to be measured. See TS 38.215 [9] clause 5.1.1.

**SSB-PositionQCL-CellsToAddMod field descriptions****physCellId**

Physical cell identity of a cell in the cell list.

**ssb-PositionQCL**

Indicates the QCL relationship between SS/PBCH blocks for a specific cell as specified in TS 38.213 [13], clause 4.1. If provided, the cell specific value overwrites the value signalled by *ssb-PositionQCL-Common*.

Conditional Presence	Explanation
<i>CSI-RS</i>	This field is mandatory present if <i>csi-rs-ResourceConfigMobility</i> is configured, otherwise, it is absent.
<i>SSBorAssociatedSSB</i>	This field is mandatory present if <i>ssb-ConfigMobility</i> is configured or <i>associatedSSB</i> is configured in at least one cell. Otherwise, it is absent, Need R.
<i>IntraFreqConnected</i>	This field is optionally present, Need R if the UE is configured with a serving cell for which ( <i>absoluteFrequencySSB</i> , <i>subcarrierSpacing</i> ) in <i>ServingCellConfigCommon</i> is equal to ( <i>ssbFrequency</i> , <i>ssbSubcarrierSpacing</i> ) in this <i>MeasObjectNR</i> , otherwise, it is absent.
<i>SharedSpectrum</i>	This field is mandatory present if this <i>MeasObject</i> is for a frequency which operates with shared spectrum channel access. Otherwise, it is absent, Need R.

– **MeasObjectNR-SL**

The IE *MeasObjectNR-SL* concerns a measurement object including a list of transmission resource pool(s) for which CBR measurement is performed for NR sidelink communication.

**MeasObjectNR-SL information element**

```
-- ASN1START
-- TAG-MEASOBJECTNR-SL-START

MeasObjectNR-SL-r16 ::= SEQUENCE {
    tx-PoolMeasToRemoveList-r16 Tx-PoolMeasList-r16 OPTIONAL, -- Need N
    tx-PoolMeasToAddModList-r16 Tx-PoolMeasList-r16 OPTIONAL -- Need N
}
```

```
Tx-PoolMeasList-r16 ::= SEQUENCE (SIZE (1..maxNrofSL-PoolToMeasureNR-r16)) OF SL-ResourcePoolID-r16
-- TAG-MEASOBJECTNR-SL-STOP
-- ASN1STOP
```

## – *MeasObjectToAddModList*

The IE *MeasObjectToAddModList* concerns a list of measurement objects to add or modify.

### *MeasObjectToAddModList* information element

```
-- ASN1START
-- TAG-MEASOBJECTTOADDMODLIST-START

MeasObjectToAddModList ::= SEQUENCE (SIZE (1..maxNrofObjectId)) OF MeasObjectToAddMod

MeasObjectToAddMod ::= SEQUENCE {
    measObjectId          MeasObjectId,
    measObject            CHOICE {
        measObjectNR      MeasObjectNR,
        ...,
        measObjectEUTRA   MeasObjectEUTRA,
        measObjectUTRA-FDD-r16 MeasObjectUTRA-FDD-r16,
        measObjectNR-SL-r16 MeasObjectNR-SL-r16,
        measObjectCLI-r16 MeasObjectCLI-r16
    }
}

-- TAG-MEASOBJECTTOADDMODLIST-STOP
-- ASN1STOP
```

## – *MeasObjectUTRA-FDD*

The IE *MeasObjectUTRA-FDD* specifies information applicable for inter-RAT UTRA-FDD neighbouring cells.

### *MeasObjectUTRA-FDD* information element

```
-- ASN1START
-- TAG-MEASOBJECTUTRA-FDD-START

MeasObjectUTRA-FDD-r16 ::= SEQUENCE {
    carrierFreq-r16          ARFCN-ValueUTRA-FDD-r16,
    utra-FDD-Q-OffsetRange-r16 UTRA-FDD-Q-OffsetRange-r16 OPTIONAL, -- Need R
    cellsToRemoveList-r16    UTRA-FDD-CellIndexList-r16 OPTIONAL, -- Need N
    cellsToAddModList-r16   CellsToAddModListUTRA-FDD-r16 OPTIONAL, -- Need N
    ...
}

-- TAG-MEASOBJECTUTRA-FDD-STOP
-- ASN1STOP
```

```

CellsToAddModListUTRA-FDD-r16 ::= SEQUENCE (SIZE (1..maxCellMeasUTRA-FDD-r16)) OF CellsToAddModUTRA-FDD-r16

CellsToAddModUTRA-FDD-r16 ::= SEQUENCE {
    cellIndexUTRA-FDD-r16          UTRA-FDD-CellIndex-r16,
    physCellId-r16                 PhysCellIdUTRA-FDD-r16
}

UTRA-FDD-CellIndexList-r16 ::= SEQUENCE (SIZE (1..maxCellMeasUTRA-FDD-r16)) OF UTRA-FDD-CellIndex-r16

UTRA-FDD-CellIndex-r16 ::= INTEGER (1..maxCellMeasUTRA-FDD-r16)

-- TAG-MEASOBJECTUTRA-FDD-STOP
-- ASN1STOP

```

#### **MeasObjectUTRA-FDD field descriptions**

<b>carrierFreq</b>	Identifies UTRA-FDD carrier frequency for which this configuration is valid. NR does not configure more than one measurement object for the same physical frequency regardless of the ARFCN used to indicate this.
<b>cellIndexUTRA-FDD</b>	Entry index in the neighbouring cell list.
<b>cellsToAddModList</b>	List of UTRA-FDD cells to add/modify in the neighbouring cell list.
<b>cellsToRemoveList</b>	List of cells to remove from the neighbouring cell list.
<b>utra-FDD-Q-OffsetRange</b>	Used to indicate a frequency specific offset to be applied when evaluating triggering conditions for measurement reporting. The value is in dB.

#### – **MeasResultCellListSFTD-NR**

The IE *MeasResultCellListSFTD-NR* consists of SFN and radio frame boundary difference between the PCell and an NR cell as specified in TS 38.215 [9] and TS 38.133 [14].

#### **MeasResultCellListSFTD-NR information element**

```

-- ASN1START
-- TAG-MEASRESULTCELLLISTSFTD-NR-START

MeasResultCellListSFTD-NR ::= SEQUENCE (SIZE (1..maxCellSFTD)) OF MeasResultCellSFTD-NR

MeasResultCellSFTD-NR ::= SEQUENCE {
    physCellId          PhysCellId,
    sfn-OffsetResult    INTEGER (0..1023),
    frameBoundaryOffsetResult  INTEGER (-30720..30719),
    rsrp-Result         RSRP-Range OPTIONAL
}

-- TAG-MEASRESULTCELLLISTSFTD-NR-STOP
-- ASN1STOP

```

**MeasResultCellSFTD-NR field descriptions****sfn-OffsetResult**

Indicates the SFN difference between the PCell and the NR cell as an integer value according to TS 38.215 [9].

**frameBoundaryOffsetResult**

Indicates the frame boundary difference between the PCell and the NR cell as an integer value according to TS 38.215 [9].

– **MeasResultCellListSFTD-EUTRA**

The IE *MeasResultCellListSFTD-EUTRA* consists of SFN and radio frame boundary difference between the PCell and an E-UTRA PSCell.

**MeasResultCellListSFTD-EUTRA information element**

```
-- ASN1START
-- TAG-MEASRESULTCELLLISTSFTD-EUTRA-START

MeasResultCellListSFTD-EUTRA ::=          SEQUENCE (SIZE (1..maxCellsFTD)) OF MeasResultSFTD-EUTRA

MeasResultSFTD-EUTRA ::=                SEQUENCE {
    eutra-PhysCellId                      EUTRA-PhysCellId,
    sfn-OffsetResult                      INTEGER (0..1023),
    frameBoundaryOffsetResult             INTEGER (-30720..30719),
    rsrp-Result                           RSRP-Range                               OPTIONAL
}

-- TAG-MEASRESULTCELLLISTSFTD-EUTRA-STOP
-- ASN1STOP
```

**MeasResultSFTD-EUTRA field descriptions****eutra-PhysCellId**

Identifies the physical cell identity of the E-UTRA cell for which the reporting is being performed.

**sfn-OffsetResult**

Indicates the SFN difference between the PCell and the E-UTRA cell as an integer value according to TS 38.215 [9].

**frameBoundaryOffsetResult**

Indicates the frame boundary difference between the PCell and the E-UTRA cell as an integer value according to TS 38.215 [9].

– **MeasResults**

The IE *MeasResults* covers measured results for intra-frequency, inter-frequency, inter-RAT mobility and measured results for sidelink.

**MeasResults information element**

```
-- ASN1START
```



```

-- TAG-MEASRESULTS-START

MeasResults ::=
  measId
  measResultServingMOList
  measResultNeighCells
    measResultListNR
    ...
    measResultListEUTRA
    measResultListUTRA-FDD-r16
  }
  ...
  [[
  measResultServFreqListEUTRA-SCG
  measResultServFreqListNR-SCG
  measResultSFTD-EUTRA
  measResultSFTD-NR
  ]],
  [[
  measResultCellListSFTD-NR
  ]],
  [[
  measResultForRSSI-r16
  locationInfo-r16
  ul-PDCP-DelayValueResultList-r16
  measResultsSL-r16
  measResultCLI-r16
  ]]
}

MeasResultServMOList ::=
SEQUENCE (SIZE (1..maxNrofServingCells)) OF MeasResultServMO

MeasResultServMO ::=
  servCellId
  measResultServingCell
  measResultBestNeighCell
  ...
}

MeasResultListNR ::=
SEQUENCE (SIZE (1..maxCellReport)) OF MeasResultNR

MeasResultNR ::=
  physCellId
  measResult
    cellResults
      resultsSSB-Cell
      resultsCSI-RS-Cell
    },
  rsIndexResults
    resultsSSB-Indexes
    resultsCSI-RS-Indexes
  }

```

```

SEQUENCE {
  MeasId,
  MeasResultServMOList,
  CHOICE {
    MeasResultListNR,
    MeasResultListEUTRA,
    MeasResultListUTRA-FDD-r16
  }
  OPTIONAL,
  ...
  [[
  MeasResultServFreqListEUTRA-SCG
  MeasResultServFreqListNR-SCG
  MeasResultSFTD-EUTRA
  MeasResultCellSFTD-NR
  ]],
  OPTIONAL,
  OPTIONAL,
  OPTIONAL,
  OPTIONAL,
  [[
  MeasResultCellListSFTD-NR
  ]],
  OPTIONAL,
  [[
  MeasResultForRSSI-r16
  LocationInfo-r16
  UL-PDCP-DelayValueResultList-r16
  MeasResultsSL-r16
  MeasResultCLI-r16
  ]],
  OPTIONAL,
  OPTIONAL,
  OPTIONAL,
  OPTIONAL,
  OPTIONAL
}

SEQUENCE (SIZE (1..maxCellReport)) OF MeasResultNR

SEQUENCE {
  PhysCellId
  SEQUENCE {
    SEQUENCE {
      MeasQuantityResults
      MeasQuantityResults
    }
    SEQUENCE {
      ResultsPerSSB-IndexList
      ResultsPerCSI-RS-IndexList
    }
  }
  OPTIONAL,
  OPTIONAL,
  OPTIONAL,
  OPTIONAL,
  OPTIONAL,
  OPTIONAL,
  OPTIONAL
}

```

```

    },
    ...,
    [[
    cgi-Info          CGI-InfoNR          OPTIONAL
    ]]
}

MeasResultListEUTRA ::= SEQUENCE (SIZE (1..maxCellReport)) OF MeasResultEUTRA

MeasResultEUTRA ::= SEQUENCE {
    eutra-PhysCellId
    measResult

    cgi-Info          CGI-InfoEUTRA      OPTIONAL,
    ...
}

MultiBandInfoListEUTRA ::= SEQUENCE (SIZE (1..maxMultiBands)) OF FreqBandIndicatorEUTRA

MeasQuantityResults ::= SEQUENCE {
    rsrp              RSRP-Range          OPTIONAL,
    rsrq              RSRQ-Range          OPTIONAL,
    sinr              SINR-Range          OPTIONAL
}

MeasQuantityResultsEUTRA ::= SEQUENCE {
    rsrp              RSRP-RangeEUTRA     OPTIONAL,
    rsrq              RSRQ-RangeEUTRA     OPTIONAL,
    sinr              SINR-RangeEUTRA     OPTIONAL
}

ResultsPerSSB-IndexList ::= SEQUENCE (SIZE (1..maxNrofIndexesToReport2)) OF ResultsPerSSB-Index

ResultsPerSSB-Index ::= SEQUENCE {
    ssb-Index
    ssb-Results          OPTIONAL
}

ResultsPerCSI-RS-IndexList ::= SEQUENCE (SIZE (1..maxNrofIndexesToReport2)) OF ResultsPerCSI-RS-Index

ResultsPerCSI-RS-Index ::= SEQUENCE {
    csi-RS-Index
    csi-RS-Results          OPTIONAL
}

MeasResultServFreqListEUTRA-SCG ::= SEQUENCE (SIZE (1..maxNrofServingCellsEUTRA)) OF MeasResult2EUTRA

MeasResultServFreqListNR-SCG ::= SEQUENCE (SIZE (1..maxNrofServingCells)) OF MeasResult2NR

MeasResultListUTRA-FDD-r16 ::= SEQUENCE (SIZE (1..maxCellReport)) OF MeasResultUTRA-FDD-r16

MeasResultUTRA-FDD-r16 ::= SEQUENCE {
    physCellId-r16
    measResult-r16
    utra-FDD-RSCP-r16     SEQUENCE {
                            INTEGER (-5..91)    OPTIONAL,

```

```

    }
    }
    }
MeasResultForRSSI-r16 ::= SEQUENCE {
    rssi-Result-r16          RSSI-Range-r16,
    channelOccupancy-r16    INTEGER (0..100)
}

MeasResultCLI-r16 ::= SEQUENCE {
    measResultListSRS-RSRP-r16  MeasResultListSRS-RSRP-r16
    measResultListCLI-RSSI-r16  MeasResultListCLI-RSSI-r16
}
OPTIONAL,
OPTIONAL

MeasResultListSRS-RSRP-r16 ::= SEQUENCE (SIZE (1.. maxCLI-Report-r16)) OF MeasResultSRS-RSRP-r16

MeasResultSRS-RSRP-r16 ::= SEQUENCE {
    srs-ResourceId-r16      SRS-ResourceId,
    srs-RSRP-Result-r16    SRS-RSRP-Range-r16
}

MeasResultListCLI-RSSI-r16 ::= SEQUENCE (SIZE (1.. maxCLI-Report-r16)) OF MeasResultCLI-RSSI-r16

MeasResultCLI-RSSI-r16 ::= SEQUENCE {
    rssi-ResourceId-r16     RSSI-ResourceId-r16,
    cli-RSSI-Result-r16    CLI-RSSI-Range-r16
}

UL-PDCP-DelayValueResultList-r16 ::= SEQUENCE (SIZE (1..maxDRB)) OF UL-PDCP-DelayValueResult-r16

UL-PDCP-DelayValueResult-r16 ::= SEQUENCE {
    drb-Id-r16              DRB-Identity,
    averageDelay-r16        INTEGER (0..10000),
    ...
}

-- TAG-MEASRESULTS-STOP
-- ASN1STOP

```

<i>MeasResultEUTRA</i> field descriptions
---

<b><i>eutra-PhysCellId</i></b>
--------------------------------

Identifies the physical cell identity of the E-UTRA cell for which the reporting is being performed. The UE reports a value in the range 0..503, other values are reserved.
---

<b>MeasResultNR field descriptions</b>
<b>averageDelay</b> Indicates average delay for the packets during the reporting period, as specified in TS 38.314 [53]. Value 0 corresponds to 0 millisecond, value 1 corresponds to 0.1 millisecond, value 2 corresponds to 0.2 millisecond, and so on.
<b>cellResults</b> Cell level measurement results.
<b>drb-Id</b> Indicates DRB value for which uplink PDCP delay ratio or value is provided, according to TS 38.314 [53].
<b>excessDelay</b> Indicates excess queueing delay ratio in UL, according to excess delay ratio measurement report mapping table, as defined in TS 38.314 [53], Table 4.2.1.1.1-1.
<b>locationInfo</b> Positioning related information and measurements.
<b>physCellId</b> The physical cell identity of the NR cell for which the reporting is being performed.
<b>resultsSSB-Cell</b> Cell level measurement results based on SS/PBCH related measurements.
<b>resultsSSB-Indexes</b> Beam level measurement results based on SS/PBCH related measurements.
<b>resultsCSI-RS-Cell</b> Cell level measurement results based on CSI-RS related measurements.
<b>resultsCSI-RS-Indexes</b> Beam level measurement results based on CSI-RS related measurements.
<b>rsIndexResults</b> Beam level measurement results.

<b>MeasResultUTRA-FDD field descriptions</b>
<b>physCellId</b> The physical cell identity of the UTRA-FDD cell for which the reporting is being performed.
<b>utra-FDD-EcN0</b> According to CPICH_Ec/No in TS 25.133 [46] for FDD.
<b>utra-FDD-RSCP</b> According to CPICH_RSCP in TS 25.133 [46] for FDD.

<b>MeasResults field descriptions</b>
<b>measId</b> Identifies the measurement identity for which the reporting is being performed.
<b>measQuantityResults</b> The value <i>sinr</i> is not included when it is used for LogMeasReport-r16.
<b>measResultCellListSFTD-NR</b> SFTD measurement results between the PCell and the NR neighbour cell(s) in NR standalone.
<b>measResultCLI</b> CLI measurement results.
<b>measResultEUTRA</b> Measured results of an E-UTRA cell.
<b>measResultForRSSI</b> Includes measured RSSI result in dBm (see TS 38.215 [9]) and <i>channelOccupancy</i> which is the percentage of samples when the RSSI was above the configured <i>channelOccupancyThreshold</i> for the associated <i>reportConfig</i> .
<b>measResultListEUTRA</b> List of measured results for the maximum number of reported best cells for an E-UTRA measurement identity.
<b>measResultListNR</b> List of measured results for the maximum number of reported best cells for an NR measurement identity.
<b>measResultListUTRA-FDD</b> List of measured results for the maximum number of reported best cells for a UTRA-FDD measurement identity.
<b>measResultNR</b> Measured results of an NR cell.
<b>measResultServFreqListEUTRA-SCG</b> Measured results of the E-UTRA SCG serving frequencies: the measurement result of PSCell and each SCell, if any, and of the best neighbouring cell on each E-UTRA SCG serving frequency.
<b>measResultServFreqListNR-SCG</b> Measured results of the NR SCG serving frequencies: the measurement result of PSCell and each SCell, if any, and of the best neighbouring cell on each NR SCG serving frequency.
<b>measResultServingMOList</b> Measured results of measured cells with reference signals indicated in the serving cell measurement objects including measurement results of SpCell, configured SCell(s) and best neighbouring cell within measured cells with reference signals indicated in on each serving cell measurement object. If the sending of the <i>MeasurementReport</i> message is triggered by a measurement configured by an NR <i>RRCReconfiguration</i> message that was received embedded within an E-UTRA <i>RRConnectionReconfiguration</i> message (i.e. CBR measurements), this field is not applicable and its contents is ignored by the network.
<b>measResultSFTD-EUTRA</b> SFTD measurement results between the PCell and the E-UTRA PScell in NE-DC.
<b>measResultSFTD-NR</b> SFTD measurement results between the PCell and the NR PScell in NR-DC.
<b>measResultUTRA-FDD</b> Measured result of a UTRA-FDD cell.

– **MeasResult2EUTRA**

The IE *MeasResult2EUTRA* contains measurements on E-UTRA frequencies.

**MeasResult2EUTRA information element**

```

-- ASN1START
-- TAG-MEASRESULT2EUTRA-START

MeasResult2EUTRA ::= SEQUENCE {
    carrierFreq                ARFCN-ValueEUTRA,
    measResultServingCell      MeasResultEUTRA OPTIONAL,
    measResultBestNeighCell    MeasResultEUTRA OPTIONAL,
    ...
}

-- TAG-MEASRESULT2EUTRA-STOP
-- ASN1STOP

```

**– MeasResult2NR**

The IE *MeasResult2NR* contains measurements on NR frequencies.

**MeasResult2NR information element**

```

-- ASN1START
-- TAG-MEASRESULT2NR-START

MeasResult2NR ::= SEQUENCE {
    ssbFrequency                ARFCN-ValueNR OPTIONAL,
    refFreqCSI-RS              ARFCN-ValueNR OPTIONAL,
    measResultServingCell      MeasResultNR OPTIONAL,
    measResultNeighCellListNR  MeasResultListNR OPTIONAL,
    ...
}

-- TAG-MEASRESULT2NR-STOP
-- ASN1STOP

```

**– MeasResultIdleEUTRA**

The IE *MeasResultIdleEUTRA* covers the E-UTRA measurement results performed in RRC\_IDLE and RRC\_INACTIVE.

**MeasResultIdleEUTRA information element**

```

-- ASN1START
-- TAG-MEASRESULTIDLEEUTRA-START

MeasResultIdleEUTRA-r16 ::= SEQUENCE {
    measResultsPerCarrierListIdleEUTRA-r16 SEQUENCE (SIZE (1.. maxFreqIdle-r16)) OF MeasResultsPerCarrierIdleEUTRA-r16,
    ...
}

```

```

}
MeasResultsPerCarrierIdleEUTRA-r16 ::= SEQUENCE {
    carrierFreqEUTRA-r16 ARFCN-ValueEUTRA,
    measResultsPerCellListIdleEUTRA-r16 SEQUENCE (SIZE (1..maxCellMeasIdle-r16)) OF MeasResultsPerCellIdleEUTRA-r16,
    ...
}
MeasResultsPerCellIdleEUTRA-r16 ::= SEQUENCE {
    eutra-PhysCellId-r16 EUTRA-PhysCellId,
    measIdleResultEUTRA-r16 SEQUENCE {
        rsrp-ResultEUTRA-r16 RSRP-RangeEUTRA OPTIONAL,
        rsrq-ResultEUTRA-r16 RSRQ-RangeEUTRA-r16 OPTIONAL
    },
    ...
}
-- TAG-MEASRESULTIDLEEUTRA-STOP
-- ASN1STOP

```

<i>MeasResultIdleEUTRA field descriptions</i>
<b>carrierFreqEUTRA</b> Indicates the E-UTRA carrier frequency.
<b>eutra-PhysCellId</b> Indicates the physical cell identity of an E-UTRA cell.
<b>measIdleResultEUTRA</b> Idle/inactive measurement results for an E-UTRA cell.
<b>measResultsPerCarrierListIdleEUTRA</b> List of idle/inactive measured results for the maximum number of reported E-UTRA carriers.
<b>measResultsPerCellListIdleEUTRA</b> List of idle/inactive measured results for the maximum number of reported best cells for a given E-UTRA carrier.

## – *MeasResultIdleNR*

The IE *MeasResultIdleNR* covers the NR measurement results performed in RRC\_IDLE and RRC\_INACTIVE.

### ***MeasResultIdleNR* information element**

```

-- ASN1START
-- TAG-MEASRESULTIDLENR-START
MeasResultIdleNR-r16 ::= SEQUENCE {
    measResultServingCell-r16 SEQUENCE {
        rsrp-Result-r16 RSRP-Range OPTIONAL,
        rsrq-Result-r16 RSRQ-Range OPTIONAL,
        resultsSSB-Indexes-r16 ResultsPerSSB-IndexList-r16 OPTIONAL
    },
    measResultsPerCarrierListIdleNR-r16 SEQUENCE (SIZE (1.. maxFreqIdle-r16)) OF MeasResultsPerCarrierIdleNR-r16 OPTIONAL,

```

```

}
...
}
MeasResultsPerCarrierIdleNR-r16 ::= SEQUENCE {
    carrierFreq-r16          ARFCN-ValueNR,
    measResultsPerCellListIdleNR-r16 SEQUENCE (SIZE (1..maxCellMeasIdle-r16)) OF MeasResultsPerCellIdleNR-r16,
    ...
}

MeasResultsPerCellIdleNR-r16 ::= SEQUENCE {
    physCellId-r16          PhysCellId,
    measIdleResultNR-r16    SEQUENCE {
        rsrp-Result-r16      RSRP-Range                                OPTIONAL,
        rsrq-Result-r16      RSRQ-Range                                OPTIONAL,
        resultsSSB-Indexes-r16 ResultsPerSSB-IndexList-r16          OPTIONAL
    },
    ...
}

ResultsPerSSB-IndexList-r16 ::= SEQUENCE (SIZE (1.. maxNrofIndexesToReport)) OF ResultsPerSSB-IndexIdle-r16

ResultsPerSSB-IndexIdle-r16 ::= SEQUENCE {
    ssb-Index-r16          SSB-Index,
    ssb-Results-r16        SEQUENCE {
        ssb-RSRP-Result-r16 RSRP-Range                                OPTIONAL,
        ssb-RSRQ-Result-r16 RSRQ-Range                                OPTIONAL
    }
}

-- TAG-MEASRESULTIDLENR-STOP
-- ASN1STOP

```

<b>MeasResultIdleNR field descriptions</b>	
<b>carrierFreq</b>	Indicates the NR carrier frequency.
<b>measIdleResultNR</b>	Idle/inactive measurement results for an NR cell (optionally including beam level measurements).
<b>measResultServingCell</b>	Measured results of the serving cell (i.e., PCell) from idle/inactive measurements.
<b>measResultsPerCellListIdleNR</b>	List of idle/inactive measured results for the maximum number of reported best cells for a given NR carrier.
<b>resultsSSB-Indexes</b>	Beam level measurement results (indexes and optionally, beam measurements).

– **MeasResultSCG-Failure**

The IE *MeasResultSCG-Failure* is used to provide information regarding failures detected by the UE in (NG)EN-DC and NR-DC.



**MeasResultSCG-Failure information element**

```

-- ASN1START
-- TAG-MEASRESULTSCG-FAILURE-START

MeasResultSCG-Failure ::=          SEQUENCE {
    measResultPerMOList             MeasResultList2NR,
    ...
    [[
    locationInfo-r16                 LocationInfo-r16          OPTIONAL
    ]]
}

MeasResultList2NR ::=              SEQUENCE (SIZE (1..maxFreq)) OF MeasResult2NR

-- TAG-MEASRESULTSCG-FAILURE-STOP
-- ASN1STOP

```

– **MeasResultsSL**

The IE *MeasResultsSL* covers measured results for NR sidelink communication.

**MeasResultsSL information element**

```

-- ASN1START
-- TAG-MEASRESULTSSL-START

MeasResultsSL-r16 ::=              SEQUENCE {
    measResultsListSL-r16           CHOICE {
        measResultNR-SL-r16        MeasResultNR-SL-r16,
        ...
    },
    ...
}

MeasResultNR-SL-r16 ::=            SEQUENCE {
    measResultListCBR-NR-r16        SEQUENCE (SIZE (1.. maxNrofSL-PoolToMeasureNR-r16)) OF MeasResultCBR-NR-r16,
    ...
}

MeasResultCBR-NR-r16 ::=           SEQUENCE {
    sl-poolReportIdentity-r16       SL-ResourcePoolID-r16,
    sl-CBR-ResultsNR-r16           SL-CBR-r16,
    ...
}

-- TAG-MEASRESULTSSL-STOP
-- ASN1STOP

```

<i>MeasResultsSL</i> field descriptions
<b><i>measResultNR-SL</i></b> Include the measured results for NR sidelink communication.

<i>MeasResultNR-SL</i> field descriptions
<b><i>measResultListCBR-NR</i></b> CBR measurement results for NR sidelink communication.
<b><i>sl-poolReportIdentity</i></b> The identity of the transmission resource pool which is corresponding to the <i>sl-ResourcePoolID</i> configured in a resource pool for NR sidelink communication.

## – *MeasTriggerQuantityEUTRA*

The IE *MeasTriggerQuantityEUTRA* is used to configure the trigger quantity and reporting range for E-UTRA measurements. The RSRP, RSRQ and SINR ranges correspond to *RSRP-Range*, *RSRQ-Range* and *RS-SINR-Range* in TS 36.331 [10], respectively.

### *MeasTriggerQuantityEUTRA* information element

```
-- ASN1START
-- TAG-MEASTRIGGERQUANTITYEUTRA-START

MeasTriggerQuantityEUTRA ::=
    CHOICE {
        rsrp          RSRP-RangeEUTRA,
        rsrq          RSRQ-RangeEUTRA,
        sinr          SINR-RangeEUTRA
    }

RSRP-RangeEUTRA ::=
    INTEGER (0..97)

RSRQ-RangeEUTRA ::=
    INTEGER (0..34)

SINR-RangeEUTRA ::=
    INTEGER (0..127)

-- TAG-MEASTRIGGERQUANTITYEUTRA-STOP
-- ASN1STOP
```

## – *MobilityStateParameters*

The IE *MobilityStateParameters* contains parameters to determine UE mobility state.

### *MobilityStateParameters* information element

```
-- ASN1START
-- TAG-MOBILITYSTATEPARAMETERS-START

MobilityStateParameters ::=
    SEQUENCE {
```

```

t-Evaluation          ENUMERATED {
                        s30, s60, s120, s180, s240, spare3, spare2, spare1},
t-HystNormal          ENUMERATED {
                        s30, s60, s120, s180, s240, spare3, spare2, spare1},
n-CellChangeMedium   INTEGER (1..16),
n-CellChangeHigh     INTEGER (1..16)
}
-- TAG-MOBILITYSTATEPARAMETERS-STOP
-- ASN1STOP

```

#### **MobilityStateParameters field descriptions**

##### ***n-CellChangeHigh***

The number of cell changes to enter high mobility state. Corresponds to  $N_{CR\_H}$  in TS 38.304 [20].

##### ***n-CellChangeMedium***

The number of cell changes to enter medium mobility state. Corresponds to  $N_{CR\_M}$  in TS 38.304 [20].

##### ***t-Evaluation***

The duration for evaluating criteria to enter mobility states. Corresponds to  $T_{CRmax}$  in TS 38.304 [20]. Value in seconds, *s30* corresponds to 30 s and so on.

##### ***t-HystNormal***

The additional duration for evaluating criteria to enter normal mobility state. Corresponds to  $T_{CRmaxHyst}$  in TS 38.304 [20]. Value in seconds, value *s30* corresponds to 30 seconds and so on.

## – *MsgA-ConfigCommon*

The IE *MsgA-ConfigCommon* is used to configure the PRACH and PUSCH resource for transmission of MsgA in 2-step random access type procedure.

```

-- ASN1START
-- TAG-MSGACONFIGCOMMON-START

MsgA-ConfigCommon-r16 ::= SEQUENCE {
    rach-ConfigCommonTwoStepRA-r16 RACH-ConfigCommonTwoStepRA-r16,
    msgA-PUSCH-Config-r16           MsgA-PUSCH-Config-r16           OPTIONAL --Cond InitialBWPConfig
}
-- TAG-MSGACONFIGCOMMON-STOP
-- ASN1STOP

```

#### **MsgA-ConfigCommon field descriptions**

##### ***msgA-PUSCH-Config***

Configuration of cell-specific MsgA PUSCH parameters which the UE uses for contention-based MsgA PUSCH transmission of this BWP. If the field is not configured for the selected UL BWP, the UE shall use the MsgA PUSCH configuration of initial UL BWP.

##### ***rach-ConfigCommonTwoStepRA***

Configuration of cell specific random access parameters which the UE uses for contention based and contention free 2-step random access type procedure as well as for 2-step RA type contention based beam failure recovery in this BWP.

Conditional Presence	Explanation
<i>InitialBWPConfig</i>	The field is mandatory present when <i>MsgA-ConfigCommon</i> is configured for the initial uplink BWP, or when <i>MsgA-ConfigCommon</i> is configured for a non-initial uplink BWP and <i>MsgA-ConfigCommon</i> is not configured for the initial uplink BWP, otherwise the field is Need S.

## – *MsgA-PUSCH-Config*

The IE *MsgA-PUSCH-Config* is used to specify the PUSCH allocation for MsgA in 2-step random access type procedure.

### *MsgA-PUSCH-Config* information element

```

-- ASN1START
-- TAG-MSG-A-PUSCH-CONFIG-START

MsgA-PUSCH-Config-r16 ::=
    msgA-PUSCH-ResourceGroupA-r16
    msgA-PUSCH-ResourceGroupB-r16
    msgA-TransformPrecoder-r16
    msgA-DataScramblingIndex-r16
    msgA-DeltaPreamble-r16
}

MsgA-PUSCH-Resource-r16 ::=
    msgA-MCS-r16
    nrofSlotsMsgA-PUSCH-r16
    nrofMsgA-PO-PerSlot-r16
    msgA-PUSCH-TimeDomainOffset-r16
    msgA-PUSCH-TimeDomainAllocation-r16
    startSymbolAndLengthMsgA-PO-r16
    mappingTypeMsgA-PUSCH-r16
    guardPeriodMsgA-PUSCH-r16
    guardBandMsgA-PUSCH-r16
    frequencyStartMsgA-PUSCH-r16
    nrofPRBs-PerMsgA-PO-r16
    nrofMsgA-PO-FDM-r16
    msgA-IntraSlotFrequencyHopping-r16
    msgA-HoppingBits-r16
    msgA-DMRS-Config-r16
    nrofDMRS-Sequences-r16
    msgA-Alpha-r16

    interlaceIndexFirstPO-MsgA-PUSCH-r16
    nrofInterlacesPerMsgA-PO-r16
    ...
}

MsgA-DMRS-Config-r16 ::=
    msgA-DMRS-AdditionalPosition-r16
    msgA-MaxLength-r16
    msgA-PUSCH-DMRS-CDM-Group-r16

```

SEQUENCE {

- MsgA-PUSCH-Resource-r16 OPTIONAL, -- Cond InitialBWPConfig
- MsgA-PUSCH-Resource-r16 OPTIONAL, -- Cond GroupBConfigured
- ENUMERATED {enabled, disabled} OPTIONAL, -- Need R
- INTEGER (0..1023) OPTIONAL, -- Need S
- INTEGER (-1..6) OPTIONAL, -- Need R

SEQUENCE {

- INTEGER (0..15),
- INTEGER (1..4),
- ENUMERATED {one, two, three, six},
- INTEGER (1..32),
- INTEGER (1..maxNrofUL-Allocations) OPTIONAL, -- Need S
- INTEGER (0..127) OPTIONAL, -- Need S
- ENUMERATED {typeA, typeB} OPTIONAL, -- Need S
- INTEGER (0..3) OPTIONAL, -- Need R
- INTEGER (0..1),
- INTEGER (0..maxNrofPhysicalResourceBlocks-1),
- INTEGER (1..32),
- ENUMERATED {one, two, four, eight},
- ENUMERATED {enabled} OPTIONAL, -- Need R
- BIT STRING (SIZE(2)) OPTIONAL, -- Need R
- MsgA-DMRS-Config-r16,
- INTEGER (1..2),
- ENUMERATED {alpha0, alpha04, alpha05, alpha06, alpha07, alpha08, alpha09, alpha1} OPTIONAL, -- Need S
- INTEGER (1..10) OPTIONAL, -- Need R
- INTEGER (1..10) OPTIONAL, -- Need R

SEQUENCE {

- ENUMERATED {pos0, pos1, pos3} OPTIONAL, -- Need S
- ENUMERATED {len2} OPTIONAL, -- Need S
- INTEGER (0..1) OPTIONAL, -- Need S

```

msgA-PUSCH-NrofPorts-r16          INTEGER (0..1)          OPTIONAL, -- Need S
msgA-ScramblingID0-r16           INTEGER (0..65535)       OPTIONAL, -- Need S
msgA-ScramblingID1-r16           INTEGER (0..65535)       OPTIONAL, -- Need S
}

-- TAG-MSG-A-PUSCH-CONFIG-STOP
-- ASN1STOP

```

<b><i>MsgA-PUSCH-Config</i> field descriptions</b>
<b><i>msgA-DataScramblingIndex</i></b> Identifier used to initiate data scrambling (c_init) for msgA PUSCH. If the field is absent the UE applies the value Physical cell ID ( <i>physCellID</i> ).
<b><i>msgA-DeltaPreamble</i></b> Power offset of msgA PUSCH relative to the preamble received target power (see TS 38.213 [13], clause 7.1).
<b><i>msgA-PUSCH-ResourceGroupA</i></b> MsgA PUSCH resources that the UE shall use when performing MsgA transmission using preambles group A. If field is not configured for the selected UL BWP, the UE shall use the MsgA PUSCH configuration for group A of initial UL BWP.
<b><i>msgA-PUSCH-ResourceGroupB</i></b> MsgA PUSCH resources that the UE shall use when performing MsgA transmission using preambles group B.
<b><i>msgA-TransformPrecoder</i></b> Enables or disables the transform precoder for MsgA transmission (see clause 6.1.3 of TS 38.214 [19]).

<b><i>MsgA-PUSCH-Resource</i> field descriptions</b>	
<b><i>guardBandMsgA-PUSCH</i></b>	PRB-level guard band between FD Med PUSCH occasions (see TS 38.213 [13], clause 8.1A). If interlaced PUSCH is configured, value 0 is applied.
<b><i>guardPeriodMsgA-PUSCH</i></b>	Guard period between PUSCH occasions in the unit of symbols (see TS 38.213 [13], clause 8.1A).
<b><i>frequencyStartMsgA-PUSCH</i></b>	Offset of lowest PUSCH occasion in frequency domain with respect to PRB 0 (see TS 38.213 [13], clause 8.1A).
<b><i>interlaceIndexFirstPO-MsgA-PUSCH</i></b>	Interlace index of the first PUSCH occasion in frequency domain if interlaced PUSCH is configured. For 30kHz SCS only the integers 1, 2, 3, 4, 5 are applicable (see TS 38.213 [13], clause 8.1A).
<b><i>mappingTypeMsgA-PUSCH</i></b>	PUSCH mapping type A or B. If the field is absent, the UE shall use the parameter <i>msgA-PUSCH-TimeDomainAllocation</i> (see TS 38.213 [13], clause 8.1A).
<b><i>msgA-Alpha</i></b>	Dedicated alpha value for MsgA PUSCH. If value is absent, the UE shall use the value of <i>msg3-Alpha</i> if configured, else UE applies value 1 (see TS 38.213 [13], clause 7.1.1).
<b><i>msgA-DMRS-Config</i></b>	DMRS configuration for msgA PUSCH (see TS 38.213 [13], clause 8.1A and TS 38.214 [19] clause 6.2.2).
<b><i>msgA-HoppingBits</i></b>	Value of hopping bits to indicate which frequency offset to be used for second hop. See Table 8.3-1 in 38.213 [13]. This field is mandatory present when the field <i>msgA-IntraSlotFrequencyHopping</i> is configured. Otherwise, the field is absent.
<b><i>msgA-IntraSlotFrequencyHopping</i></b>	Intra-slot frequency hopping per PUSCH occasion (see TS 38.213 [13], clause 8.1A).
<b><i>msgA-MCS</i></b>	Indicates the MCS index for msgA PUSCH from the Table 6.1.4.1-1 for DFT-s-OFDM and Table 5.1.3.1-1 for CP-OFDM in 38.214 [19].
<b><i>msgA-PUSCH-TimeDomainAllocation</i></b>	Indicates a combination of start symbol and length and PUSCH mapping type from the TDRA table ( <i>PUSCH-TimeDomainResourceAllocationList</i> if provided in <i>PUSCH-ConfigCommon</i> , or else the default Table 6.1.2.1.1-2 in 38.214 [19] is used if <i>pusch-TimeDomainAllocationList</i> is not provided in <i>PUSCH-ConfigCommon</i> ). The parameter K2 in the table is not used for msgA PUSCH. The network configures one of <i>msgA-PUSCH-TimeDomainAllocation</i> and <i>startSymbolAndLengthMsgA-PO</i> , but not both. If the field is absent, the UE shall use the value of <i>startSymbolAndLengthMsgA-PO</i> .
<b><i>msgA-PUSCH-TimeDomainOffset</i></b>	A single time offset with respect to the start of each PRACH slot (with at least one valid RO), counted as the number of slots (based on the numerology of active UL BWP). See 38.213 [13], clause 8.1A.
<b><i>nrofDMRS-Sequences</i></b>	Number of DMRS sequences for MsgA PUSCH for CP-OFDM. In case of single PUSCH configuration or if the DMRS symbols of multiple configurations are not overlapped, if the DMRS resources configured in one PUSCH occasion is no larger than 8 (for <i>len2</i> ) or 4 (for <i>len1</i> ), then only DMRS port is configured.
<b><i>nrofInterlacesPerMsgA-PO</i></b>	Number of consecutive interlaces per PUSCH occasion if interlaced PUSCH is configured. For 30kHz SCS only the integers 1, 2, 3, 4, 5 are applicable (see TS 38.213 [13], clause 8.1A).
<b><i>nrofMsgA-PO-FDM</i></b>	The number of msgA PUSCH occasions FD Med in one time instance (see TS 38.213 [13], clause 8.1A).
<b><i>nrofMsgA-PO-PerSlot</i></b>	Number of time domain PUSCH occasions in each slot. PUSCH occasions including guard period are contiguous in time domain within a slot (see TS 38.213 [13], clause 8.1A).
<b><i>nrofPRBs-PerMsgA-PO</i></b>	Number of PRBs per PUSCH occasion (see TS 38.213 [13], clause 8.1A).

<p><b><i>nrofSlotsMsgA-PUSCH</i></b> Number of slots (in active UL BWP numerology) containing one or multiple PUSCH occasions, each slot has the same time domain resource allocation (see TS 38.213 [13], clause 8.1A).</p>
<p><b><i>startSymbolAndLengthMsgA-PO</i></b> An index giving valid combinations of start symbol, length and mapping type as start and length indicator (SLIV) for the first msgA PUSCH occasion, for RRC_CONNECTED UEs in non-initial BWP as described in TS 38.214 [19] clause 6.1.2. The network configures the field so that the allocation does not cross the slot boundary. The number of occupied symbols excludes the guard period. If the field is absent, the UE shall use the value in <i>msgA-PUSCH-TimeDomainAllocation</i> (see TS 38.213 [13], clause 8.1A). The network configures one of <i>msgA-PUSCH-TimeDomainAllocation</i> and <i>startSymbolAndLengthMsgA-PO</i>, but not both. If the field is absent, the UE shall use the value of <i>msgA-PUSCH-TimeDomainAllocation</i>.</p>

<b><i>MsgA-DMRS-Config</i> field descriptions</b>
<p><b><i>msgA-DMRS-AdditionalPosition</i></b> Indicates the position for additional DM-RS. If the field is absent, the UE applies value <i>pos2</i>.</p>
<p><b><i>msgA-MaxLength</i></b> indicates single-symbol or double-symbol DMRS. If the field is absent, the UE applies value <i>len1</i>.</p>
<p><b><i>msgA-PUSCH-DMRS-CDM-group</i></b> 1-bit indication of indices of CDM group(s). If the field is absent, then both CDM groups are used.</p>
<p><b><i>msgA-PUSCH-NrofPort</i></b> 0 indicates 1 port per CDM group, 1 indicates 2 ports per CDM group. If the field is absent then 4 ports per CDM group are used.</p>
<p><b><i>msgA-ScramblingID0</i></b> UL DMRS scrambling initialization for CP-OFDM. If the field is absent the UE applies the value Physical cell ID (<i>physCellID</i>).</p>
<p><b><i>msgA-ScramblingID1</i></b> UL DMRS scrambling initialization for CP-OFDM. If the field is absent the UE applies the value Physical cell ID (<i>physCellID</i>).</p>

<b>Conditional Presence</b>	<b>Explanation</b>
<i>GroupBConfigured</i>	The field is mandatory present if <i>groupB-ConfiguredTwoStepRA</i> is configured in <i>RACH-ConfigCommonTwoStepRA</i> , otherwise the field is absent.
<i>InitialBWPConfig</i>	The field is mandatory present when <i>MsgA-ConfigCommon</i> is configured for the initial uplink BWP, or when <i>MsgA-ConfigCommon</i> is configured for a non-initial uplink BWP and <i>MsgA-ConfigCommon</i> is not configured for the initial uplink BWP, otherwise the field is Need S.

## – *MultiFrequencyBandListNR*

The IE *MultiFrequencyBandListNR* is used to configure a list of one or multiple NR frequency bands.

### ***MultiFrequencyBandListNR* information element**

```
-- ASN1START
-- TAG-MULTIFREQUENCYBANDLISTNR-START

MultiFrequencyBandListNR ::= SEQUENCE (SIZE (1..maxNrofMultiBands)) OF FreqBandIndicatorNR

-- TAG-MULTIFREQUENCYBANDLISTNR-STOP
-- ASN1STOP
```

## – MultiFrequencyBandListNR-SIB

The IE *MultiFrequencyBandListNR-SIB* indicates the list of frequency bands, for which cell (re-)selection parameters are common, and a list of *additionalPmax* and *additionalSpectrumEmission*.

### MultiFrequencyBandListNR-SIB information element

```
-- ASN1START
-- TAG-MULTIFREQUENCYBANDLISTNR-SIB-START

MultiFrequencyBandListNR-SIB ::=
    SEQUENCE (SIZE (1.. maxNrofMultiBands)) OF NR-MultiBandInfo

NR-MultiBandInfo ::=
    SEQUENCE {
        freqBandIndicatorNR          FreqBandIndicatorNR          OPTIONAL,  -- Cond OptULNotSIB2
        nr-NS-PmaxList              NR-NS-PmaxList              OPTIONAL  -- Need S
    }

-- TAG-MULTIFREQUENCYBANDLISTNR-SIB-STOP
-- ASN1STOP
```

#### NR-MultiBandInfo field descriptions

##### **freqBandIndicatorNR**

Provides an NR frequency band number as defined in TS 38.101-1 [15] and TS 38.101-2 [39], table 5.2-1.

##### **nr-NS-PmaxList**

Provides a list of *additionalPmax* and *additionalSpectrumEmission* values. If the field is absent the UE uses value 0 for the *additionalSpectrumEmission* (see TS 38.101-1 [15] table 6.2.3.1-1A , and TS 38.101-2 [39], table 6.2.3.1-2).

Conditional Presence	Explanation
<i>OptULNotSIB2</i>	The field is absent for <i>SIB2</i> and is mandatory present in <i>SIB4</i> and <i>frequencyInfoDL-SIB</i> . Otherwise, if the field is absent in <i>frequencyInfoUL-SIB</i> in <i>UplinkConfigCommonSIB</i> , the UE will use the frequency band indicated in <i>frequencyInfoDL-SIB</i> in <i>DownlinkConfigCommonSIB</i> .

## – NeedForGapsConfigNR

The IE *NeedForGapsConfigNR* contains configuration related to the reporting of measurement gap requirement information.

### NeedForGapsConfigNR information element

```
-- ASN1START
-- TAG-NeedForGapsConfigNR-START

NeedForGapsConfigNR-r16 ::=
    SEQUENCE {
        requestedTargetBandFilterNR-r16 SEQUENCE (SIZE (1..maxBands)) OF FreqBandIndicatorNR          OPTIONAL  -- Need R
```



```

}
-- TAG-NeedForGapsConfigNR-STOP
-- ASN1STOP

```

<i>NeedForGapsConfigNR field descriptions</i>
---

<b><i>requestedTargetBandFilterNR</i></b>
---

Indicates the target NR bands that the UE is requested to report the gap requirement information.
---

## – *NeedForGapsInfoNR*

The IE *NeedForGapsInfoNR* indicates whether measurement gap is required for the UE to perform SSB based measurements on an NR target band while NR-DC or NE-DC is not configured.

### *NeedForGapsInfoNR* information element

```

-- ASN1START
-- TAG-NeedForGapsInfoNR-START

NeedForGapsInfoNR-r16 ::=          SEQUENCE {
    intraFreq-needForGap-r16        NeedForGapsIntraFreqList-r16,
    interFreq-needForGap-r16        NeedForGapsBandListNR-r16
}

NeedForGapsIntraFreqList-r16 ::=   SEQUENCE (SIZE (1.. maxNrofServingCells)) OF NeedForGapsIntraFreq-r16

NeedForGapsBandListNR-r16 ::=      SEQUENCE (SIZE (1..maxBands)) OF NeedForGapsNR-r16

NeedForGapsIntraFreq-r16 ::=       SEQUENCE {
    servCellId-r16                  ServCellIndex,
    gapIndicationIntra-r16           ENUMERATED {gap, no-gap}
}

NeedForGapsNR-r16 ::=              SEQUENCE {
    bandNR-r16                       FreqBandIndicatorNR,
    gapIndication-r16                 ENUMERATED {gap, no-gap}
}

-- TAG-NeedForGapsInfoNR-STOP
-- ASN1STOP

```

<b>NeedForGapsInfoNR field descriptions</b>
<b><i>intraFreq-needForGap</i></b> Indicates the measurement gap requirement information for NR intra-frequency measurement.
<b><i>interFreq-needForGap</i></b> Indicates the measurement gap requirement information for NR inter-frequency measurement.

<b>NeedForGapsIntraFreq field descriptions</b>
<b><i>servCellId</i></b> Indicates the serving cell which contains the target SSB (associated with the initial DL BWP) to be measured.
<b><i>gapIndicationIntra</i></b> Indicates whether measurement gap is required for the UE to perform intra-frequency SSB based measurements on the concerned serving cell. Value <i>gap</i> indicates that a measurement gap is needed if any of the UE configured BWPs do not contain the frequency domain resources of the SSB associated to the initial DL BWP. Value <i>no-gap</i> indicates a measurement gap is not needed to measure the SSB associated to the initial DL BWP for all configured BWPs, no matter the SSB is within the configured BWP or not.

<b>NeedForGapsNR field descriptions</b>
<b><i>bandNR</i></b> Indicates the NR target band to be measured.
<b><i>gapIndication</i></b> Indicates whether measurement gap is required for the UE to perform SSB based measurements on the concerned NR target band while NR-DC or NE-DC is not configured. The UE determines this information based on the resultant configuration of the <i>RRCReconfiguration</i> or <i>RRCResume</i> message that triggers this response. Value <i>gap</i> indicates that a measurement gap is needed, value <i>no-gap</i> indicates a measurement gap is not needed.

## – *NextHopChainingCount*

The IE *NextHopChainingCount* is used to update the  $K_{gNB}$  key and corresponds to parameter NCC: See TS 33.501 [11].

### ***NextHopChainingCount* information element**

```
-- ASN1START
-- TAG-NEXTHOPCHAININGCOUNT-START

NextHopChainingCount ::=
    INTEGER (0..7)

-- TAG-NEXTHOPCHAININGCOUNT-STOP
-- ASN1STOP
```

## – *NG-5G-S-TMSI*

The IE *NG-5G-S-TMSI* contains a 5G S-Temporary Mobile Subscription Identifier (5G-S-TMSI), a temporary UE identity provided by the 5GC which uniquely identifies the UE within the tracking area, see TS 23.003 [21].

**NG-5G-S-TMSI information element**

```

-- ASN1START
-- TAG-NG-5G-S-TMSI-START

NG-5G-S-TMSI ::=
    BIT STRING (SIZE (48))

-- TAG-NG-5G-S-TMSI-STOP
-- ASN1STOP

```

— ***NPN-Identity***

The IE *NPN-Identity* includes either a list of CAG-IDs or a list of NIDs per PLMN Identity. Further information regarding how to set the IE is specified in TS 23.003 [21].

***NPN-Identity* information element**

```

-- ASN1START
-- TAG-NPN-IDENTITY-START

NPN-Identity-r16 ::=
    CHOICE {
        pni-npn-r16
            SEQUENCE {
                plmn-Identity-r16
                cag-IdentityList-r16
            },
        snpn-r16
            SEQUENCE {
                plmn-Identity
                nid-List-r16
            }
    }

CAG-IdentityInfo-r16 ::=
    SEQUENCE {
        cag-Identity-r16
        manualCAGselectionAllowed-r16
    }
    BIT STRING (SIZE (32)),
    ENUMERATED {true}
    OPTIONAL -- Need R

NID-r16 ::=
    BIT STRING (SIZE (44))

-- TAG-NPN-IDENTITY-STOP
-- ASN1STOP

```

<i>NPN-Identity</i> field descriptions
<p><b>CAG-Identity</b> A CAG-ID as specified in TS 23.003 [21]. The PLMN ID and a CAG ID in the <i>NPN-Identity</i> identifies a PNI-NPN.</p>
<p><b>cag-IdentityList</b> The <i>cag-IdentityList</i> contains one or more CAG IDs. All CAG IDs associated to the same PLMN ID are listed in the same <i>cag-IdentityList</i> entry.</p>
<p><b>manualCAGselectionAllowed</b> The <i>manualCAGselectionAllowed</i> indicates that the CAG ID can be selected manually even if it is outside the UE's allowed CAG list.</p>
<p><b>NID</b> A NID as specified in TS 23.003 [21]. The PLMN ID and a NID in the <i>NPN-Identity</i> identifies a SNPN.</p>
<p><b>nid-List</b> The <i>nid-List</i> contains one or more <i>NID</i>.</p>

## – *NPN-IdentityInfoList*

The IE *NPN-IdentityInfoList* includes a list of NPN identity information.

### *NPN-IdentityInfoList* information element

```

-- ASN1START
-- TAG-NPN-IDENTITYINFOLIST-START

NPN-IdentityInfoList-r16 ::= SEQUENCE (SIZE (1..maxNPN-r16)) OF NPN-IdentityInfo-r16

NPN-IdentityInfo-r16 ::= SEQUENCE {
    npn-IdentityList-r16          SEQUENCE (SIZE (1..maxNPN-r16)) OF NPN-Identity-r16,
    trackingAreaCode-r16        TrackingAreaCode,
    ranac-r16                    RAN-AreaCode                               OPTIONAL,      -- Need R
    cellIdentity-r16            CellIdentity,
    cellReservedForOperatorUse-r16 ENUMERATED {reserved, notReserved},
    iab-Support-r16             ENUMERATED {true}                          OPTIONAL,      -- Need R
    ...
}

-- TAG-NPN-IDENTITYINFOLIST-STOP
-- ASN1STOP

```

<b><i>NPN-IdentityInfoList</i> field descriptions</b>
<p><b><i>iab-Support</i></b> This field combines both the support of IAB and the cell status for IAB. If the field is present, the cell supports IAB and the cell is also considered as a candidate for cell (re)selection for IAB-nodes; if the field is absent, the cell does not support IAB and/or the cell is barred for IAB-node.</p>
<p><b><i>NPN-IdentityInfo</i></b> The <i>NPN-IdentityInfo</i> contains one or more NPN identities and additional information associated with those NPNs. Only the same type of NPNs (either SNPNs or PNI-NPNs) can be listed in a <i>NPN-IdentityInfo</i> element.</p>
<p><b><i>nnp-IdentityList</i></b> The <i>nnp-IdentityList</i> contains one or more NPN Identity elements.</p>
<p><b><i>trackingAreaCode</i></b> Indicates the Tracking Area Code to which the cell indicated by cellIdentity field belongs.</p>
<p><b><i>ranac</i></b> Indicates the RAN Area Code to which the cell indicated by cellIdentity field belongs.</p>
<p><b><i>cellReservedForOperatorUse</i></b> Indicates whether the cell is reserved for operator use (for the NPN(s) identified in the <i>nnp-IdentityList</i>) as defined in TS 38.304 [20]. This field is ignored by NPN capable IAB-MT.</p>

### – *NR-NS-PmaxList*

The IE *NR-NS-PmaxList* is used to configure a list of *additionalPmax* and *additionalSpectrumEmission*, as defined in TS 38.101-1 [15], table 6.2.3.1-1A, and TS 38.101-2 [39], table 6.2.3.1-2, for a given frequency band.

#### ***NR-NS-PmaxList* information element**

```

-- ASN1START
-- TAG-NR-NS-PMAXLIST-START

NR-NS-PmaxList ::=
    SEQUENCE (SIZE (1..maxNR-NS-Pmax)) OF NR-NS-PmaxValue

NR-NS-PmaxValue ::=
    SEQUENCE {
        additionalPmax                P-Max
        additionalSpectrumEmission    AdditionalSpectrumEmission
    }

-- TAG-NR-NS-PMAXLIST-STOP
-- ASN1STOP

```

### – *NZP-CSI-RS-Resource*

The IE *NZP-CSI-RS-Resource* is used to configure Non-Zero-Power (NZP) CSI-RS transmitted in the cell where the IE is included, which the UE may be configured to measure on (see TS 38.214 [19], clause 5.2.2.3.1). A change of configuration between periodic, semi-persistent or aperiodic for an *NZP-CSI-RS-Resource* is not supported without a release and add.

**NZP-CSI-RS-Resource information element**

```

-- ASN1START
-- TAG-NZP-CSI-RS-RESOURCE-START

NZP-CSI-RS-Resource ::=
    nzp-CSI-RS-ResourceId          SEQUENCE {
        resourceMapping           CSI-RS-ResourceMapping,
        powerControlOffset        INTEGER (-8..15),
        powerControlOffsetSS      ENUMERATED{db-3, db0, db3, db6}          OPTIONAL, -- Need R
        scramblingID              ScramblingId,
        periodicityAndOffset      CSI-ResourcePeriodicityAndOffset      OPTIONAL, -- Cond PeriodicOrSemiPersistent
        qcl-InfoPeriodicCSI-RS   TCI-StateId                          OPTIONAL, -- Cond Periodic
        ...
    }

-- TAG-NZP-CSI-RS-RESOURCE-STOP
-- ASN1STOP

```

<b>NZP-CSI-RS-Resource field descriptions</b>	
<b>periodicityAndOffset</b>	Periodicity and slot offset <i>s1</i> corresponds to a periodicity of 1 slot, <i>s2</i> to a periodicity of two slots, and so on. The corresponding offset is also given in number of slots (see TS 38.214 [19], clause 5.2.2.3.1). Network always configures the UE with a value for this field for periodic and semi-persistent NZP-CSI-RS-Resource (as indicated in <i>CSI-ResourceConfig</i> ).
<b>powerControlOffset</b>	Power offset of PDSCH RE to NZP CSI-RS RE. Value in dB (see TS 38.214 [19], clauses 5.2.2.3.1 and 4.1).
<b>powerControlOffsetSS</b>	Power offset of NZP CSI-RS RE to SSS RE. Value in dB (see TS 38.214 [19], clause 5.2.2.3.1).
<b>qcl-InfoPeriodicCSI-RS</b>	For a target periodic CSI-RS, contains a reference to one <i>TCI-State</i> in TCI-States for providing the QCL source and QCL type. For periodic CSI-RS, the source can be SSB or another periodic-CSI-RS. Refers to the <i>TCI-State</i> which has this value for <i>tcI-StateId</i> and is defined in <i>tcI-StatesToAddModList</i> in the <i>PD SCH-Config</i> included in the <i>BWP-Downlink</i> corresponding to the serving cell and to the DL BWP to which the resource belongs to (see TS 38.214 [19], clause 5.2.2.3.1).
<b>resourceMapping</b>	OFDM symbol location(s) in a slot and subcarrier occupancy in a PRB of the CSI-RS resource.
<b>scramblingID</b>	Scrambling ID (see TS 38.214 [19], clause 5.2.2.3.1).

Conditional Presence	Explanation
<i>Periodic</i>	The field is optionally present, Need M, for periodic <i>NZP-CSI-RS-Resources</i> (as indicated in <i>CSI-ResourceConfig</i> ). The field is absent otherwise.
<i>PeriodicOrSemiPersistent</i>	The field is optionally present, Need M, for periodic and semi-persistent <i>NZP-CSI-RS-Resources</i> (as indicated in <i>CSI-ResourceConfig</i> ). The field is absent otherwise.

– *NZP-CSI-RS-ResourceId*

The IE *NZP-CSI-RS-ResourceId* is used to identify one NZP-CSI-RS-Resource.

***NZP-CSI-RS-ResourceId* information element**

```
-- ASN1START
-- TAG-NZP-CSI-RS-RESOURCEID-START

NZP-CSI-RS-ResourceId ::=          INTEGER (0..maxNrofNZP-CSI-RS-Resources-1)

-- TAG-NZP-CSI-RS-RESOURCEID-STOP
-- ASN1STOP
```

– *NZP-CSI-RS-ResourceSet*

The IE *NZP-CSI-RS-ResourceSet* is a set of Non-Zero-Power (NZP) CSI-RS resources (their IDs) and set-specific parameters.

***NZP-CSI-RS-ResourceSet* information element**

```
-- ASN1START
-- TAG-NZP-CSI-RS-RESOURCESET-START
NZP-CSI-RS-ResourceSet ::=          SEQUENCE {
  nzp-CSI-ResourceSetId             NZP-CSI-RS-ResourceSetId,
  nzp-CSI-RS-Resources              SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId,
  repetition                        ENUMERATED { on, off }                                OPTIONAL, -- Need S
  aperiodicTriggeringOffset         INTEGER(0..6)                                  OPTIONAL, -- Need S
  trs-Info                          ENUMERATED {true}                                OPTIONAL, -- Need R
  ...,
  [[
  aperiodicTriggeringOffset-r16     INTEGER(0..31)                                  OPTIONAL -- Need S
  ]]
}

-- TAG-NZP-CSI-RS-RESOURCESET-STOP
-- ASN1STOP
```

<b>NZP-CSI-RS-ResourceSet field descriptions</b>
<p><b><i>aperiodicTriggeringOffset, aperiodicTriggeringOffset-r16</i></b>            Offset X between the slot containing the DCI that triggers a set of aperiodic NZP CSI-RS resources and the slot in which the CSI-RS resource set is transmitted. For <i>aperiodicTriggeringOffset</i>, the value 0 corresponds to 0 slots, value 1 corresponds to 1 slot, value 2 corresponds to 2 slots, value 3 corresponds to 3 slots, value 4 corresponds to 4 slots, value 5 corresponds to 16 slots, value 6 corresponds to 24 slots. For <i>aperiodicTriggeringOffset-r16</i>, the value indicates the number of slots. The network configures only one of the fields. When neither field is included, the UE applies the value 0.</p>
<p><b><i>nzp-CSI-RS-Resources</i></b>            NZP-CSI-RS-Resources associated with this NZP-CSI-RS resource set (see TS 38.214 [19], clause 5.2). For CSI, there are at most 8 NZP CSI RS resources per resource set.</p>
<p><b><i>repetition</i></b>            Indicates whether repetition is on/off. If the field is set to <i>off</i> or if the field is absent, the UE may not assume that the NZP-CSI-RS resources within the resource set are transmitted with the same downlink spatial domain transmission filter (see TS 38.214 [19], clauses 5.2.2.3.1 and 5.1.6.1.2). It can only be configured for CSI-RS resource sets which are associated with <i>CSI-ReportConfig</i> with report of L1 RSRP or "no report".</p>
<p><b><i>trs-Info</i></b>            Indicates that the antenna port for all NZP-CSI-RS resources in the CSI-RS resource set is same. If the field is absent or released the UE applies the value <i>false</i> (see TS 38.214 [19], clause 5.2.2.3.1).</p>

### – *NZP-CSI-RS-ResourceSetId*

The IE *NZP-CSI-RS-ResourceSetId* is used to identify one *NZP-CSI-RS-ResourceSet*.

#### ***NZP-CSI-RS-ResourceSetId* information element**

```
-- ASN1START
-- TAG-NZP-CSI-RS-RESOURCESETID-START

NZP-CSI-RS-ResourceSetId ::=          INTEGER (0..maxNrofNZP-CSI-RS-ResourceSets-1)

-- TAG-NZP-CSI-RS-RESOURCESETID-STOP
-- ASN1STOP
```

### – *P-Max*

The IE *P-Max* is used to limit the UE's uplink transmission power on a carrier frequency, in TS 38.101-1 [15] and is used to calculate the parameter *Pcompensation* defined in TS 38.304 [20].

#### ***P-Max* information element**

```
-- ASN1START
-- TAG-P-MAX-START

P-Max ::=          INTEGER (-30..33)

-- TAG-P-MAX-STOP
-- ASN1STOP
```



## – PCI-List

The IE *PCI-List* concerns a list of physical cell identities, which may be used for different purposes.

### **PCI-List information element**

```
-- ASN1START
-- TAG-PCI-LIST-START

PCI-List ::=
    SEQUENCE (SIZE (1..maxNrofCellMeas)) OF PhysCellId

-- TAG-PCI-LIST-STOP
-- ASN1STOP
```

## – PCI-Range

The IE *PCI-Range* is used to encode either a single or a range of physical cell identities. The range is encoded by using a *start* value and by indicating the number of consecutive physical cell identities (including *start*) in the range. For fields comprising multiple occurrences of *PCI-Range*, the Network may configure overlapping ranges of physical cell identities.

### **PCI-Range information element**

```
-- ASN1START
-- TAG-PCI-RANGE-START

PCI-Range ::=
    SEQUENCE {
        start
            PhysCellId,
        range
            ENUMERATED {n4, n8, n12, n16, n24, n32, n48, n64, n84,
                       n96, n128, n168, n252, n504, n1008,spare1}
    }
    OPTIONAL -- Need S

-- TAG-PCI-RANGE-STOP
-- ASN1STOP
```

#### **PCI-Range field descriptions**

##### **range**

Indicates the number of physical cell identities in the range (including *start*). Value *n4* corresponds with 4, value *n8* corresponds with 8 and so on. The UE shall apply value 1 in case the field is absent, in which case only the physical cell identity value indicated by *start* applies.

##### **start**

Indicates the lowest physical cell identity in the range.

## – PCI-RangeElement

The IE *PCI-RangeElement* is used to define a PCI-Range as part of a list (e.g. AddMod list).

**PCI-RangeElement** information element

```

-- ASN1START
-- TAG-PCI-RANGEELEMENT-START

PCI-RangeElement ::=
    pci-RangeIndex
    pci-Range
}
SEQUENCE {
    PCI-RangeIndex,
    PCI-Range
}

-- TAG-PCI-RANGEELEMENT-STOP
-- ASN1STOP

```

**PCI-RangeElement** field descriptions**pci-Range**

Physical cell identity or a range of physical cell identities.

– **PCI-RangeIndex**

The IE PCI-RangeIndex identifies a physical cell id range, which may be used for different purposes.

**PCI-RangeIndex** information element

```

-- ASN1START
-- TAG-PCI-RANGEINDEX-START

PCI-RangeIndex ::=
    INTEGER (1..maxNrofPCI-Ranges)

-- TAG-PCI-RANGEINDEX-STOP
-- ASN1STOP

```

– **PCI-RangeIndexList**

The IE *PCI-RangeIndexList* concerns a list of indexes of physical cell id ranges, which may be used for different purposes.

**PCI-RangeIndexList** information element

```

-- ASN1START
-- TAG-PCI-RANGEINDEXLIST-START

PCI-RangeIndexList ::=
    SEQUENCE (SIZE (1..maxNrofPCI-Ranges)) OF PCI-RangeIndex

-- TAG-PCI-RANGEINDEXLIST-STOP
-- ASN1STOP

```

– *PDCCH-Config*

The IE *PDCCH-Config* is used to configure UE specific PDCCH parameters such as control resource sets (CORESET), search spaces and additional parameters for acquiring the PDCCH. If this IE is used for the scheduled cell in case of cross carrier scheduling, the fields other than *searchSpacesToAddModList* and *searchSpacesToReleaseList* are absent. If the IE is used for a dormant BWP, the fields other than *controlResourceSetToAddModList* and *controlResourceSetToReleaseList* are absent.

***PDCCH-Config* information element**

```
-- ASN1START
-- TAG-PDCCH-CONFIG-START

PDCCH-Config ::=
    SEQUENCE {
        controlResourceSetToAddModList SEQUENCE(SIZE (1..3)) OF ControlResourceSet OPTIONAL, -- Need N
        controlResourceSetToReleaseList SEQUENCE(SIZE (1..3)) OF ControlResourceSetId OPTIONAL, -- Need N
        searchSpacesToAddModList SEQUENCE(SIZE (1..10)) OF SearchSpace OPTIONAL, -- Need N
        searchSpacesToReleaseList SEQUENCE(SIZE (1..10)) OF SearchSpaceId OPTIONAL, -- Need N
        downlinkPreemption SetupRelease { DownlinkPreemption } OPTIONAL, -- Need M
        tpc-PUSCH SetupRelease { PUSCH-TPC-CommandConfig } OPTIONAL, -- Need M
        tpc-PUCCH SetupRelease { PUCCH-TPC-CommandConfig } OPTIONAL, -- Need M
        tpc-SRS SetupRelease { SRS-TPC-CommandConfig } OPTIONAL, -- Need M
        ...,
        [[
            controlResourceSetToAddModList2-r16 SEQUENCE (SIZE (1..2)) OF ControlResourceSet OPTIONAL, -- Need N
            controlResourceSetToReleaseList-r16 SEQUENCE (SIZE (1..5)) OF ControlResourceSetId-r16 OPTIONAL, -- Need N
            searchSpacesToAddModListExt-r16 SEQUENCE(SIZE (1..10)) OF SearchSpaceExt-r16 OPTIONAL, -- Need N
            uplinkCancellation-r16 SetupRelease { UplinkCancellation-r16 } OPTIONAL, -- Need M
            monitoringCapabilityConfig-r16 ENUMERATED { r15monitoringcapability,r16monitoringcapability } OPTIONAL, -- Need M
            searchSpaceSwitchConfig-r16 SearchSpaceSwitchConfig-r16 OPTIONAL -- Need R
        ]]
    }

SearchSpaceSwitchConfig-r16 ::=
    SEQUENCE {
        cellGroupsForSwitchList-r16 SEQUENCE(SIZE (1..4)) OF CellGroupForSwitch-r16 OPTIONAL, -- Need R
        searchSpaceSwitchDelay-r16 INTEGER (10..52) OPTIONAL -- Need R
    }

CellGroupForSwitch-r16 ::=
    SEQUENCE(SIZE (1..16)) OF ServCellIndex

-- TAG-PDCCH-CONFIG-STOP
-- ASN1STOP
```

<b>PDCCH-Config field descriptions</b>
<p><b>controlResourceSetToAddModList, controlResourceSetToAddModList2</b> List of UE specifically configured Control Resource Sets (CORESETs) to be used by the UE. The network configures at most 3 CORESETs per BWP per cell (including UE-specific and common CORESETs). The UE shall consider entries in <i>controlResourceSetToAddModList</i> and in <i>controlResourceSetToAddModList2</i> as a single list, i.e. an entry created using <i>controlResourceSetToAddModList</i> can be modified using <i>controlResourceSetToAddModList2</i> and vice-versa. In case network reconfigures control resource set with the same <i>ControlResourceSetId</i> as used for <i>commonControlResourceSet</i> configured via <i>PDCCH-ConfigCommon</i>, the configuration from <i>PDCCH-Config</i> always takes precedence and should not be updated by the UE based on <i>-servingCellConfigCommon</i>.</p>
<p><b>controlResourceSetToReleaseList</b> List of UE specifically configured Control Resource Sets (CORESETs) to be released by the UE. This field only applies to CORESETs configured by <i>controlResourceSetToAddModList</i> and does not release the field <i>commonControlResourceSet</i> configured by <i>PDCCH-ConfigCommon</i>.</p>
<p><b>downlinkPreemption</b> Configuration of downlink preemption indications to be monitored in this cell (see TS 38.213 [13], clause 11.2).</p>
<p><b>monitoringCapabilityConfig</b> Configures either Rel-15 PDCCH monitoring capability or Rel-16 PDCCH monitoring capability for PDCCH monitoring on a serving cell. Value <i>r15monitoringcapability</i> enables the Rel-15 monitoring capability, and value <i>r16monitoringcapability</i> enables the Rel-16 PDCCH monitoring capability (see TS 38.213 [13], clause 10.1).</p>
<p><b>searchSpacesToAddModList, searchSpacesToAddModListExt</b> List of UE specifically configured Search Spaces. The network configures at most 10 Search Spaces per BWP per cell (including UE-specific and common Search Spaces). If the network includes <i>searchSpaceToAddModListExt</i>, it includes the same number of entries, and listed in the same order, as in <i>searchSpacesToAddModList</i>.</p>
<p><b>tpc-PUCCH</b> Enable and configure reception of group TPC commands for PUCCH.</p>
<p><b>tpc-PUSCH</b> Enable and configure reception of group TPC commands for PUSCH.</p>
<p><b>tpc-SRS</b> Enable and configure reception of group TPC commands for SRS.</p>
<p><b>uplinkCancellation</b> Configuration of uplink cancellation indications to be monitored in this cell (see TS 38.213 [13], clause 11.2A).</p>

<b>SearchSpaceSwitchConfig field descriptions</b>
<p><b>cellGroupsForSwitchList</b> The list of serving cells which are bundled for the search space group switching purpose (see TS 38.213 [13], clause 10.4). A serving cell can belong to only one <i>CellGroupForSwitch</i>. The network configures the same list for all BWPs of serving cells in the same <i>CellGroupForSwitch</i>.</p>
<p><b>searchSpaceSwitchDelay</b> Indicates the value to be applied by a UE for Search Space Set Group switching; corresponds to the P value in TS 38.213 [13], clause 10.4. The network configures the same value for all BWPs of serving cells in the same <i>CellGroupForSwitch</i>.</p>

– **PDCCH-ConfigCommon**

The IE *PDCCH-ConfigCommon* is used to configure cell specific PDCCH parameters provided in SIB as well as in dedicated signalling.

**PDCCH-ConfigCommon information element**

```
-- ASN1START
-- TAG-PDCCH-CONFIGCOMMON-START
```

```

PDCCH-ConfigCommon ::=
    controlResourceSetZero          SEQUENCE {
        ControlResourceSetZero      OPTIONAL, -- Cond InitialBWP-Only
    commonControlResourceSet        ControlResourceSet      OPTIONAL, -- Need R
    searchSpaceZero                  SearchSpaceZero          OPTIONAL, -- Cond InitialBWP-Only
    commonSearchSpaceList            SEQUENCE (SIZE(1..4)) OF SearchSpace OPTIONAL, -- Need R
    searchSpaceSIB1                  SearchSpaceId              OPTIONAL, -- Need S
    searchSpaceOtherSystemInformation SearchSpaceId              OPTIONAL, -- Need S
    pagingSearchSpace                SearchSpaceId              OPTIONAL, -- Need S
    ra-SearchSpace                   SearchSpaceId              OPTIONAL, -- Need S
    ...,
    [[
    firstPDCCH-MonitoringOccasionOfPO CHOICE {
        sCS15KHzZoneT                 SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..139),
        sCS30KHzZoneT-SCS15KHzHalfT   SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..279),
        sCS60KHzZoneT-SCS30KHzHalfT-SCS15KHzQuarterT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..559),
        sCS120KHzZoneT-SCS60KHzHalfT-SCS30KHzQuarterT-SCS15KHzZoneEighthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..1119),
        sCS120KHzHalfT-SCS60KHzQuarterT-SCS30KHzZoneEighthT-SCS15KHzZoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..2239),
        sCS120KHzQuarterT-SCS60KHzZoneEighthT-SCS30KHzZoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..4479),
        sCS120KHzZoneEighthT-SCS60KHzZoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..8959),
        sCS120KHzZoneSixteenthT       SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..17919)
    }
    ]],
    [[
    commonSearchSpaceListExt-r16      SEQUENCE (SIZE(1..4)) OF SearchSpaceExt-r16  OPTIONAL -- Need R
    ]]
}

-- TAG-PDCCH-CONFIGCOMMON-STOP
-- ASN1STOP

```

<b><i>PDCCH-ConfigCommon</i> field descriptions</b>	
<b><i>commonControlResourceSet</i></b>	An additional common control resource set which may be configured and used for any common or UE-specific search space. If the network configures this field, it uses a <i>ControlResourceSetId</i> other than 0 for this <i>ControlResourceSet</i> . The network configures the <i>commonControlResourceSet</i> in <i>SIB1</i> so that it is contained in the bandwidth of CORESET#0.
<b><i>commonSearchSpaceList</i>, <i>commonSearchSpaceListExt</i></b>	A list of additional common search spaces. If the network configures this field, it uses the <i>SearchSpaceIds</i> other than 0. If the field is included, it replaces any previous list, i.e. all the entries of the list are replaced and each of the <i>SearchSpace</i> entries is considered to be newly created and the conditions and Need codes for setup of the entry apply. If the network includes <i>commonSearchSpaceListExt</i> , it includes the same number of entries, and listed in the same order, as in <i>commonSearchSpaceList</i> .
<b><i>controlResourceSetZero</i></b>	Parameters of the common CORESET#0 which can be used in any common or UE-specific search spaces. The values are interpreted like the corresponding bits in <i>MIB pdccch-ConfigSIB1</i> . Even though this field is only configured in the initial BWP (BWP#0) <i>controlResourceSetZero</i> can be used in search spaces configured in other DL BWP(s) than the initial DL BWP if the conditions defined in TS 38.213 [13], clause 10 are satisfied.
<b><i>firstPDCCH-MonitoringOccasionOfPO</i></b>	Indicates the first PDCCH monitoring occasion of each PO of the PF on this BWP, see TS 38.304 [20].
<b><i>pagingSearchSpace</i></b>	ID of the Search space for paging (see TS 38.213 [13], clause 10.1). If the field is absent, the UE does not receive paging in this BWP (see TS 38.213 [13], clause 10).
<b><i>ra-SearchSpace</i></b>	ID of the Search space for random access procedure (see TS 38.213 [13], clause 10.1). If the field is absent, the UE does not receive RAR in this BWP. This field is mandatory present in the DL BWP(s) if the conditions described in TS 38.321 [3], subclause 5.15 are met.
<b><i>searchSpaceOtherSystemInformation</i></b>	ID of the Search space for other system information, i.e., <i>SIB2</i> and beyond (see TS 38.213 [13], clause 10.1) If the field is absent, the UE does not receive other system information in this BWP.
<b><i>searchSpaceSIB1</i></b>	ID of the search space for <i>SIB1</i> message. In the initial DL BWP of the UE's PCell, the network sets this field to 0. If the field is absent, the UE does not receive <i>SIB1</i> in this BWP. (see TS 38.213 [13], clause 10)
<b><i>searchSpaceZero</i></b>	Parameters of the common SearchSpace#0. The values are interpreted like the corresponding bits in <i>MIB pdccch-ConfigSIB1</i> . Even though this field is only configured in the initial BWP (BWP#0), <i>searchSpaceZero</i> can be used in search spaces configured in other DL BWP(s) than the initial DL BWP if the conditions described in TS 38.213 [13], clause 10, are satisfied.

<b>Conditional Presence</b>	<b>Explanation</b>
<i>InitialBWP-Only</i>	If <i>SIB1</i> is broadcast the field is mandatory present in the <i>PDCCH-ConfigCommon</i> of the initial BWP (BWP#0) in <i>ServingCellConfigCommon</i> ; it is absent in other BWPs and when sent in system information. If <i>SIB1</i> is not broadcast and there is an SSB associated to the cell, the field is optionally present, Need M, in the <i>PDCCH-ConfigCommon</i> of the initial BWP (BWP#0) in <i>ServingCellConfigCommon</i> (still with the same setting for all UEs). In other cases, the field is absent.
<i>OtherBWP</i>	This field is optionally present, Need R, if this BWP is not the initial DL BWP and <i>pagingSearchSpace</i> is configured in this BWP. Otherwise this field is absent.

– ***PDCCH-ConfigSIB1***

The IE *PDCCH-ConfigSIB1* is used to configure CORESET#0 and search space#0.

**PDCCH-ConfigSIB1** information element

```

-- ASN1START
-- TAG-PDCCH-CONFIGSIB1-START

PDCCH-ConfigSIB1 ::=
    controlResourceSetZero
    searchSpaceZero
}

SEQUENCE {
    ControlResourceSetZero,
    SearchSpaceZero
}

-- TAG-PDCCH-CONFIGSIB1-STOP
-- ASN1STOP

```

**PDCCH-ConfigSIB1** field descriptions**controlResourceSetZero**

Determines a common ControlResourceSet (CORESET) with ID #0, see TS 38.213 [13], clause 13.

**searchSpaceZero**

Determines a common search space with ID #0, see TS 38.213 [13], clause 13.

– **PDCCH-ServingCellConfig**

The IE *PDCCH-ServingCellConfig* is used to configure UE specific PDCCH parameters applicable across all bandwidth parts of a serving cell.

**PDCCH-ServingCellConfig** information element

```

-- ASN1START
-- TAG-PDCCH-SERVINGCELLCONFIG-START

PDCCH-ServingCellConfig ::=
    slotFormatIndicator
    ...
    [
        availabilityIndicator-r16
        searchSpaceSwitchTimer-r16
    ]
}

SEQUENCE {
    SetupRelease { SlotFormatIndicator }
    SetupRelease { AvailabilityIndicator-r16 }
    INTEGER (1..80)
}

OPTIONAL, -- Need M
OPTIONAL, -- Need M
OPTIONAL -- Need R

-- TAG-PDCCH-SERVINGCELLCONFIG-STOP
-- ASN1STOP

```

<i>PDCCH-ServingCellConfig</i> field descriptions
<p><b>availabilityIndicator</b> Use to configure monitoring a PDCCH for Availability Indicators (AI).</p>
<p><b>searchSpaceSwitchTimer</b> The value of the timer in slots for monitoring PDCCH in the active DL BWP of the serving cell before moving to the default search space group (see TS 38.213 [13], clause 10.4). For 15 kHz SCS, {1..20} are valid. For 30 kHz SCS, {1..40} are valid. For 60kHz SCS, {1..80} are valid. The network configures the same value for all serving cells in the same <i>CellGroupForSwitch</i>.</p>
<p><b>slotFormatIndicator</b> Configuration of Slot-Format-Indicators to be monitored in the correspondingly configured PDCCHs of this serving cell.</p>

## – *PDCP-Config*

The IE *PDCP-Config* is used to set the configurable PDCP parameters for signalling and data radio bearers.

### *PDCP-Config* information element

```

-- ASN1START
-- TAG-PDCP-CONFIG-START

PDCP-Config ::= SEQUENCE {
  drb SEQUENCE {
    discardTimer      ENUMERATED {ms10, ms20, ms30, ms40, ms50, ms60, ms75, ms100, ms150, ms200,
                                  ms250, ms300, ms500, ms750, ms1500, infinity} OPTIONAL, -- Cond Setup
    pdcp-SN-SizeUL    ENUMERATED {len12bits, len18bits} OPTIONAL, -- Cond Setup2
    pdcp-SN-SizeDL    ENUMERATED {len12bits, len18bits} OPTIONAL, -- Cond Setup2
    headerCompression CHOICE {
      notUsed          NULL,
      rohc             SEQUENCE {
        maxCID         INTEGER (1..16383) DEFAULT 15,
        profiles       SEQUENCE {
          profile0x0001 BOOLEAN,
          profile0x0002 BOOLEAN,
          profile0x0003 BOOLEAN,
          profile0x0004 BOOLEAN,
          profile0x0006 BOOLEAN,
          profile0x0101 BOOLEAN,
          profile0x0102 BOOLEAN,
          profile0x0103 BOOLEAN,
          profile0x0104 BOOLEAN
        }
      }
    },
    drb-ContinueROHC  ENUMERATED { true } OPTIONAL -- Need N
  },
  uplinkOnlyROHC     SEQUENCE {
    maxCID           INTEGER (1..16383) DEFAULT 15,
    profiles         SEQUENCE {
      profile0x0006  BOOLEAN
    }
  },
  drb-ContinueROHC   ENUMERATED { true } OPTIONAL -- Need N
},

```



```

    ...
    },
    integrityProtection      ENUMERATED { enabled }
    statusReportRequired    ENUMERATED { true }
    outOfOrderDelivery      ENUMERATED { true }
}
moreThanOneRLC             SEQUENCE {
    primaryPath             SEQUENCE {
        cellGroup          CellGroupId
        logicalChannel      LogicalChannelIdentity
    },
    ul-DataSplitThreshold  UL-DataSplitThreshold
    pdcp-Duplication       BOOLEAN
}
t-Reordering              ENUMERATED {
    ms0, ms1, ms2, ms4, ms5, ms8, ms10, ms15, ms20, ms30, ms40,
    ms50, ms60, ms80, ms100, ms120, ms140, ms160, ms180, ms200, ms220,
    ms240, ms260, ms280, ms300, ms500, ms750, ms1000, ms1250,
    ms1500, ms1750, ms2000, ms2250, ms2500, ms2750,
    ms3000, spare28, spare27, spare26, spare25, spare24,
    spare23, spare22, spare21, spare20,
    spare19, spare18, spare17, spare16, spare15, spare14,
    spare13, spare12, spare11, spare10, spare09,
    spare08, spare07, spare06, spare05, spare04, spare03,
    spare02, spare01 }
....
[[
cipheringDisabled          ENUMERATED {true}
]],
[[
discardTimerExt-r16       SetupRelease { DiscardTimerExt-r16 }
moreThanTwoRLC-DRB-r16   SEQUENCE {
    splitSecondaryPath-r16 LogicalChannelIdentity
    duplicationState-r16   SEQUENCE (SIZE (3)) OF BOOLEAN
}
ethernetHeaderCompression-r16 SetupRelease { EthernetHeaderCompression-r16 }
]]
}

EthernetHeaderCompression-r16 ::= SEQUENCE {
    ehc-Common-r16          SEQUENCE {
        ehc-CID-Length-r16  ENUMERATED { bits7, bits15 },
        ...
    },
    ehc-Downlink-r16        SEQUENCE {
        drb-ContinueEHC-DL-r16 ENUMERATED { true }
        ...
    }
    ehc-Uplink-r16          SEQUENCE {
        maxCID-EHC-UL-r16    INTEGER (1..32767),
        drb-ContinueEHC-UL-r16 ENUMERATED { true }
        ...
    }
}

```

```

OPTIONAL, -- Cond ConnectedTo5GC1
OPTIONAL, -- Cond Rlc-AM-UM
OPTIONAL, -- Need R
OPTIONAL, -- Cond DRB

```

```

OPTIONAL, -- Need R
OPTIONAL, -- Need R

```

```

OPTIONAL, -- Cond SplitBearer
OPTIONAL, -- Need R
OPTIONAL, -- Cond MoreThanOneRLC

```

```

OPTIONAL, -- Need S

```

```

OPTIONAL -- Cond ConnectedTo5GC

```

```

OPTIONAL, -- Cond DRB2

```

```

OPTIONAL, -- Cond SplitBearer2
OPTIONAL, -- Need S
OPTIONAL, -- Cond MoreThanTwoRLC-DRB
OPTIONAL, -- Need M

```

```

OPTIONAL, -- Need R

```

```

OPTIONAL, -- Need M

```

```

OPTIONAL, -- Need R

```

```

OPTIONAL, -- Need M

```

```
}  
UL-DataSplitThreshold ::= ENUMERATED {  
    b0, b100, b200, b400, b800, b1600, b3200, b6400, b12800, b25600, b51200, b102400, b204800,  
    b409600, b819200, b1228800, b1638400, b2457600, b3276800, b4096000, b4915200, b5734400,  
    b6553600, infinity, spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1}  
  
DiscardTimerExt-r16 ::= ENUMERATED {ms0dot5, ms1, ms2, ms4, ms6, ms8, spare2, spare1}  
  
-- TAG-PDCP-CONFIG-STOP  
-- ASN1STOP
```

<b>PDCP-Config field descriptions</b>
<p><b><i>cipheringDisabled</i></b> If included, ciphering is disabled for this DRB regardless of which ciphering algorithm is configured for the SRB/DRBs. The field may only be included if the UE is connected to 5GC. Otherwise the field is absent. The network configures all DRBs with the same PDU-session ID with same value for this field. The value for this field cannot be changed after the DRB is set up.</p>
<p><b><i>discardTimer</i></b> Value in ms of <i>discardTimer</i> specified in TS 38.323 [5]. Value <i>ms10</i> corresponds to 10 ms, value <i>ms20</i> corresponds to 20 ms and so on. The value for this field cannot be changed in case of reconfiguration with sync, if the bearer is configured as DAPS bearer.</p>
<p><b><i>discardTimerExt</i></b> Value in ms of <i>discardTimer</i> specified in TS 38.323 [5]. Value <i>ms0dot5</i> corresponds to 0.5 ms, value <i>ms1</i> corresponds to 1ms and so on. If this field is present, the field <i>discardTimer</i> is ignored and <i>discardTimerExt</i> is used instead.</p>
<p><b><i>drb-ContinueROHC</i></b> Indicates whether the PDCP entity continues or resets the ROHC header compression protocol during PDCP re-establishment, as specified in TS 38.323 [5]. This field is configured only in case of resuming an RRC connection or reconfiguration with sync, where the PDCP termination point is not changed and the <i>fullConfig</i> is not indicated. The network does not include the field if the bearer is configured as DAPS bearer.</p>
<p><b><i>duplicationState</i></b> This field indicates the uplink PDCP duplication state for the associated RLC entities at the time of receiving this IE. If set to <i>true</i>, the PDCP duplication state is activated for the associated RLC entity. The index for the indication is determined by ascending order of logical channel ID of all RLC entities other than the primary RLC entity indicated by <i>primaryPath</i> in the order of MCG and SCG, as in clause 6.1.3.32 of TS 38.321 [3]. If the number of associated RLC entities other than the primary RLC entity is two, UE ignores the value in the largest index of this field. If the field is absent, the PDCP duplication states are deactivated for all associated RLC entities.</p>
<p><b><i>ethernetHeaderCompression</i></b> This field configures Ethernet Header Compression. This field can only be configured for a bi-directional DRB. The network reconfigures <i>ethernetHeaderCompression</i> only upon reconfiguration involving PDCP re-establishment.</p>
<p><b><i>headerCompression</i></b> If rohc is configured, the UE shall apply the configured ROHC profile(s) in both uplink and downlink. If <i>uplinkOnlyROHC</i> is configured, the UE shall apply the configured ROHC profile(s) in uplink (there is no header compression in downlink). ROHC can be configured for any bearer type. ROHC and EHC can be both configured simultaneously for a DRB. The network reconfigures <i>headerCompression</i> only upon reconfiguration involving PDCP re-establishment, and without any <i>drb-ContinueROHC</i>. Network configures <i>headerCompression</i> to <i>notUsed</i> when <i>outOfOrderDelivery</i> is configured.</p>
<p><b><i>integrityProtection</i></b> Indicates whether or not integrity protection is configured for this radio bearer. The network configures all DRBs with the same PDU-session ID with same value for this field. The value for this field cannot be changed after the DRB is set up.</p>
<p><b><i>maxCID</i></b> Indicates the value of the MAX_CID parameter as specified in TS 38.323 [5]. The total value of MAX_CIDs across all bearers for the UE should be less than or equal to the value of <i>maxNumberROHC-ContextSessions</i> parameter as indicated by the UE.</p>
<p><b><i>moreThanOneRLC</i></b> This field configures UL data transmission when more than one RLC entity is associated with the PDCP entity. This field is not present if the bearer is configured as DAPS bearer.</p>
<p><b><i>moreThanTwoRLC-DRB</i></b> This field configures UL data transmission when more than two RLC entities are associated with the PDCP entity for DRBs.</p>
<p><b><i>outOfOrderDelivery</i></b> Indicates whether or not <i>outOfOrderDelivery</i> specified in TS 38.323 [5] is configured. This field should be either always present or always absent, after the radio bearer is established.</p>

<b>PDCP-Config field descriptions</b>
<p><b><i>pdcp-Duplication</i></b> Indicates whether or not uplink duplication status at the time of receiving this IE is configured and activated as specified in TS 38.323 [5]. The presence of this field indicates that duplication is configured. PDCP duplication is not configured for CA packet duplication of LTE RLC bearer. The value of this field, when the field is present, indicates the state of the duplication at the time of receiving this IE. If set to <i>true</i>, duplication is activated. The value of this field is always <i>true</i>, when configured for a SRB. For PDCP entity with more than two associated RLC entities for UL transmission, this field is always present. If the field <i>moreThanTwoRLC-DRB</i> is present, the value of this field is ignored and the state of the duplication is indicated by <i>duplicationState</i>. For PDCP entity with more than two associated RLC entities, only NR RLC bearer is supported.</p>
<p><b><i>pdcp-SN-SizeDL</i></b> PDCP sequence number size for downlink, 12 or 18 bits, as specified in TS 38.323 [5]. For SRBs only the value <i>len12bits</i> is applicable. The value for this field cannot be changed in case of reconfiguration with sync, if the bearer is configured as DAPS bearere.</p>
<p><b><i>pdcp-SN-SizeUL</i></b> PDCP sequence number size for uplink, 12 or 18 bits, as specified in TS 38.323 [5]. For SRBs only the value <i>len12bits</i> is applicable. The value for this field cannot be changed in case of reconfiguration with sync, if the bearer is configured as DAPS bearer.</p>
<p><b><i>primaryPath</i></b> Indicates the cell group ID and LCID of the primary RLC entity as specified in TS 38.323 [5], clause 5.2.1 for UL data transmission when more than one RLC entity is associated with the PDCP entity. In this version of the specification, only cell group ID corresponding to MCG is supported for SRBs. The NW indicates <i>cellGroup</i> for split bearers using logical channels in different cell groups. The NW always indicates <i>logicalChannel</i> if CA based PDCP duplication is configured in the cell group indicated by <i>cellGroup</i> of this field.</p>
<p><b><i>splitSecondaryPath</i></b> Indicates the LCID of the split secondary RLC entity as specified in TS 38.323 [5] for fallback to split bearer operation when UL data transmission with more than two RLC entities is associated with the PDCP entity. This RLC entity belongs to a cell group that is different from the cell group indicated by <i>cellGroup</i> in the field <i>primaryPath</i>.</p>
<p><b><i>statusReportRequired</i></b> For AM DRBs and DAPS UM DRBs, indicates whether the DRB is configured to send a PDCP status report in the uplink, as specified in TS 38.323 [5]. For DAPS AM DRBs, it also indicates whether the DRB is configured to send a second PDCP status report in the uplink, as specified in TS 38.323 [5].</p>
<p><b><i>t-Reordering</i></b> Value in ms of t-Reordering specified in TS 38.323 [5]. Value <i>ms0</i> corresponds to 0 ms, value <i>ms20</i> corresponds to 20 ms, value <i>ms40</i> corresponds to 40 ms, and so on. When the field is absent the UE applies the value <i>infinity</i>. The value for this field cannot be changed in case of reconfiguration with sync, if the bearer is configured as DAPS bearer.</p>
<p><b><i>ul-DataSplitThreshold</i></b> Parameter specified in TS 38.323 [5]. Value <i>b0</i> corresponds to 0 bytes, value <i>b100</i> corresponds to 100 bytes, value <i>b200</i> corresponds to 200 bytes, and so on. The network sets this field to <i>infinity</i> for UEs not supporting <i>splitDRB-withUL-Both-MCG-SCG</i>. If the field is absent when the split bearer is configured for the radio bearer first time, then the default value <i>infinity</i> is applied.</p>

<b>EthernetHeaderCompression field descriptions</b>	
<b>drb-ContinueEHC-DL</b>	Indicates whether the PDCP entity continues or resets the downlink EHC header compression protocol during PDCP re-establishment, as specified in TS 38.323 [5]. The field is configured only in case of resuming an RRC connection or reconfiguration with sync, where the PDCP termination point is not changed and the <i>fullConfig</i> is not indicated.
<b>drb-ContinueEHC-UL</b>	Indicates whether the PDCP entity continues or resets the uplink EHC header compression protocol during PDCP re-establishment, as specified in TS 38.323 [5]. The field is configured only in case of resuming an RRC connection or reconfiguration with sync, where the PDCP termination point is not changed and the <i>fullConfig</i> is not indicated.
<b>ehc-CID-Length</b>	Indicates the length of the CID field for EHC packet. The value <i>bits7</i> indicates the length is 7 bits, and the value <i>bits15</i> indicates the length is 15 bits. Once the field <i>ethernetHeaderCompression-r16</i> is configured for a DRB, the value of the field <i>ehc-CID-Length</i> for this DRB is not reconfigured to a different value.
<b>ehc-Common</b>	Indicates the configurations that apply for both downlink and uplink.
<b>ehc-Downlink</b>	Indicates the configurations that apply for only downlink. If the field is configured, then Ethernet header compression is configured for downlink. Otherwise, it is not configured for downlink.
<b>ehc-Uplink</b>	Indicates the configurations that apply for only uplink. If the field is configured, then Ethernet header compression is configured for uplink. Otherwise, it is not configured for uplink.
<b>maxCID-EHC-UL</b>	Indicates the value of the MAX_CID_EHC_UL parameter as specified in TS 38.323 [5]. The total value of MAX_CID_EHC_UL across all bearers for the UE should be less than or equal to the value of <i>maxNumberEHC-Contexts</i> parameter as indicated by the UE.

<b>Conditional presence</b>	<b>Explanation</b>
<i>DRB</i>	This field is mandatory present when the corresponding DRB is being set up, absent for SRBs. Otherwise this field is optionally present, need M.
<i>DRB2</i>	This field is optionally present in case of DRB, need M. Otherwise, it is absent for SRBs.
<i>MoreThanOneRLC</i>	This field is mandatory present upon RRC reconfiguration with setup of a PDCP entity for a radio bearer with more than one associated logical channel and upon RRC reconfiguration with the association of additional logical channels to the PDCP entity. The field is also mandatory present in case the field <i>moreThanTwoRLC-DRB</i> is included in <i>PDCP-Config</i> . Upon RRC reconfiguration when a PDCP entity is associated with multiple logical channels, this field is optionally present need M. Otherwise, this field is absent. Need R.
<i>MoreThanTwoRLC-DRB</i>	For SRBs, this field is absent. For DRBs, this field is mandatory present upon RRC reconfiguration with setup of a PDCP entity for a radio bearer with more than two associated logical channels and upon RRC reconfiguration with the association of more than one additional logical channel to the PDCP entity. Upon RRC reconfiguration when a PDCP entity is associated with more than two logical channels, this field is optionally present, Need M. Otherwise, the field is absent, Need R.
<i>Rlc-AM-UM</i>	For RLC UM (if the UE supports DAPS handover) or RLC AM, the field is optionally present, need R. Otherwise, the field is absent.
<i>Setup</i>	The field is mandatory present in case of radio bearer setup. Otherwise the field is optionally present, need M.
<i>SplitBearer</i>	The field is absent for SRBs. Otherwise, the field is optional present, need M, in case of radio bearer with more than one associated RLC mapped to different cell groups.
<i>SplitBearer2</i>	The field is mandatory present, in case of a split bearer. Otherwise the field is absent.
<i>ConnectedTo5GC</i>	The field is optionally present, need R, if the UE is connected to 5GC. Otherwise the field is absent.
<i>ConnectedTo5GC1</i>	The field is optionally present, need R, if the UE is connected to NR/5GC. Otherwise the field is absent.
<i>Setup2</i>	This field is mandatory present in case for radio bearer setup for RLC-AM and RLC-UM. Otherwise, this field is absent, Need M.

## – PDSCH-Config

The *PDSCH-Config* IE is used to configure the UE specific PDSCH parameters.

### PDSCH-Config information element

```

-- ASN1START
-- TAG-PDSCH-CONFIG-START

PDSCH-Config ::=
    SEQUENCE {
        dataScramblingIdentityPDSCH          INTEGER (0..1023)                OPTIONAL, -- Need S
        dmrs-DownlinkForPDSCH-MappingTypeA  SetupRelease { DMRS-DownlinkConfig }  OPTIONAL, -- Need M
        dmrs-DownlinkForPDSCH-MappingTypeB  SetupRelease { DMRS-DownlinkConfig }  OPTIONAL, -- Need M

        tci-StatesToAddModList              SEQUENCE (SIZE(1..maxNrofTCI-States)) OF TCI-State          OPTIONAL, -- Need N
        tci-StatesToReleaseList              SEQUENCE (SIZE(1..maxNrofTCI-States)) OF TCI-StateId         OPTIONAL, -- Need N
        vrb-ToPRB-Interleaver                ENUMERATED {n2, n4}                OPTIONAL, -- Need S
        resourceAllocation                   ENUMERATED { resourceAllocationType0, resourceAllocationType1, dynamicSwitch},  OPTIONAL, -- Need M
        pdsch-TimeDomainAllocationList       SetupRelease { PDSCH-TimeDomainResourceAllocationList }  OPTIONAL, -- Need S
        pdsch-AggregationFactor              ENUMERATED { n2, n4, n8 }          OPTIONAL, -- Need N
        rateMatchPatternToAddModList         SEQUENCE (SIZE (1..maxNrofRateMatchPatterns)) OF RateMatchPattern  OPTIONAL, -- Need N
        rateMatchPatternToReleaseList        SEQUENCE (SIZE (1..maxNrofRateMatchPatterns)) OF RateMatchPatternId  OPTIONAL, -- Need R
        rateMatchPatternGroup1               RateMatchPatternGroup              OPTIONAL, -- Need R
        rateMatchPatternGroup2               RateMatchPatternGroup              OPTIONAL, -- Need R

        rbg-Size                             ENUMERATED {config1, config2},
        mcs-Table                             ENUMERATED {qam256, qam64LowSE}    OPTIONAL, -- Need S
        maxNrofCodeWordsScheduledByDCI        ENUMERATED {n1, n2}                OPTIONAL, -- Need R

        prb-BundlingType                      CHOICE {
            staticBundling                    SEQUENCE {
                bundleSize                    ENUMERATED { n4, wideband }          OPTIONAL -- Need S
            },
            dynamicBundling                   SEQUENCE {
                bundleSizeSet1                ENUMERATED { n4, wideband, n2-wideband, n4-wideband }  OPTIONAL, -- Need S
                bundleSizeSet2                ENUMERATED { n4, wideband }          OPTIONAL -- Need S
            }
        },
        zp-CSI-RS-ResourceToAddModList        SEQUENCE (SIZE (1..maxNrofZP-CSI-RS-Resources)) OF ZP-CSI-RS-Resource  OPTIONAL, -- Need N
        zp-CSI-RS-ResourceToReleaseList       SEQUENCE (SIZE (1..maxNrofZP-CSI-RS-Resources)) OF ZP-CSI-RS-ResourceId  OPTIONAL, -- Need N
        aperiodic-ZP-CSI-RS-ResourceSetsToAddModList SEQUENCE (SIZE (1..maxNrofZP-CSI-RS-ResourceSets)) OF ZP-CSI-RS-ResourceSet  OPTIONAL, -- Need N
        aperiodic-ZP-CSI-RS-ResourceSetsToReleaseList SEQUENCE (SIZE (1..maxNrofZP-CSI-RS-ResourceSets)) OF ZP-CSI-RS-ResourceSetId  OPTIONAL, -- Need N
        sp-ZP-CSI-RS-ResourceSetsToAddModList SEQUENCE (SIZE (1..maxNrofZP-CSI-RS-ResourceSets)) OF ZP-CSI-RS-ResourceSet  OPTIONAL, -- Need N
        sp-ZP-CSI-RS-ResourceSetsToReleaseList SEQUENCE (SIZE (1..maxNrofZP-CSI-RS-ResourceSets)) OF ZP-CSI-RS-ResourceSetId  OPTIONAL, -- Need N
        p-ZP-CSI-RS-ResourceSet               SetupRelease { ZP-CSI-RS-ResourceSet }  OPTIONAL, -- Need M
        ...,
    }

```

```

[[
maxMIMO-Layers-r16                SetupRelease { MaxMIMO-LayersDL-r16 }           OPTIONAL, -- Need M
minimumSchedulingOffsetK0-r16     SetupRelease { MinSchedulingOffsetK0-Values-r16 }         OPTIONAL, -- Need M

-- Start of the parameters for DCI format 1_2 introduced in V16.1.0
antennaPortsFieldPresenceDCI-1-2-r16    ENUMERATED {enabled}           OPTIONAL, -- Need S
aperiodicZP-CSI-RS-ResourceSetsToAddModListDCI-1-2-r16 SEQUENCE (SIZE (1..maxNrofZP-CSI-RS-ResourceSets)) OF ZP-CSI-RS-ResourceSet
                                                                    OPTIONAL, -- Need N
aperiodicZP-CSI-RS-ResourceSetsToReleaseListDCI-1-2-r16 SEQUENCE (SIZE (1..maxNrofZP-CSI-RS-ResourceSets)) OF ZP-CSI-RS-ResourceSetId
                                                                    OPTIONAL, -- Need N
dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2-r16 SetupRelease { DMRS-DownlinkConfig }         OPTIONAL, -- Need M
dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2-r16 SetupRelease { DMRS-DownlinkConfig }         OPTIONAL, -- Need M
dmrs-SequenceInitializationDCI-1-2-r16    ENUMERATED {enabled}           OPTIONAL, -- Need S
harq-ProcessNumberSizeDCI-1-2-r16        INTEGER (0..4)                  OPTIONAL, -- Need R
mcs-TableDCI-1-2-r16                    ENUMERATED {qam256, qam64LowSE} OPTIONAL, -- Need S
numberOfBitsForRV-DCI-1-2-r16           INTEGER (0..2)                  OPTIONAL, -- Need R
pdsch-TimeDomainAllocationListDCI-1-2-r16 SetupRelease { PDSCH-TimeDomainResourceAllocationList-r16 }
                                                                    OPTIONAL, -- Need M

prb-BundlingTypeDCI-1-2-r16             CHOICE {
  staticBundling-r16                    SEQUENCE {
    bundleSize-r16                       ENUMERATED { n4, wideband }           OPTIONAL, -- Need S
  },
  dynamicBundling-r16                   SEQUENCE {
    bundleSizeSet1-r16                   ENUMERATED { n4, wideband, n2-wideband, n4-wideband } OPTIONAL, -- Need S
    bundleSizeSet2-r16                   ENUMERATED { n4, wideband }           OPTIONAL, -- Need S
  }
}
priorityIndicatorDCI-1-2-r16            ENUMERATED {enabled}           OPTIONAL, -- Need R
rateMatchPatternGroup1DCI-1-2-r16      RateMatchPatternGroup          OPTIONAL, -- Need S
rateMatchPatternGroup2DCI-1-2-r16      RateMatchPatternGroup          OPTIONAL, -- Need S
resourceAllocationType1GranularityDCI-1-2-r16 ENUMERATED {n2,n4,n8,n16}     OPTIONAL, -- Need R
vrb-ToPRB-InterleaverDCI-1-2-r16      ENUMERATED {n2, n4}            OPTIONAL, -- Need R
referenceOfSLIVDCI-1-2-r16             ENUMERATED {enabled}           OPTIONAL, -- Need S
resourceAllocationDCI-1-2-r16          ENUMERATED { resourceAllocationType0, resourceAllocationType1, dynamicSwitch}
                                                                    OPTIONAL, -- Need M

-- End of the parameters for DCI format 1_2 introduced in V16.1.0

priorityIndicatorDCI-1-1-r16            ENUMERATED {enabled}           OPTIONAL, -- Need S
dataScramblingIdentityPDSCH2-r16       INTEGER (0..1023)              OPTIONAL, -- Need R
pdsch-TimeDomainAllocationList-r16     SetupRelease { PDSCH-TimeDomainResourceAllocationList-r16 }         OPTIONAL, -- Need M
repetitionSchemeConfig-r16             SetupRelease { RepetitionSchemeConfig-r16 }         OPTIONAL, -- Need M
]]

RateMatchPatternGroup ::= SEQUENCE (SIZE (1..maxNrofRateMatchPatternsPerGroup)) OF CHOICE {
  cellLevel RateMatchPatternId,
  bwpLevel RateMatchPatternId
}

MinSchedulingOffsetK0-Values-r16 ::= SEQUENCE (SIZE (1..maxNrOfMinSchedulingOffsetValues-r16)) OF INTEGER (0..maxK0-SchedulingOffset-r16)

MaxMIMO-LayersDL-r16 ::= INTEGER (1..8)

-- TAG-PDSCH-CONFIG-STOP

```

-- ASN1STOP



<b>PDSCH-Config field descriptions</b>
<p><b>antennaPortsFieldPresenceDCI-1-2</b> Configure the presence of "Antenna ports" field in DCI format 1_2. When the field is configured, then the "Antenna ports" field is present in DCI format 1_2. Otherwise, the field size is set to 0 for DCI format 1_2 (See TS 38.212 [17], clause 7.3.1.1.3). If neither <i>dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2</i> nor <i>dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2</i> is configured, this field is absent.</p>
<p><b>aperiodic-ZP-CSI-RS-ResourceSetsToAddModList, aperiodic-ZP-CSI-RS-ResourceSetsToAddModListDCI-1-2</b> AddMod/Release lists for configuring aperiodically triggered zero-power CSI-RS resource sets. Each set contains a <i>ZP-CSI-RS-ResourceSetId</i> and the IDs of one or more <i>ZP-CSI-RS-Resources</i> (the actual resources are defined in the <i>zp-CSI-RS-ResourceToAddModList</i>). The network configures the UE with at most 3 aperiodic <i>ZP-CSI-RS-ResourceSets</i> and it uses only the <i>ZP-CSI-RS-ResourceSetId</i> 1 to 3. The network triggers a set by indicating its <i>ZP-CSI-RS-ResourceSetId</i> in the DCI payload. The DCI codepoint '01' triggers the resource set with <i>ZP-CSI-RS-ResourceSetId</i> 1, the DCI codepoint '10' triggers the resource set with <i>ZP-CSI-RS-ResourceSetId</i> 2, and the DCI codepoint '11' triggers the resource set with <i>ZP-CSI-RS-ResourceSetId</i> 3 (see TS 38.214 [19], clause 5.1.4.2). The field <i>aperiodic-ZP-CSI-RS-ResourceSetsToAddModList</i> applies to DCI format 1_1 and the field <i>aperiodic-ZP-CSI-RS-ResourceSetsToAddModListDCI-1-2</i> applies to DCI format 1_2 (see TS 38.214 [19], clause 5.1.4.2 and TS 38.212 [17] clause 7.3.1).</p>
<p><b>dataScramblingIdentityPDSCH, dataScramblingIdentityPDSCH2</b> Identifier(s) used to initialize data scrambling (<i>c_init</i>) for PDSCH as specified in TS 38.211 [16], clause 7.3.1.1. The <i>dataScramblingIdentityPDSCH2</i> is configured if <i>coresetPoolIndex</i> is configured with 1 for at least one CORESET in the same BWP.</p>
<p><b>dmrs-DownlinkForPDSCH-MappingTypeA, dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2</b> DMRS configuration for PDSCH transmissions using PDSCH mapping type A (chosen dynamically via <i>PDSCH-TimeDomainResourceAllocation</i>). Only the fields <i>dmrs-Type</i>, <i>dmrs-AdditionalPosition</i> and <i>maxLength</i> may be set differently for mapping type A and B. The field <i>dmrs-DownlinkForPDSCH-MappingTypeA</i> applies to DCI format 1_1 and the field <i>dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2</i> applies to DCI format 1_2 (see TS 38.212 [17], clause 7.3.1).</p>
<p><b>dmrs-DownlinkForPDSCH-MappingTypeB, dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2</b> DMRS configuration for PDSCH transmissions using PDSCH mapping type B (chosen dynamically via <i>PDSCH-TimeDomainResourceAllocation</i>). Only the fields <i>dmrs-Type</i>, <i>dmrs-AdditionalPosition</i> and <i>maxLength</i> may be set differently for mapping type A and B. The field <i>dmrs-DownlinkForPDSCH-MappingTypeB</i> applies to DCI format 1_1 and the field <i>dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2</i> applies to DCI format 1_2 (see TS 38.212 [17], clause 7.3.1).</p>
<p><b>dmrs-SequenceInitializationDCI-1-2</b> Configure whether the field "DMRS Sequence Initialization" is present or not in DCI format 1_2. If the field is absent, then the UE applies the value of 0 bit for the field "DMRS Sequence Initialization" in DCI format 1_2. If the field is present, then the UE applies the value of 1 bit as in DCI format 1_2 (see TS 38.212 [17], clause 7.3.1).</p>
<p><b>harq-ProcessNumberSizeDCI-1-2</b> Configure the number of bits for the field "HARQ process number" in DCI format 1_2 (see TS 38.212 [17], clause 7.3.1).</p>
<p><b>maxMIMO-Layers</b> Indicates the maximum number of MIMO layers to be used for PDSCH in this DL BWP. If not configured, the UE uses the <i>maxMIMO-Layers</i> configuration in IE <i>PDSCH-ServingCellConfig</i> of the serving cell to which this BWP belongs, when the UE operates in this BWP. The value of <i>maxMIMO-Layers</i> for a DL BWP shall be smaller than or equal to the value of <i>maxMIMO-Layers</i> configured in IE <i>PDSCH-ServingCellConfig</i> of the serving cell to which this BWP belongs.</p>
<p><b>maxNrofCodeWordsScheduledByDCI</b> Maximum number of code words that a single DCI may schedule. This changes the number of MCS/RV/NDI bits in the DCI message from 1 to 2.</p>
<p><b>mcs-Table, mcs-TableDCI-1-2</b> Indicates which MCS table the UE shall use for PDSCH. (see TS 38.214 [19], clause 5.1.3.1). If the field is absent the UE applies the value 64QAM. The field <i>mcs-Table</i> applies to DCI format 1_0 and DCI format 1_1, and the field <i>mcs-TableDCI-1-2</i> applies to DCI format 1_2 (see TS 38.214 [19], clause 5.1.3.1).</p>
<p><b>minimumSchedulingOffsetK0</b> List of minimum K0 values. Minimum K0 parameter denotes minimum applicable value(s) for the TDRA table for PDSCH and for A-CSI RS triggering Offset(s) (see TS 38.214 [19], clause 5.3.1).</p>
<p><b>numberOfBitsForRV-DCI-1-2</b> Configures the number of bits for "Redundancy version" in the DCI format 1_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.214 [19], clause 5.1.2.1).</p>
<p><b>pdsch-AggregationFactor</b> Number of repetitions for data (see TS 38.214 [19], clause 5.1.2.1). When the field is absent the UE applies the value 1.</p>

<p><b><i>pdsch-TimeDomainAllocationList, pdsch-TimeDomainAllocationListDCI-1-2</i></b> List of time-domain configurations for timing of DL assignment to DL data (see table 5.1.2.1.1-1 in TS 38.214 [19]). The <i>pdsch-TimeDomainAllocationList</i> (with or without suffix) applies to DCI format 1_0 and DCI format 1_1, and the field <i>pdsch-TimeDomainAllocationListDCI-1-2</i> applies to DCI format 1_2, respectively (see table 5.1.2.1.1-1A in TS 38.214 [19]). The network does not configure the <i>pdsch-TimeDomainAllocationList-r16</i> or the <i>pdsch-TimeDomainAllocationListDCI-1-2</i> simultaneously with i the <i>pdsch-TimeDomainAllocationList</i> (without suffix).</p>
<p><b><i>prb-BundlingType, prb-BundlingTypeDCI-1-2</i></b> Indicates the PRB bundle type and bundle size(s) (see TS 38.214 [19], clause 5.1.2.3). If <i>dynamic</i> is chosen, the actual <i>bundleSizeSet1</i> or <i>bundleSizeSet2</i> to use is indicated via DCI. Constraints on <i>bundleSize(Set)</i> setting depending on <i>vrb-ToPRB-Interleaver</i> and <i>rbg-Size</i> settings are described in TS 38.214 [19], clause 5.1.2.3. If a <i>bundleSize(Set)</i> value is absent, the UE applies the value <i>n2</i>. The field <i>prb-BundlingType</i> applies to DCI format 1_1, and the field <i>prb-BundlingTypeDCI-1-2</i> applies to DCI format 1_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.214 [19], clause 5.1.2.3).</p>
<p><b><i>priorityIndicatorDCI-1-1, priorityIndicatorDCI-1-2</i></b> Configure the presence of "priority indicator" in DCI format 1_1/1_2. When the field is absent in the IE, then 0 bit for "priority indicator" in DCI format 1_1/1_2. The field <i>priorityIndicatorDCI-1-1</i> applies to DCI format 1_1 and the field <i>priorityIndicatorDCI-1-2</i> applies to DCI format 1_2, respectively (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13] clause 9).</p>
<p><b><i>p-ZP-CSI-RS-ResourceSet</i></b> A set of periodically occurring ZP-CSI-RS-Resources (the actual resources are defined in the <i>zp-CSI-RS-ResourceToAddModList</i>). The network uses the ZP-CSI-RS-ResourceSetId=0 for this set.</p>
<p><b><i>rateMatchPatternGroup1, rateMatchPatternGroup1DCI-1-2</i></b> The IDs of a first group of <i>RateMatchPatterns</i> defined in <i>PDSCH-Config-&gt;rateMatchPatternToAddModList</i> (BWP level) or in <i>ServingCellConfig-&gt;rateMatchPatternToAddModList</i> (cell level). These patterns can be activated dynamically by DCI (see TS 38.214 [19], clause 5.1.4.1). The field <i>rateMatchPatternGroup1</i> applies to DCI format 1_1, and the field <i>rateMatchPatternGroup1DCI-1-2</i> applies to DCI format 1_2 (see TS 38.214 [19], clause 5.1.4.1).</p>
<p><b><i>rateMatchPatternGroup2, rateMatchPatternGroup2DCI-1-2</i></b> The IDs of a second group of <i>RateMatchPatterns</i> defined in <i>PDSCH-Config-&gt;rateMatchPatternToAddModList</i> (BWP level) or in <i>ServingCellConfig-&gt;rateMatchPatternToAddModList</i> (cell level). These patterns can be activated dynamically by DCI (see TS 38.214 [19], clause 5.1.4.1). The field <i>rateMatchPatternGroup2</i> applies to DCI format 1_1, and the field <i>rateMatchPatternGroup2DCI-1-2</i> applies to DCI format 1_2 (see TS 38.214 [19], clause 5.1.4.1).</p>
<p><b><i>rateMatchPatternToAddModList</i></b> Resources patterns which the UE should rate match PDSCH around. The UE rate matches around the union of all resources indicated in the rate match patterns (see TS 38.214 [19], clause 5.1.4.1).</p>
<p><b><i>rbg-Size</i></b> Selection between config 1 and config 2 for RBG size for PDSCH. The UE ignores this field if <i>resourceAllocation</i> is set to <i>resourceAllocationType1</i> (see TS 38.214 [19], clause 5.1.2.2.1).</p>
<p><b><i>referenceOfSLIVDCI-1-2</i></b> Enable using the starting symbol of the PDCCH monitoring occasion in which the DL assignment is detected as the reference of the SLIV for DCI format 1_2. When the RRC parameter enables the utilization of the new reference, the new reference is applied for TDRA entries with K0=0. For other entries (if any) in the same TDRA table, the reference is slot boundary as in Rel-15. PDSCH mapping type A is not supported with the new reference. The new reference of SLIV is not configured for a serving cell configured to be scheduled by cross-carrier scheduling on a scheduling cell with different numerology (see TS 38.212 [17] clause 7.3.1 and TS 38.214 [19] clause 5.1.2.1).</p>
<p><b><i>repetitionSchemeConfig</i></b> Configure the UE with repetition schemes</p>
<p><b><i>resourceAllocation, resourceAllocationDCI-1-2</i></b> Configuration of resource allocation type 0 and resource allocation type 1 for non-fallback DCI (see TS 38.214 [19], clause 5.1.2.2). The field <i>resourceAllocation</i> applies to DCI format 1_1, and the field <i>resourceAllocationDCI-1-2</i> applies to DCI format 1_2 (see TS 38.214 [19], clause 5.1.2.2).</p>
<p><b><i>resourceAllocationType1GranularityDCI-1-2</i></b> Configure the scheduling granularity applicable for both the starting point and length indication for resource allocation type 1 in DCI format 1_2. If this field is absent, the granularity is 1 PRB (see TS 38.214 [19], clause 5.1.2.2.2).</p>

<p><b>sp-ZP-CSI-RS-ResourceSetsToAddModList</b> AddMod/Release lists for configuring semi-persistent zero-power CSI-RS resource sets. Each set contains a <i>ZP-CSI-RS-ResourceSetId</i> and the IDs of one or more <i>ZP-CSI-RS-Resources</i> (the actual resources are defined in the <i>zp-CSI-RS-ResourceToAddModList</i>) (see TS 38.214 [19], clause 5.1.4.2).</p>
<p><b>tcj-StatesToAddModList</b> A list of Transmission Configuration Indicator (TCI) states indicating a transmission configuration which includes QCL-relationships between the DL RSs in one RS set and the PDSCH DMRS ports (see TS 38.214 [19], clause 5.1.5).</p>
<p><b>vrb-ToPRB-Interleaver, vrb-ToPRB-InterleaverDCI-1-2</b> Interleaving unit configurable between 2 and 4 PRBs (see TS 38.211 [16], clause 7.3.1.6). When the field is absent, the UE performs non-interleaved VRB-to-PRB mapping. The field <i>vrb-ToPRB-Interleaver</i> applies to DCI format 1_1, and the field <i>vrb-ToPRB-InterleaverDCI-1-2</i> applies to DCI format 1_2 (see TS 38.211 [16], clause 7.3.1.6).</p>
<p><b>zp-CSI-RS-ResourceToAddModList</b> A list of Zero-Power (ZP) CSI-RS resources used for PDSCH rate-matching. Each resource in this list may be referred to from only one type of resource set, i.e., aperiodic, semi-persistent or periodic (see TS 38.214 [19]).</p>

## – PDSCH-ConfigCommon

The IE *PDSCH-ConfigCommon* is used to configure cell specific PDSCH parameters.

### **PDSCH-ConfigCommon** information element

```
-- ASN1START
-- TAG-PDSCH-CONFIGCOMMON-START

PDSCH-ConfigCommon ::=
    pdsch-TimeDomainAllocationList SEQUENCE {
        ...
    }
    OPTIONAL, -- Need R

-- TAG-PDSCH-CONFIGCOMMON-STOP
-- ASN1STOP
```

### **PDSCH-ConfigCommon** field descriptions

<p><b>pdsch-TimeDomainAllocationList</b> List of time-domain configurations for timing of DL assignment to DL data (see table 5.1.2.1.1-1 in TS 38.214 [19]).</p>
---

## – PDSCH-ServingCellConfig

The IE *PDSCH-ServingCellConfig* is used to configure UE specific PDSCH parameters that are common across the UE's BWPs of one serving cell.

### **PDSCH-ServingCellConfig** information element

```
-- ASN1START
-- TAG-PDSCH-SERVINGCELLCONFIG-START

PDSCH-ServingCellConfig ::=
    SEQUENCE {
```

```

codeBlockGroupTransmission      SetupRelease { PDSCH-CodeBlockGroupTransmission }
xOverhead                       ENUMERATED { xOh6, xOh12, xOh18 }
nrofHARQ-ProcessesForPDSCH     ENUMERATED {n2, n4, n6, n10, n12, n16}
pucch-Cell                      ServCellIndex
...
[[
maxMIMO-Layers                  INTEGER (1..8)
processingType2Enabled          BOOLEAN
]],
[[
pdsch-CodeBlockGroupTransmissionList-r16 SetupRelease { PDSCH-CodeBlockGroupTransmissionList-r16 }
]]
}

PDSCH-CodeBlockGroupTransmission ::= SEQUENCE {
maxCodeBlockGroupsPerTransportBlock ENUMERATED {n2, n4, n6, n8},
codeBlockGroupFlushIndicator        BOOLEAN,
...
}

PDSCH-CodeBlockGroupTransmissionList-r16 ::= SEQUENCE (SIZE (1..2)) OF PDSCH-CodeBlockGroupTransmission

-- TAG-PDSCH-SERVINGCELLCONFIG-STOP
-- ASN1STOP

```

<b>PDSCH-CodeBlockGroupTransmission field descriptions</b>
<b>codeBlockGroupFlushIndicator</b> Indicates whether CBGFI for CBG based (re)transmission in DL is enabled (true). (see TS 38.212 [17], clause 7.3.1.2.2).
<b>maxCodeBlockGroupsPerTransportBlock</b> Maximum number of code-block-groups (CBGs) per TB. In case of multiple CW, the maximum CBG is 4 (see TS 38.213 [13], clause 9.1.1).

<b><i>PDSCH-ServingCellConfig</i> field descriptions</b>	
<b><i>codeBlockGroupTransmission</i></b>	Enables and configures code-block-group (CBG) based transmission (see TS 38.213 [13], clause 9.1.1).
<b><i>maxMIMO-Layers</i></b>	Indicates the maximum number of MIMO layers to be used for PDSCH in all BWPs of this serving cell. (see TS 38.212 [17], clause 5.4.2.1).
<b><i>nrofHARQ-ProcessesForPDSCH</i></b>	The number of HARQ processes to be used on the PDSCH of a serving cell. Value <i>n2</i> corresponds to 2 HARQ processes, value <i>n4</i> to 4 HARQ processes, and so on. If the field is absent, the UE uses 8 HARQ processes (see TS 38.214 [19], clause 5.1).
<b><i>pdsch-CodeBlockGroupTransmissionList</i></b>	A list of configurations for up to two simultaneously constructed HARQ-ACK codebooks (see TS 38.213 [13], clause 9.3).
<b><i>processingType2Enabled</i></b>	Enables configuration of advanced processing time capability 2 for PDSCH (see 38.214 [19], clause 5.3).
<b><i>pucch-Cell</i></b>	The ID of the serving cell (of the same cell group) to use for PUCCH. If the field is absent, the UE sends the HARQ feedback on the PUCCH of the SpCell of this cell group, or on this serving cell if it is a PUCCH SCell.
<b><i>xOverhead</i></b>	Accounts for overhead from CSI-RS, CORESET, etc. If the field is absent, the UE applies value xOh0 (see TS 38.214 [19], clause 5.1.3.2).

<b>Conditional Presence</b>	<b>Explanation</b>
<i>SCellAddOnly</i>	It is optionally present, Need S, for (non-PUCCH) SCells when adding a new SCell. The field is absent, Need M, when reconfiguring SCells. The field is also absent for the SpCells as well as for a PUCCH SCell.

## – *PDSCH-TimeDomainResourceAllocationList*

The IE *PDSCH-TimeDomainResourceAllocation* is used to configure a time domain relation between PDCCH and PDSCH. The *PDSCH-TimeDomainResourceAllocationList* contains one or more of such *PDSCH-TimeDomainResourceAllocations*. The network indicates in the DL assignment which of the configured time domain allocations the UE shall apply for that DL assignment. The UE determines the bit width of the DCI field based on the number of entries in the *PDSCH-TimeDomainResourceAllocationList*. Value 0 in the DCI field refers to the first element in this list, value 1 in the DCI field refers to the second element in this list, and so on.

### ***PDSCH-TimeDomainResourceAllocationList* information element**

```
-- ASN1START
-- TAG-PDSCH-TIMEDOMAINRESOURCEALLOCATIONLIST-START

PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE (SIZE(1..maxNrofDL-Allocations)) OF PDSCH-TimeDomainResourceAllocation

PDSCH-TimeDomainResourceAllocation ::= SEQUENCE {
    k0                INTEGER(0..32)                OPTIONAL,    -- Need S
    mappingType       ENUMERATED {typeA, typeB},
    startSymbolAndLength  INTEGER (0..127)
}

PDSCH-TimeDomainResourceAllocationList-r16 ::= SEQUENCE (SIZE(1..maxNrofDL-Allocations)) OF PDSCH-TimeDomainResourceAllocation-r16
```

```

PDSCH-TimeDomainResourceAllocation-r16 ::= SEQUENCE {
    k0-r16                INTEGER(0..32)                OPTIONAL, -- Need S
    mappingType-r16      ENUMERATED {typeA, typeB},
    startSymbolAndLength-r16  INTEGER(0..127),
    repetitionNumber-r16  ENUMERATED {n2, n3, n4, n5, n6, n7, n8, n16}  OPTIONAL, -- Cond Formats1-0and1-1
    ...
}

-- TAG-PDSCH-TIMEDOMAINRESOURCEALLOCATIONLIST-STOP
-- ASN1STOP

```

#### **PDSCH-TimeDomainResourceAllocation field descriptions**

<b>k0</b>	Slot offset between DCI and its scheduled PDSCH (see TS 38.214 [19], clause 5.1.2.1) When the field is absent the UE applies the value 0.
<b>mappingType</b>	PDSCH mapping type. (see TS 38.214 [19], clause 5.3).
<b>repetitionNumber</b>	Indicates the number of PDSCH transmission occasions for slot-based repetition scheme in IE <i>RepetitionSchemeConfig</i> . The parameter is used as specified in 38.214 [19].
<b>startSymbolAndLength</b>	An index giving valid combinations of start symbol and length (jointly encoded) as start and length indicator (SLIV). The network configures the field so that the allocation does not cross the slot boundary (see TS 38.214 [19], clause 5.1.2.1).

Conditional Presence	Explanation
<i>Formats1-0and1-1</i>	In <i>pdsch-TimeDomainResourceAllocationList-r16</i> , this field is optionally present, Need R. In <i>pdsch-TimeDomainAllocationListDCI-1-2</i> , this field is absent.

## – PHR-Config

The IE *PHR-Config* is used to configure parameters for power headroom reporting.

#### **PHR-Config information element**

```

-- ASN1START
-- TAG-PHR-CONFIG-START

PHR-Config ::=
    SEQUENCE {
        phr-PeriodicTimer      ENUMERATED {sf10, sf20, sf50, sf100, sf200,sf500, sf1000, infinity},
        phr-ProhibitTimer      ENUMERATED {sf0, sf10, sf20, sf50, sf100,sf200, sf500, sf1000},
        phr-Tx-PowerFactorChange  ENUMERATED {dB1, dB3, dB6, infinity},
        multiplePHR             BOOLEAN,
        dummy                   BOOLEAN,
        phr-Type2OtherCell       BOOLEAN,
        phr-ModeOtherCG          ENUMERATED {real, virtual},
        ...
        [[
            mpe-Reporting-FR2-r16 SetupRelease { MPE-Config-FR2-r16 }  OPTIONAL  -- Need M
        ]]
    }

```

```

    }}
  }
MPE-Config-FR2-r16 ::=
    mpe-ProhibitTimer-r16
    mpe-Threshold-r16
}
SEQUENCE {
    ENUMERATED {sf0, sf10, sf20, sf50, sf100, sf200, sf500, sf1000},
    ENUMERATED {dB3, dB6, dB9, dB12}
}
-- TAG-PHR-CONFIG-STOP
-- ASN1STOP

```

<b>PHR-Config field descriptions</b>
<p><b>dummy</b> This field is not used in this version of the specification and the UE ignores the received value.</p>
<p><b>mpe-ProhibitTimer</b> Value in number of subframes for MPE reporting, as specified in TS 38.321 [3]. Value <i>sf10</i> corresponds to 10 subframes, and so on.</p>
<p><b>mpe-Reporting-FR2</b> Indicates whether the UE shall report MPE P-MPR in the PHR MAC control element, as specified in TS 38.321 [3].</p>
<p><b>mpe-Threshold</b> Value of the P-MPR threshold in dB for reporting MPE P-MPR when FR2 is configured, as specified in TS 38.321 [3]. The same value applies for each serving cell (although the associated functionality is performed independently for each cell).</p>
<p><b>multiplePHR</b> Indicates if power headroom shall be reported using the Single Entry PHR MAC control element or Multiple Entry PHR MAC control element defined in TS 38.321 [3]. True means to use Multiple Entry PHR MAC control element and False means to use the Single Entry PHR MAC control element defined in TS 38.321 [3]. The network configures this field to <i>true</i> for MR-DC and UL CA for NR, and to <i>false</i> in all other cases.</p>
<p><b>phr-ModeOtherCG</b> Indicates the mode (i.e. real or virtual) used for the PHR of the activated cells that are part of the other Cell Group (i.e. MCG or SCG), when DC is configured. If the UE is configured with only one cell group (no DC), it ignores the field.</p>
<p><b>phr-PeriodicTimer</b> Value in number of subframes for PHR reporting as specified in TS 38.321 [3]. Value <i>sf10</i> corresponds to 10 subframes, value <i>sf20</i> corresponds to 20 subframes, and so on.</p>
<p><b>phr-ProhibitTimer</b> Value in number of subframes for PHR reporting as specified in TS 38.321 [3]. Value <i>sf0</i> corresponds to 0 subframe, value <i>sf10</i> corresponds to 10 subframes, value <i>sf20</i> corresponds to 20 subframes, and so on.</p>
<p><b>phr-Tx-PowerFactorChange</b> Value in dB for PHR reporting as specified in TS 38.321 [3]. Value <i>dB1</i> corresponds to 1 dB, <i>dB3</i> corresponds to 3 dB and so on. The same value applies for each serving cell (although the associated functionality is performed independently for each cell).</p>
<p><b>phr-Type2OtherCell</b> If set to true, the UE shall report a PHR type 2 for the SpCell of the other MAC entity. See TS 38.321 [3], clause 5.4.6. Network sets this field to <i>false</i> if the UE is not configured with an E-UTRA MAC entity.</p>

– *PhysCellId*

The *PhysCellId* identifies the physical cell identity (PCI).

**PhysCellId** information element

```

-- ASN1START
-- TAG-PHYSCCELLID-START

PhysCellId ::=
    INTEGER (0..1007)

-- TAG-PHYSCCELLID-STOP
-- ASN1STOP

```

**PhysicalCellGroupConfig**

The IE *PhysicalCellGroupConfig* is used to configure cell-group specific L1 parameters.

**PhysicalCellGroupConfig** information element

```

-- ASN1START
-- TAG-PHYSICALCELLGROUPCONFIG-START

PhysicalCellGroupConfig ::=
    SEQUENCE {
        harq-ACK-SpatialBundlingPUCCH      ENUMERATED {true}                OPTIONAL, -- Need S
        harq-ACK-SpatialBundlingPUSCH     ENUMERATED {true}                OPTIONAL, -- Need S
        p-NR-FR1                           P-Max                          OPTIONAL, -- Need R
        pdsch-HARQ-ACK-Codebook            ENUMERATED {semiStatic, dynamic},
        tpc-SRS-RNTI                       RNTI-Value                     OPTIONAL, -- Need R
        tpc-PUCCH-RNTI                     RNTI-Value                     OPTIONAL, -- Need R
        tpc-PUSCH-RNTI                     RNTI-Value                     OPTIONAL, -- Need R
        sp-CSI-RNTI                        RNTI-Value                     OPTIONAL, -- Need R
        cs-RNTI                            SetupRelease { RNTI-Value }    OPTIONAL, -- Need M
        . . .
        [[
        mcs-C-RNTI                          RNTI-Value                     OPTIONAL, -- Need R
        p-UE-FR1                             P-Max                          OPTIONAL, -- Cond MCG-Only
        ]],
        [[
        xScale                              ENUMERATED {dB0, dB6, spare2, spare1} OPTIONAL, -- Cond SCG-Only
        ]],
        [[
        pdcch-BlindDetection                 SetupRelease { PDCCH-BlindDetection } OPTIONAL, -- Need M
        ]],
        [[
        dcp-Config-r16                       SetupRelease { DCP-Config-r16 }  OPTIONAL, -- Need M
        harq-ACK-SpatialBundlingPUCCH-secondaryPUCCHgroup-r16  ENUMERATED {enabled, disabled}  OPTIONAL, -- Cond twoPUCCHgroup
        harq-ACK-SpatialBundlingPUSCH-secondaryPUCCHgroup-r16  ENUMERATED {enabled, disabled}  OPTIONAL, -- Cond twoPUCCHgroup
        pdsch-HARQ-ACK-Codebook-secondaryPUCCHgroup-r16        ENUMERATED {semiStatic, dynamic} OPTIONAL, -- Cond twoPUCCHgroup
        p-NR-FR2-r16                                             P-Max                          OPTIONAL, -- Need R
        p-UE-FR2-r16                                             P-Max                          OPTIONAL, -- Cond MCG-Only
        nr-dc-PCmode-FR1-r16                                     ENUMERATED {semi-static-model1, semi-static-mode2, dynamic}  OPTIONAL, -- Cond MCG-Only
        nr-dc-PCmode-FR2-r16                                     ENUMERATED {semi-static-model1, semi-static-mode2, dynamic}  OPTIONAL, -- Cond MCG-Only
        pdsch-HARQ-ACK-Codebook-r16                            ENUMERATED {enhancedDynamic}    OPTIONAL, -- Need R
        nfi-TotalDAI-Included-r16                               ENUMERATED {true}              OPTIONAL, -- Need R
        ]],
    }

```



```

    ul-TotalDAI-Included-r16          ENUMERATED {true}          OPTIONAL, -- Need R
    pdsch-HARQ-ACK-OneShotFeedback-r16 ENUMERATED {true}          OPTIONAL, -- Need R
    pdsch-HARQ-ACK-OneShotFeedbackNDI-r16 ENUMERATED {true}          OPTIONAL, -- Need R
    pdsch-HARQ-ACK-OneShotFeedbackCBG-r16 ENUMERATED {true}          OPTIONAL, -- Need R
    downlinkAssignmentIndexDCI-0-2-r16 ENUMERATED { enabled }      OPTIONAL, -- Need S
    downlinkAssignmentIndexDCI-1-2-r16 ENUMERATED {n1, n2, n4}        OPTIONAL, -- Need S
    pdsch-HARQ-ACK-CodebookList-r16    SetupRelease {PDSCH-HARQ-ACK-CodebookList-r16} OPTIONAL, -- Need M
    ackNackFeedbackMode-r16           ENUMERATED {joint, separate}  OPTIONAL, -- Need R
    pdcch-BlindDetectionCA-CombIndicator-r16 SetupRelease { PDCCH-BlindDetectionCA-CombIndicator-r16 } OPTIONAL, -- Need M
    pdcch-BlindDetection2-r16         SetupRelease { PDCCH-BlindDetection2-r16 }   OPTIONAL, -- Need M
    pdcch-BlindDetection3-r16         SetupRelease { PDCCH-BlindDetection3-r16 }   OPTIONAL, -- Need M
    bdFactorR-r16                     ENUMERATED {n1}                  OPTIONAL, -- Need R
  ]]
}

PDCCH-BlindDetection ::=          INTEGER (1..15)

DCP-Config-r16 ::=                SEQUENCE {
  ps-RNTI-r16                      RNTI-Value,
  ps-Offset-r16                     INTEGER (1..120),
  sizeDCI-2-6-r16                   INTEGER (1..maxDCI-2-6-Size-r16),
  ps-PositionDCI-2-6-r16            INTEGER (0..maxDCI-2-6-Size-1-r16),
  ps-WakeUp-r16                     ENUMERATED {true}          OPTIONAL, -- Need S
  ps-TransmitPeriodicL1-RSRP-r16    ENUMERATED {true}          OPTIONAL, -- Need S
  ps-TransmitOtherPeriodicCSI-r16   ENUMERATED {true}          OPTIONAL, -- Need S
}

PDSCH-HARQ-ACK-CodebookList-r16 ::= SEQUENCE (SIZE (1..2)) OF ENUMERATED {semiStatic, dynamic}

PDCCH-BlindDetectionCA-CombIndicator-r16 ::= SEQUENCE {
  pdcch-BlindDetectionCA1-r16      INTEGER (1..15),
  pdcch-BlindDetectionCA2-r16      INTEGER (1..15)
}

PDCCH-BlindDetection2-r16 ::=      INTEGER (1..15)

PDCCH-BlindDetection3-r16 ::=      INTEGER (1..15)

-- TAG-PHYSICALCELLGROUPCONFIG-STOP
-- ASN1STOP

```

<b>PhysicalCellGroupConfig field descriptions</b>
<p><b>ackNackFeedbackMode</b> Indicates which among the joint and separate ACK/NACK feedback modes to use within a slot as specified in TS 38.213 (clause 9). Field is present only when two different values of CORESETPoolIndex in ControlResourceSet are configured in a cell.</p>
<p><b>bdFactorR</b> Parameter for determining and distributing the maximum numbers of BD/CCE for mPDCCH based mPDSCH transmission as specified in TS 38.213 [13] Clause 10.1.</p>
<p><b>cs-RNTI</b> RNTI value for downlink SPS (see <i>SPS-Config</i>) and uplink configured grant (see <i>ConfiguredGrantConfig</i>).</p>
<p><b>downlinkAssignmentIndexDCI-0-2</b> Indicates if "Downlink assignment index" is present or absent in DCI format 0_2. If the field "downlinkAssignmentIndexDCI-0-2" is absent, then 0 bit for "Downlink assignment index" in DCI format 0_2. If the field "downlinkAssignmentIndexDCI-0-2" is present, then the bitwidth of "Downlink assignment index" in DCI format 0_2 is defined in the same as that in DCI format 0_1 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 9.1).</p>
<p><b>downlinkAssignmentIndexDCI-1-2</b> Configures the number of bits for "Downlink assignment index" in DCI format 1_2. If the field is absent, then 0 bit for "Downlink assignment index" in DCI format 1_2. Note that 1 bit and 2 bits are applied if only one serving cell is configured in the DL and the higher layer parameter pdsch-HARQ-ACK-Codebook=dynamic. 4 bits is applied if more than one serving cell are configured in the DL and the higher layer parameter pdsch-HARQ-ACK-Codebook is set to dynamic (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 9.1).</p>
<p><b>harq-ACK-SpatialBundlingPUCCH</b> Enables spatial bundling of HARQ ACKs. It is configured per cell group (i.e. for all the cells within the cell group) for PUCCH reporting of HARQ-ACK. It is only applicable when more than 4 layers are possible to schedule. When the field is absent, the spatial bundling of PUCCH HARQ ACKs for the primary PUCCH group is disabled (see TS 38.213 [13], clause 9.1.2.1). If the field <i>harq-ACK SpatialBundlingPUCCH-secondaryPUCCHgroup</i> is present, <i>harq-ACK-SpatialBundlingPUCCH</i> is only applied to primary PUCCH group.</p>
<p><b>harq-ACK-SpatialBundlingPUCCH-secondaryPUCCHgroup</b> Indicates whether spatial bundling of PUCCH HARQ ACKs for the secondary PUCCH group is enabled or disabled. The field is only applicable when more than 4 layers are possible to schedule (see TS 38.213 [13], clause 9.1.2.1). When the field is absent, the use of spatial bundling of PUCCH HARQ ACKs for the secondary PUCCH group is indicated by <i>harq-ACK-SpatialBundlingPUCCH</i>. See TS 38.213 [13], clause 9.1.2.1.</p>
<p><b>harq-ACK-SpatialBundlingPUSCH</b> Enables spatial bundling of HARQ ACKs. It is configured per cell group (i.e. for all the cells within the cell group) for PUSCH reporting of HARQ-ACK. It is only applicable when more than 4 layers are possible to schedule. When the field is absent, the spatial bundling of PUSCH HARQ ACKs for the primary PUCCH group is disabled (see TS 38.213 [13], clauses 9.1.2.2 and 9.1.3.2). If the field <i>harq-ACK SpatialBundlingPUSCH-secondaryPUCCHgroup</i> is present, <i>harq-ACK-SpatialBundlingPUSCH</i> is only applied to primary PUCCH group.</p>
<p><b>harq-ACK-SpatialBundlingPUSCH-secondaryPUCCHgroup</b> Indicates whether spatial bundling of PUSCH HARQ ACKs for the secondary PUCCH group is enabled or disabled. The field is only applicable when more than 4 layers are possible to schedule (see TS 38.213 [13], clauses 9.1.2.2 and 9.1.3.2). When the field is absent, the use of spatial bundling of PUSCH HARQ ACKs for the secondary PUCCH group is indicated by <i>harq-ACK-SpatialBundlingPUSCH</i>. See TS 38.213 [13], clauses 9.1.2.2 and 9.1.3.2.</p>
<p><b>mcs-C-RNTI</b> RNTI to indicate use of <i>qam64LowSE</i> for grant-based transmissions. When the <i>mcs-C-RNTI</i> is configured, RNTI scrambling of DCI CRC is used to choose the corresponding MCS table.</p>
<p><b>nfi-TotalDAI-Included</b> Indicates whether the NFI and total DAI fields of the non-scheduled PDSCH group is included in the non-fallback DL grant DCI (see TS 38.212 [17], clause 7.3.1). The network configures this only when enhanced dynamic codebook is configured (<i>pdsch-HARQ-ACK-Codebook</i> is set to <i>enhancedDynamic</i>).</p>
<p><b>nrdc-PCmode-FR1</b> Indicates the uplink power sharing mode that the UE uses in NR-DC in frequency range 1 (FR1) (see TS 38.213 [13], clause 7.6).</p>
<p><b>nrdc-PCmode-FR2</b> Indicates the uplink power sharing mode that the UE uses in NR-DC in frequency range 2 (FR2) (see TS 38.213 [13], clause 7.6).</p>

<p><b><i>pdccch-BlindDetection, pdccch-BlindDetection2, pdccch-BlindDetection3</i></b> Indicates the reference number of cells for PDCCH blind detection for the CG. Network configures the field for each CG when the UE is in NR DC and sets the value in accordance with the constraints specified in TS 38.213 [13]. The network configures <i>pdccch-BlindDetection</i> only if the UE is in NR-DC. The network configures <i>pdccch-BlindDetection2</i> only if the UE is in NR-DC with at least one downlink cell using Rel-16 PDCCH monitoring capability. The network configures <i>pdccch-BlindDetection3</i> only if the UE is in NR-DC with at least one downlink cell using Rel-15 PDCCH monitoring capability.</p>
<p><b><i>pdccch-BlindDetectionCA-Comblndicator</i></b> Configure one combination of <i>pdccch-BlindDetectionCA1</i> (for R15) and <i>pdccch-BlindDetectionCA2</i> (for R16) for UE to use for scaling PDCCH monitoring capability if the number of serving cells configured to a UE is larger than the reported capability, and if UE reports more than one combination of <i>pdccch-BlindDetectionCA1</i> and <i>pdccch-BlindDetectionCA2</i> as UE capability. The combination of <i>pdccch-BlindDetectionCA1</i> and <i>pdccch-BlindDetectionCA2</i> configured by <i>pdccch-BlindDetectionCAComblndicator</i> is from the more than one combination of <i>pdccch-BlindDetectionCA1</i> and <i>pdccch-BlindDetectionCA2</i> reported by UE (see TS 38.213 [13], clause 10).</p>
<p><b><i>p-NR-FR1</i></b> The maximum total transmit power to be used by the UE in this NR cell group across all serving cells in frequency range 1 (FR1). The maximum transmit power that the UE may use may be additionally limited by <i>p-Max</i> (configured in <i>FrequencyInfoUL</i>) and by <i>p-UE-FR1</i> (configured total for all serving cells operating on FR1).</p>
<p><b><i>p-NR-FR2</i></b> The maximum total transmit power to be used by the UE in this NR cell group across all serving cells in frequency range 2 (FR2). The maximum transmit power that the UE may use may be additionally limited by <i>p-Max</i> (configured in <i>FrequencyInfoUL</i>) and by <i>p-UE-FR2</i> (configured total for all serving cells operating on FR2). This field is only used in NR-DC.</p>
<p><b><i>ps-RNTI</i></b> RNTI value for scrambling CRC of DCI format 2-6 used for power saving (see TS 38.213 [13], clause 10.1).</p>
<p><b><i>ps-Offset</i></b> The start of the search-time of DCI format 2-6 with CRC scrambled by PS-RNTI relative to the start of the <i>drx-onDurationTimer</i> of Long DRX (see TS 38.213 [13], clause 10.3). Value in multiples of 0.125ms (milliseconds). 1 corresponds to 0.125 ms, 2 corresponds to 0.25 ms, 3 corresponds to 0.375 ms and so on.</p>
<p><b><i>ps-WakeUp</i></b> Indicates the UE to wake-up if DCI format 2-6 is not detected outside active time (see TS 38.213 [13], clause 10.3). If the field is absent, the UE does not wake-up if DCI format 2-6 is not detected outside active time.</p>
<p><b><i>ps-PositionDCI-2-6</i></b> Starting position of UE wakeup and SCell dormancy indication in DCI format 2-6 (see TS 38.213 [13], clause 10.3).</p>
<p><b><i>ps-TransmitPeriodicL1-RSRP</i></b> Indicates the UE to transmit periodic L1-RSRP report(s) when the <i>drx-onDurationTimer</i> does not start (see TS 38.321 [3], clause 5.7). If the field is absent, the UE does not transmit periodic L1-RSRP report(s) when the <i>drx-onDurationTimer</i> does not start.</p>
<p><b><i>ps-TransmitOtherPeriodicCSI</i></b> Indicates the UE to transmit periodic CSI report(s) other than L1-RSRP reports when the <i>drx-onDurationTimer</i> does not start (see TS 38.321 [3], clause 5.7). If the field is absent, the UE does not transmit periodic CSI report(s) other than L1-RSRP reports when the <i>drx-onDurationTimer</i> does not start.</p>
<p><b><i>p-UE-FR1</i></b> The maximum total transmit power to be used by the UE across all serving cells in frequency range 1 (FR1) across all cell groups. The maximum transmit power that the UE may use may be additionally limited by <i>p-Max</i> (configured in <i>FrequencyInfoUL</i>) and by <i>p-NR-FR1</i> (configured for the cell group).</p>
<p><b><i>p-UE-FR2</i></b> The maximum total transmit power to be used by the UE across all serving cells in frequency range 2 (FR2) across all cell groups. The maximum transmit power that the UE may use may be additionally limited by <i>p-Max</i> (configured in <i>FrequencyInfoUL</i>) and by <i>p-NR-FR2</i> (configured for the cell group).</p>
<p><b><i>pdsch-HARQ-ACK-Codebook</i></b> The PDSCH HARQ-ACK codebook is either semi-static or dynamic. This is applicable to both CA and none CA operation (see TS 38.213 [13], clauses 9.1.2 and 9.1.3). If <i>pdsch-HARQ-ACK-Codebook-r16</i> is signalled, UE shall ignore the <i>pdsch-HARQ-ACK-Codebook</i> (without suffix). If the field <i>pdsch-HARQ-ACK-Codebook-secondaryPUCCHgroup</i> is present, <i>pdsch-HARQ-ACK-Codebook</i> is applied to primary PUCCH group. Otherwise, this field is applied to the cell group (i.e. for all the cells within the cell group).</p>

<b><i>pdsch-HARQ-ACK-CodebookList</i></b>
A list of configuration for at least two simultaneously constructed HARQ-ACK codebooks. Each configuration in the list is defined in the same way as <i>pdsch-HARQ-ACK-Codebook</i> (see TS 38.212 [17], clause 7.3.1.2.2 and TS 38.213 [13], clauses 7.2.1, 9.1.2, 9.1.3 and 9.2.1). If this field is present, the field <i>pdsch-HARQ-ACK-Codebook</i> is ignored for the case at least two HARQ-ACK codebooks are simultaneously constructed.
<b><i>pdsch-HARQ-ACK-Codebook-secondaryPUCCHgroup</i></b>
The PDSCH HARQ-ACK codebook is either semi-static or dynamic. This is applicable to both CA and none CA operation (see TS 38.213 [13], clauses 9.1.2 and 9.1.3). It is configured for secondary PUCCH group.
<b><i>pdsch-HARQ-ACK-OneShotFeedback</i></b>
When configured, the DCI_format 1_1 can request the UE to report A/N for all HARQ processes and all CCs configured in the PUCCH group (see TS 38.212 [17], clause 7.3.1).
<b><i>pdsch-HARQ-ACK-OneShotFeedbackCBG</i></b>
When configured, the DCI_format 1_1 can request the UE to include CBG level A/N for each CC with CBG level transmission configured. When not configured, the UE will report TB level A/N even if CBG level transmission is configured for a CC. The network configures this only when <i>pdsch-HARQ-ACK-OneShotFeedback</i> is configured.
<b><i>pdsch-HARQ-ACK-OneShotFeedbackNDI</i></b>
When configured, the DCI_format 1_1 can request the UE to include NDI for each A/N reported. The network configures this only when <i>pdsch-HARQ-ACK-OneShotFeedback</i> is configured.
<b><i>sizeDCI-2-6</i></b>
Size of DCI format 2-6 (see TS 38.213 [13], clause 11.5).
<b><i>sp-CSI-RNTI</i></b>
RNTI for Semi-Persistent CSI reporting on PUSCH (see <i>CSI-ReportConfig</i> ) (see TS 38.214 [19], clause 5.2.1.5.2). Network always configures the UE with a value for this field when at least one <i>CSI-ReportConfig</i> with <i>reportConfigType</i> set to <i>semiPersistentOnPUSCH</i> is configured.
<b><i>tpc-PUCCH-RNTI</i></b>
RNTI used for PUCCH TPC commands on DCI (see TS 38.213 [13], clause 10.1).
<b><i>tpc-PUSCH-RNTI</i></b>
RNTI used for PUSCH TPC commands on DCI (see TS 38.213 [13], clause 10.1).
<b><i>tpc-SRS-RNTI</i></b>
RNTI used for SRS TPC commands on DCI (see TS 38.213 [13], clause 10.1).
<b><i>ul-TotalDAI-Included</i></b>
Indicates whether the total DAI fields of the additional PDSCH group is included in the non-fallback UL grant DCI (see TS 38.212 [17], clause 7.3.1). The network configures this only when enhanced dynamic codebook is configured ( <i>pdsch-HARQ-ACK-Codebook</i> is set to <i>enhancedDynamic</i> ).
<b><i>xScale</i></b>
The UE is allowed to drop NR only if the power scaling applied to NR results in a difference between scaled and unscaled NR UL of more than <i>xScale</i> dB (see TS 38.213 [13]). If the value is not configured for dynamic power sharing, the UE assumes default value of 6 dB.

Conditional Presence	Explanation
<i>MCG-Only</i>	This field is optionally present, Need R, in the <i>PhysicalCellGroupConfig</i> of the MCG. It is absent otherwise.
<i>SCG-Only</i>	This field is optionally present, Need S, in the <i>PhysicalCellGroupConfig</i> of the SCG in (NG)EN-DC as defined in TS 38.213 [13]. It is absent otherwise.
<i>twoPUCCHgroup</i>	This field is optionally present, Need R, if secondary PUCCH group is configured. It is absent otherwise.

– *PLMN-Identity*

The IE *PLMN-Identity* identifies a Public Land Mobile Network. Further information regarding how to set the IE is specified in TS 23.003 [21].

**PLMN-Identity information element**

```

-- ASN1START
-- TAG-PLMN-IDENTITY-START

PLMN-Identity ::=
    mcc          SEQUENCE {
        MCC      MCC          OPTIONAL,          -- Cond MCC
        mnc      MNC
    }

MCC ::=
    SEQUENCE (SIZE (3)) OF MCC-MNC-Digit

MNC ::=
    SEQUENCE (SIZE (2..3)) OF MCC-MNC-Digit

MCC-MNC-Digit ::=
    INTEGER (0..9)

-- TAG-PLMN-IDENTITY-STOP
-- ASN1STOP

```

**PLMN-Identity field descriptions**

<b>mcc</b>	The first element contains the first MCC digit, the second element the second MCC digit and so on. If the field is absent, it takes the same value as the <i>mcc</i> of the immediately preceding IE PLMN-Identity. See TS 23.003 [21].
<b>mnc</b>	The first element contains the first MNC digit, the second element the second MNC digit and so on. See TS 23.003 [21].

Conditional Presence	Explanation
MCC	This field is mandatory present when PLMN-Identity is not used in a list or if it is the first entry of PLMN-Identity in a list. Otherwise it is optionally present, Need S.

– **PLMN-IdentityInfoList**

The IE *PLMN-IdentityInfoList* includes a list of PLMN identity information.

**PLMN-IdentityInfoList information element**

```

-- ASN1START
-- TAG-PLMN-IDENTITYINFOLIST-START

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

PLMN-IdentityInfo ::=
    plmn-IdentityList
    trackingAreaCode
    ranac
    cellIdentity
    cellReservedForOperatorUse
    SEQUENCE {
        SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity,
        TrackingAreaCode
        RAN-AreaCode
        CellIdentity,
        ENUMERATED {reserved, notReserved},
        OPTIONAL,          -- Need R
        OPTIONAL,          -- Need R
    }

```

```

    ...
    [[
    iab-Support-r16          ENUMERATED {true}          OPTIONAL          -- Need S
    ]]
}
-- TAG-PLMN-IDENTITYINFOLIST-STOP
-- ASN1STOP

```

#### ***PLMN-IdentityInfo* field descriptions**

##### ***cellReservedForOperatorUse***

Indicates whether the cell is reserved for operator use (per PLMN), as defined in TS 38.304 [20]. This field is ignored by IAB-MT.

##### ***iab-Support***

This field combines both the support of IAB and the cell status for IAB. If the field is present, the cell supports IAB and the cell is also considered as a candidate for cell (re)selection for IAB-node; if the field is absent, the cell does not support IAB and/or the cell is barred for IAB-node.

##### ***trackingAreaCode***

Indicates Tracking Area Code to which the cell indicated by *cellIdentity* field belongs. The absence of the field indicates that the cell only supports PSCell/SCell functionality (per PLMN).

#### – ***PLMN-IdentityList2***

Includes a list of PLMN identities.

#### ***PLMN-IdentityList2* information element**

```

-- ASN1START
-- TAG-PLMNIDENTITYLIST2-START

PLMN-IdentityList2-r16 ::= SEQUENCE (SIZE (1..16)) OF PLMN-Identity

-- TAG-PLMNIDENTITYLIST2-STOP
-- ASN1STOP

```

#### – ***PRB-Id***

The IE *PRB-Id* identifies a Physical Resource Block (PRB) position within a carrier.

#### ***PRB-Id* information element**

```

-- ASN1START
-- TAG-PRB-ID-START

PRB-Id ::= INTEGER (0..maxNrofPhysicalResourceBlocks-1)

-- TAG-PRB-ID-STOP
-- ASN1STOP

```

– *PTRS-DownlinkConfig*

The IE *PTRS-DownlinkConfig* is used to configure downlink phase tracking reference signals (PTRS) (see TS 38.214 [19] clause 5.1.6.3)

***PTRS-DownlinkConfig* information element**

```

-- ASN1START
-- TAG-PTRS-DOWNLINKCONFIG-START

PTRS-DownlinkConfig ::=
    frequencyDensity          SEQUENCE (SIZE (2)) OF INTEGER (1..276)          OPTIONAL, -- Need S
    timeDensity               SEQUENCE (SIZE (3)) OF INTEGER (0..29)          OPTIONAL, -- Need S
    epre-Ratio                INTEGER (0..3)                                  OPTIONAL, -- Need S
    resourceElementOffset    ENUMERATED { offset01, offset10, offset11 }      OPTIONAL, -- Need S
    ...,
    [[
    maxNrofPorts-r16         ENUMERATED {n1, n2}                              OPTIONAL  -- Need R
    ]]
}

-- TAG-PTRS-DOWNLINKCONFIG-STOP
-- ASN1STOP

```

***PTRS-DownlinkConfig* field descriptions**

<b><i>epre-Ratio</i></b> EPRE ratio between PTRS and PDSCH. Value 0 corresponds to the codepoint "00" in table 4.1-2. Value 1 corresponds to codepoint "01", and so on. If the field is not provided, the UE applies value 0 (see TS 38.214 [19], clause 4.1).
<b><i>frequencyDensity</i></b> Presence and frequency density of DL PT-RS as a function of Scheduled BW. If the field is absent, the UE uses $K_{PT-RS} = 2$ (see TS 38.214 [19], clause 5.1.6.3, table 5.1.6.3-2).
<b><i>maxNrofPorts</i></b> The maximum number of DL PTRS ports specified in TS 38.214 [19] (clause 5.1.6.3). 2 PT-RS ports can only be configured for a DL BWP that is configured, as specified in TS 38.214 [19] clause 5.1, with a mode where a single PDSCH has association between the DM-RS ports and the TCI states as defined in TS 38.214 [19] clause 5.1.6.2.
<b><i>resourceElementOffset</i></b> Indicates the subcarrier offset for DL PTRS. If the field is absent, the UE applies the value offset00 (see TS 38.214 [19], clause 6.4.1.2.2.1).
<b><i>timeDensity</i></b> Presence and time density of DL PT-RS as a function of MCS. The value 29 is only applicable for MCS Table 5.1.3.1-1 (TS 38.214 [19]). If the field is absent, the UE uses $L_{PT-RS} = 1$ (see TS 38.214 [19], clause 5.1.6.3, table 5.1.6.3-1).

– *PTRS-UplinkConfig*

The IE *PTRS-UplinkConfig* is used to configure uplink Phase-Tracking-Reference-Signals (PTRS).

**PTRS-UplinkConfig** information element

```

-- ASN1START
-- TAG-PTRS-UPLINKCONFIG-START

PTRS-UplinkConfig ::=
    transformPrecoderDisabled          SEQUENCE {
        frequencyDensity                SEQUENCE {
            frequencyDensity            SEQUENCE (SIZE (2)) OF INTEGER (1..276)           OPTIONAL, -- Need S
            timeDensity                  SEQUENCE (SIZE (3)) OF INTEGER (0..29)           OPTIONAL, -- Need S
            maxNrofPorts                 ENUMERATED {n1, n2},
            resourceElementOffset        ENUMERATED {offset01, offset10, offset11 }        OPTIONAL, -- Need S
            ptrs-Power                   ENUMERATED {p00, p01, p10, p11}                  OPTIONAL, -- Need R
        }
        transformPrecoderEnabled        SEQUENCE {
            sampleDensity                 SEQUENCE (SIZE (5)) OF INTEGER (1..276),
            timeDensityTransformPrecoding ENUMERATED {d2}                               OPTIONAL, -- Need S
        }
        ...
    }

-- TAG-PTRS-UPLINKCONFIG-STOP
-- ASN1STOP

```

**PTRS-UplinkConfig** field descriptions

<b>frequencyDensity</b>	Presence and frequency density of UL PT-RS for CP-OFDM waveform as a function of scheduled BW If the field is absent, the UE uses $K_{PT-RS} = 2$ (see TS 38.214 [19], clause 6.1).
<b>maxNrofPorts</b>	The maximum number of UL PTRS ports for CP-OFDM (see TS 38.214 [19], clause 6.2.3.1).
<b>ptrs-Power</b>	UL PTRS power boosting factor per PTRS port (see TS 38.214 [19], clause 6.1, table 6.2.3.1.3).
<b>resourceElementOffset</b>	Indicates the subcarrier offset for UL PTRS for CP-OFDM. If the field is absent, the UE applies the value offset00 (see TS 38.211 [16], clause 6.4.1.2.2).
<b>sampleDensity</b>	Sample density of PT-RS for DFT-s-OFDM, pre-DFT, indicating a set of thresholds $T=\{NRBn, n=0,1,2,3,4\}$ , that indicates dependency between presence of PT-RS and scheduled BW and the values of X and K the UE should use depending on the scheduled BW, see TS 38.214 [19], clause 6.1, table 6.2.3.2-1.
<b>timeDensity</b>	Presence and time density of UL PT-RS for CP-OFDM waveform as a function of MCS If the field is absent, the UE uses $L_{PT-RS} = 1$ (see TS 38.214 [19], clause 6.1).
<b>timeDensityTransformPrecoding</b>	Time density (OFDM symbol level) of PT-RS for DFT-s-OFDM. If the field is absent, the UE applies value d1 (see TS 38.214 [19], clause 6.1).
<b>transformPrecoderDisabled</b>	Configuration of UL PTRS without transform precoder (with CP-OFDM).
<b>transformPrecoderEnabled</b>	Configuration of UL PTRS with transform precoder (DFT-S-OFDM).



## – PUCCH-Config

The IE *PUCCH-Config* is used to configure UE specific PUCCH parameters (per BWP).

### PUCCH-Config information element

```

-- ASN1START
-- TAG-PUCCH-CONFIG-START

PUCCH-Config ::=
    SEQUENCE {
        resourceSetToAddModList          SEQUENCE (SIZE (1..maxNrofPUCCH-ResourceSets)) OF PUCCH-ResourceSet      OPTIONAL, -- Need N
        resourceSetToReleaseList          SEQUENCE (SIZE (1..maxNrofPUCCH-ResourceSets)) OF PUCCH-ResourceSetId  OPTIONAL, -- Need N
        resourceToAddModList              SEQUENCE (SIZE (1..maxNrofPUCCH-Resources)) OF PUCCH-Resource          OPTIONAL, -- Need N
        resourceToReleaseList              SEQUENCE (SIZE (1..maxNrofPUCCH-Resources)) OF PUCCH-ResourceId      OPTIONAL, -- Need N
        format1                            SetupRelease { PUCCH-FormatConfig }                               OPTIONAL, -- Need M
        format2                            SetupRelease { PUCCH-FormatConfig }                               OPTIONAL, -- Need M
        format3                            SetupRelease { PUCCH-FormatConfig }                               OPTIONAL, -- Need M
        format4                            SetupRelease { PUCCH-FormatConfig }                               OPTIONAL, -- Need M
        schedulingRequestResourceToAddModList SEQUENCE (SIZE (1..maxNrofSR-Resources)) OF SchedulingRequestResourceConfig OPTIONAL, -- Need N
        schedulingRequestResourceToReleaseList SEQUENCE (SIZE (1..maxNrofSR-Resources)) OF SchedulingRequestResourceId  OPTIONAL, -- Need N
        multi-CSI-PUCCH-ResourceList      SEQUENCE (SIZE (1..2)) OF PUCCH-ResourceId                               OPTIONAL, -- Need M
        dl-DataToUL-ACK                    SEQUENCE (SIZE (1..8)) OF INTEGER (0..15)                               OPTIONAL, -- Need M
        spatialRelationInfoToAddModList    SEQUENCE (SIZE (1..maxNrofSpatialRelationInfos)) OF PUCCH-SpatialRelationInfo OPTIONAL, -- Need N
        spatialRelationInfoToReleaseList   SEQUENCE (SIZE (1..maxNrofSpatialRelationInfos)) OF PUCCH-SpatialRelationInfoId  OPTIONAL, -- Need N
        pucch-PowerControl                  PUCCH-PowerControl                                                       OPTIONAL, -- Need M
        . . .
        [
            resourceToAddModListExt-r16     SEQUENCE (SIZE (1..maxNrofPUCCH-Resources)) OF PUCCH-ResourceExt-r16     OPTIONAL, -- Need N
            dl-DataToUL-ACK-r16              SetupRelease { DL-DataToUL-ACK-r16 }                                       OPTIONAL, -- Need M
            ul-AccessConfigListDCI-1-1-r16   SetupRelease { UL-AccessConfigListDCI-1-1-r16 }                               OPTIONAL, -- Need M
            subslotLengthForPUCCH-r16        CHOICE {
                normalCP-r16                 ENUMERATED {n2,n7},
                extendedCP-r16               ENUMERATED {n2,n6}
            }
            dl-DataToUL-ACK-DCI-1-2-r16       SetupRelease { DL-DataToUL-ACK-DCI-1-2-r16 }                               OPTIONAL, -- Need M
            numberOfBitsForPUCCH-ResourceIndicatorDCI-1-2-r16 INTEGER (0..3)                               OPTIONAL, -- Need R
            dmrs-UplinkTransformPrecodingPUCCH-r16 ENUMERATED {enabled}                               OPTIONAL, -- Cond P12-BPSK
            spatialRelationInfoToAddModList2-r16 SEQUENCE (SIZE (1..maxNrofSpatialRelationInfosDiff-r16)) OF PUCCH-SpatialRelationInfo OPTIONAL, -- Need N
            spatialRelationInfoToReleaseList2-r16 SEQUENCE (SIZE (1..maxNrofSpatialRelationInfosDiff-r16)) OF PUCCH-SpatialRelationInfoId  OPTIONAL, -- Need N
            spatialRelationInfoToAddModListExt-r16 SEQUENCE (SIZE (1..maxNrofSpatialRelationInfos-r16)) OF PUCCH-SpatialRelationInfoExt-r16 OPTIONAL, -- Need N
            spatialRelationInfoToReleaseList-r16 SEQUENCE (SIZE (1..maxNrofSpatialRelationInfos-r16)) OF PUCCH-SpatialRelationInfoId-r16  OPTIONAL, -- Need N
            resourceGroupToAddModList-r16     SEQUENCE (SIZE (1..maxNrofPUCCH-ResourceGroups-r16)) OF PUCCH-ResourceGroup-r16 OPTIONAL, -- Need N
            resourceGroupToReleaseList-r16     SEQUENCE (SIZE (1..maxNrofPUCCH-ResourceGroups-r16)) OF PUCCH-ResourceGroupId-r16  OPTIONAL, -- Need N
        ]
    }

```

```

    sps-PUCCH-AN-List-r16          SetupRelease { SPS-PUCCH-AN-List-r16 }          OPTIONAL, -- Need M
    schedulingRequestResourceToAddModList-v1610 SEQUENCE (SIZE (1..maxNrofSR-Resources)) OF SchedulingRequestResourceConfig-v1610
                                                                                   OPTIONAL -- Need N
  ]]
}

PUCCH-FormatConfig ::=
  interslotFrequencyHopping      ENUMERATED {enabled}          OPTIONAL, -- Need R
  additionalDMRS                 ENUMERATED {true}             OPTIONAL, -- Need R
  maxCodeRate                   PUCCH-MaxCodeRate              OPTIONAL, -- Need R
  nrofSlots                     ENUMERATED {n2,n4,n8}          OPTIONAL, -- Need S
  pi2BPSK                       ENUMERATED {enabled}          OPTIONAL, -- Need R
  simultaneousHARQ-ACK-CSI       ENUMERATED {true}            OPTIONAL, -- Need R
}

PUCCH-MaxCodeRate ::=
  ENUMERATED {zeroDot08, zeroDot15, zeroDot25, zeroDot35, zeroDot45, zeroDot60, zeroDot80}

-- A set with one or more PUCCH resources
PUCCH-ResourceSet ::=
  pucch-ResourceSetId           PUCCH-ResourceSetId,
  resourceList                  SEQUENCE (SIZE (1..maxNrofPUCCH-ResourcesPerSet)) OF PUCCH-ResourceId,
  maxPayloadSize                INTEGER (4..256)                OPTIONAL -- Need R
}

PUCCH-ResourceSetId ::=
  INTEGER (0..maxNrofPUCCH-ResourceSets-1)

PUCCH-Resource ::=
  pucch-ResourceId              PUCCH-ResourceId,
  startingPRB                  PRB-Id,
  intraSlotFrequencyHopping     ENUMERATED { enabled }          OPTIONAL, -- Need R
  secondHopPRB                 PRB-Id                          OPTIONAL, -- Need R
  format                       CHOICE {
    format0                     PUCCH-format0,
    format1                     PUCCH-format1,
    format2                     PUCCH-format2,
    format3                     PUCCH-format3,
    format4                     PUCCH-format4
  }
}

PUCCH-ResourceExt-r16 ::=
  interlaceAllocation-r16      SEQUENCE {
    rb-SetIndex                 INTEGER (0..4),
    interlace0                  CHOICE {
      scs15                     INTEGER (0..9),
      scs30                     INTEGER (0..4)
    }
  }
  formatExt-v1610              CHOICE {
    interlace1-v1610            INTEGER (0..9),
    occ-v1610                   SEQUENCE {
      occ-Length-v1610          ENUMERATED {n2,n4}          OPTIONAL, -- Need M
      occ-Index-v1610           ENUMERATED {n0,n1,n2,n3}      OPTIONAL, -- Need M
    }
  }
}

```

```

    }
    ...
}
OPTIONAL, -- Need R

PUCCH-ResourceId ::=
    INTEGER (0..maxNrofPUCCH-Resources-1)

PUCCH-format0 ::=
    SEQUENCE {
        initialCyclicShift
            INTEGER (0..11),
        nrofSymbols
            INTEGER (1..2),
        startingSymbolIndex
            INTEGER (0..13)
    }

PUCCH-format1 ::=
    SEQUENCE {
        initialCyclicShift
            INTEGER (0..11),
        nrofSymbols
            INTEGER (4..14),
        startingSymbolIndex
            INTEGER (0..10),
        timeDomainOCC
            INTEGER (0..6)
    }

PUCCH-format2 ::=
    SEQUENCE {
        nrofPRBs
            INTEGER (1..16),
        nrofSymbols
            INTEGER (1..2),
        startingSymbolIndex
            INTEGER (0..13)
    }

PUCCH-format3 ::=
    SEQUENCE {
        nrofPRBs
            INTEGER (1..16),
        nrofSymbols
            INTEGER (4..14),
        startingSymbolIndex
            INTEGER (0..10)
    }

PUCCH-format4 ::=
    SEQUENCE {
        nrofSymbols
            INTEGER (4..14),
        occ-Length
            ENUMERATED {n2,n4},
        occ-Index
            ENUMERATED {n0,n1,n2,n3},
        startingSymbolIndex
            INTEGER (0..10)
    }

PUCCH-ResourceGroup-r16 ::=
    SEQUENCE {
        pucch-ResourceGroupId-r16
            PUCCH-ResourceGroupId-r16,
        resourcePerGroupList-r16
            SEQUENCE (SIZE (1..maxNrofPUCCH-ResourcesPerGroup-r16)) OF PUCCH-ResourceId
    }

PUCCH-ResourceGroupId-r16 ::=
    INTEGER (0..maxNrofPUCCH-ResourceGroups-1-r16)

DL-DataToUL-ACK-r16 ::=
    SEQUENCE (SIZE (1..8)) OF INTEGER (-1..15)

DL-DataToUL-ACK-DCI-1-2-r16 ::=
    SEQUENCE (SIZE (1..8)) OF INTEGER (0..15)

UL-AccessConfigListDCI-1-1-r16 ::=
    SEQUENCE (SIZE (1..16)) OF INTEGER (0..15)

-- TAG-PUCCH-CONFIG-STOP
-- ASN1STOP

```

<b>PUCCH-Config field descriptions</b>
<p><b><i>dl-DataToUL-ACK, dl-DataToUL-ACK-DCI-1-2</i></b> List of timing for given PDSCH to the DL ACK (see TS 38.213 [13], clause 9.1.2). The field <i>dl-DataToUL-ACK</i> applies to DCI format 1_1 and the field <i>dl-DataToUL-ACK-DCI-1-2</i> applies to DCI format 1_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 9.2.3). If <i>dl-DataToUL-ACK-r16</i> is signalled, UE shall ignore the <i>dl-DataToUL-ACK</i> (without suffix). The value -1 corresponds to "non-numerical value" for the case where the A/N feedback timing is not explicitly included at the time of scheduling PDSCH.</p>
<p><b><i>dmrs-UplinkTransformPrecodingPUCCH</i></b> This field is used for PUCCH formats 3 and 4 according to TS 38.211, Clause 6.4.1.3.3.1.</p>
<p><b><i>format1</i></b> Parameters that are common for all PUCCH resources of format 1.</p>
<p><b><i>format2</i></b> Parameters that are common for all PUCCH resources of format 2.</p>
<p><b><i>format3</i></b> Parameters that are common for all PUCCH resources of format 3.</p>
<p><b><i>format4.</i></b> Parameters that are common for all PUCCH resources of format 4</p>
<p><b><i>numberOfBitsForPUCCH- ResourceIndicatorDCI-1-2</i></b> Configuration of the number of bits for "PUCCH resource indicator" in DCI format 1_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 9.2.3).</p>
<p><b><i>resourceGroupToAddModList, resourceGroupToReleaseList</i></b> Lists for adding and releasing groups of PUCCH resources that can be updated simultaneously for spatial relations with a MAC CE</p>
<p><b><i>resourceSetToAddModList, resourceSetToReleaseList</i></b> Lists for adding and releasing PUCCH resource sets (see TS 38.213 [13], clause 9.2).</p>
<p><b><i>resourceToAddModList, resourceToAddModListExt, resourceToReleaseList</i></b> Lists for adding and releasing PUCCH resources applicable for the UL BWP and serving cell in which the <i>PUCCH-Config</i> is defined. The resources defined herein are referred to from other parts of the configuration to determine which resource the UE shall use for which report. If the network includes of <i>resourceToAddModListExt</i>, it includes the same number of entries, and listed in the same order, as in <i>resourceToAddModList</i>.</p>
<p><b><i>spatialRelationInfoToAddModList, spatialRelationInfoToAddModList2, spatialRelationInfoToAddModListExt</i></b> Configuration of the spatial relation between a reference RS and PUCCH. Reference RS can be SSB/CSI-RS/SRS. If the list has more than one element, MAC-CE selects a single element (see TS 38.321 [3], clause 5.18.8 and TS 38.213 [13], clause 9.2.2). The UE shall consider entries in <i>spatialRelationInfoToAddModList</i> and in <i>spatialRelationInfoToAddModList2</i> as a single list, i.e. an entry created using <i>spatialRelationInfoToAddModList</i> can be modified using <i>spatialRelationInfoToAddModList2</i> (or deleted using <i>spatialRelationInfoToReleaseList2</i>) and vice-versa. If the network includes <i>spatialRelationInfoToAddModListExt</i>, it includes the same number of entries, and listed in the same order, as in the concatenation of <i>spatialRelationInfoToAddModList</i> and of <i>spatialRelationInfoToAddModList2</i>.</p>
<p><b><i>sps-PUCCH-AN-List</i></b> Indicates a list of PUCCH resources for DL SPS HARQ ACK. The field <i>maxPayloadSize</i> is absent for the first and the last <i>SPS-PUCCH-AN</i> in the list. If configured, this overrides <i>n1PUCCH-AN</i> in <i>SPS-config</i>.</p>
<p><b><i>subslotLengthForPUCCH</i></b> Indicate the sub-slot length for sub-slot based PUCCH feedback in number of symbols (see TS 38.213 [13], clause 9). Value <i>n2</i> corresponds to 2 symbols, value <i>n6</i> corresponding to 6 symbols, value <i>n7</i> corresponds to 7 symbols. For normal CP, the value is either <i>n2</i> or <i>n7</i>. For extended CP, the value is either <i>n2</i> or <i>n6</i>.</p>
<p><b><i>ul-AccessConfigListDCI-1-1</i></b> List of the combinations of cyclic prefix extension and UL channel access type (See TS 38.212 [17], Clause 7.3.1).</p>

<b>PUCCH-format3 field descriptions</b>	
<b><i>nrofPRBs</i></b>	The supported values are 1,2,3,4,5,6,8,9,10,12,15 and 16. The UE shall ignore this field when <i>formatExt</i> is configured.
<b>PUCCH-FormatConfig field descriptions</b>	
<b><i>additionalDMRS</i></b>	If the field is present, the UE enables 2 DMRS symbols per hop of a PUCCH Format 3 or 4 if both hops are more than X symbols when FH is enabled (X=4). And it enables 4 DMRS symbols for a PUCCH Format 3 or 4 with more than 2X+1 symbols when FH is disabled (X=4). The field is not applicable for format 1 and 2. See TS 38.213 [13], clause 9.2.2.
<b><i>interslotFrequencyHopping</i></b>	If the field is present, the UE enables inter-slot frequency hopping when PUCCH Format 1, 3 or 4 is repeated over multiple slots. For long PUCCH over multiple slots, the intra and inter slot frequency hopping cannot be enabled at the same time for a UE. The field is not applicable for format 2. See TS 38.213 [13], clause 9.2.6.
<b><i>maxCodeRate</i></b>	Max coding rate to determine how to feedback UCI on PUCCH for format 2, 3 or 4. The field is not applicable for format 1. See TS 38.213 [13], clause 9.2.5.
<b><i>nrofSlots</i></b>	Number of slots with the same PUCCH F1, F3 or F4. When the field is absent the UE applies the value <i>n1</i> . The field is not applicable for format 2. See TS 38.213 [13], clause 9.2.6.
<b><i>pi2BPSK</i></b>	If the field is present, the UE uses pi/2 BPSK for UCI symbols instead of QPSK for PUCCH. The field is not applicable for format 1 and 2. See TS 38.213 [13], clause 9.2.5.
<b><i>rb-SetIndex</i></b>	Indicates the RB set where PUCCH resource is allocated.
<b><i>simultaneousHARQ-ACK-CSI</i></b>	If the field is present, the UE uses simultaneous transmission of CSI and HARQ-ACK feedback with or without SR with PUCCH Format 2, 3 or 4. See TS 38.213 [13], clause 9.2.5. When the field is absent the UE applies the value <i>off</i> . The field is not applicable for format 1.

<b>PUCCH-Resource, PUCCH-ResourceExt field descriptions</b>	
<b>format, formatExt</b>	Selection of the PUCCH format (format 0 – 4) and format-specific parameters, see TS 38.213 [13], clause 9.2. <i>format0</i> and <i>format1</i> are only allowed for a resource in a first PUCCH resource set. <i>format2</i> , <i>format3</i> and <i>format4</i> are only allowed for a resource in non-first PUCCH resource set. The network can only configure <i>formatExt</i> when format is set to <i>format2</i> or <i>format3</i> .
<b>interlace0</b>	This is the only interlace of interlaced PUCCH Format 0 and 1 and the first interlace for interlaced PUCCH Format 2 and 3.
<b>interlace1</b>	A second interlace, in addition to interlace 0, as specified in TS 38.213 [13], clause 9.2.1. For 15KHz SCS, values {0..9} are applicable; for 30KHz SCS, values {0..4} are applicable. For 15kHz SCS, the values of <i>interlace1</i> shall satisfy $interlace1 = \text{mod}(interlace0 + X, 10)$ where $X=1, -1, \text{ or } 5$ .
<b>intraSlotFrequencyHopping</b>	Enabling intra-slot frequency hopping, applicable for all types of PUCCH formats. For long PUCCH over multiple slots, the intra and inter slot frequency hopping cannot be enabled at the same time for a UE. See TS 38.213 [13], clause 9.2.1.
<b>occ-Index</b>	Indicates the orthogonal cover code index (see TS 38.213 [13], clause 9.2.1). This field is Applicable when <i>useInterlacePUCCH-Dedicated-r16</i> is configured.
<b>occ-Length</b>	Indicates the orthogonal cover code length (see TS 38.213 [13], clause 9.2.1). Applicable when <i>useInterlacePUCCH-Dedicated-r16</i> is configured.
<b>pucch-ResourceId</b>	Identifier of the PUCCH resource.
<b>secondHopPRB</b>	Index of first PRB after frequency hopping of PUCCH. This value is applicable for intra-slot frequency hopping (see TS 38.213 [13], clause 9.2.1) or inter-slot frequency hopping (see TS 38.213 [13], clause 9.2.6).

<b>PUCCH-ResourceSet field descriptions</b>	
<b>maxPayloadSize</b>	Maximum number of UCI information bits that the UE may transmit using this PUCCH resource set (see TS 38.213 [13], clause 9.2.1). In a PUCCH occurrence, the UE chooses the first of its <i>PUCCH-ResourceSet</i> which supports the number of bits that the UE wants to transmit. The field is absent in the first set (Set0) and in the last configured set since the UE derives the maximum number of UCI information bits as specified in TS 38.213 [13], clause 9.2.1. This field can take integer values that are multiples of 4.
<b>resourceList</b>	PUCCH resources of <i>format0</i> and <i>format1</i> are only allowed in the first PUCCH resource set, i.e., in a <i>PUCCH-ResourceSet</i> with <i>pucch-ResourceSetId</i> = 0. This set may contain between 1 and 32 resources. PUCCH resources of <i>format2</i> , <i>format3</i> and <i>format4</i> are only allowed in a <i>PUCCH-ResourceSet</i> with <i>pucch-ResourceSetId</i> > 0. If present, these sets contain between 1 and 8 resources each. The UE chooses a <i>PUCCH-Resource</i> from this list as specified in TS 38.213 [13], clause 9.2.3. Note that this list contains only a list of resource IDs. The actual resources are configured in <i>PUCCH-Config</i> .

Conditional Presence	Explanation
<i>PI2-BPSK</i>	The field is optionally present, Need R, if <i>format3</i> and/or <i>format4</i> are configured and <i>pi2BPSK</i> is configured in each of them. It is absent, Need R otherwise.

– **PUCCH-ConfigCommon**

The IE *PUCCH-ConfigCommon* is used to configure the cell specific PUCCH parameters.

**PUCCH-ConfigCommon** information element

```

-- ASN1START
-- TAG-PUCCH-CONFIGCOMMON-START

PUCCH-ConfigCommon ::=
    pucch-ResourceCommon          SEQUENCE {
        pucch-GroupHopping        INTEGER (0..15)                OPTIONAL, -- Cond InitialBWP-Only
        hoppingId                  ENUMERATED { neither, enable, disable },
        p0-nominal                 INTEGER (0..1023)                OPTIONAL, -- Need R
        ...
    }
-- TAG-PUCCH-CONFIGCOMMON-STOP
-- ASN1STOP

```

**PUCCH-ConfigCommon** field descriptions

<b>hoppingId</b>	Cell-specific scrambling ID for group hopping and sequence hopping if enabled, see TS 38.211 [16], clause 6.3.2.2.
<b>p0-nominal</b>	Power control parameter P0 for PUCCH transmissions. Value in dBm. Only even values (step size 2) allowed (see TS 38.213 [13], clause 7.2).
<b>pucch-GroupHopping</b>	Configuration of group- and sequence hopping for all the PUCCH formats 0, 1, 3 and 4. Value <i>neither</i> implies neither group or sequence hopping is enabled. Value <i>enable</i> enables group hopping and disables sequence hopping. Value <i>disable</i> disables group hopping and enables sequence hopping (see TS 38.211 [16], clause 6.3.2.2).
<b>pucch-ResourceCommon</b>	An entry into a 16-row table where each row configures a set of cell-specific PUCCH resources/parameters. The UE uses those PUCCH resources until it is provided with a dedicated <i>PUCCH-Config</i> (e.g. during initial access) on the initial uplink BWP. Once the network provides a dedicated <i>PUCCH-Config</i> for that bandwidth part the UE applies that one instead of the one provided in this field (see TS 38.213 [13], clause 9.2).

Conditional Presence	Explanation
<i>InitialBWP-Only</i>	The field is mandatory present in the <i>PUCCH-ConfigCommon</i> of the initial BWP (BWP#0) in SIB1. It is absent in other BWPs.

– **PUCCH-ConfigurationList**

The IE *PUCCH-ConfigurationList* is used to configure UE specific PUCCH parameters (per BWP) for two simultaneously constructed HARQ-ACK codebooks. See TS 38.213 [13], clause 9.1.

**PUCCH-ConfigurationList** information element

```

-- ASN1START
-- TAG-PUCCH-CONFIGURATIONLIST-START

PUCCH-ConfigurationList-r16 ::= SEQUENCE (SIZE (1..2)) OF PUCCH-Config
-- TAG-PUCCH-CONFIGURATIONLIST-STOP

```

```
-- ASN1STOP
```

## – *PUCCH-PathlossReferenceRS-Id*

The IE *PUCCH-PathlossReferenceRS-Id* is an ID for a reference signal (RS) configured as PUCCH pathloss reference (see TS 38.213 [13], clause 7.2).

### *PUCCH-PathlossReferenceRS-Id* information element

```
-- ASN1START
-- TAG-PUCCH-PATHLOSSREFERENCERS-ID-START

PUCCH-PathlossReferenceRS-Id ::=          INTEGER (0..maxNrofPUCCH-PathlossReferenceRSs-1)

PUCCH-PathlossReferenceRS-Id-v1610 ::=    INTEGER (maxNrofPUCCH-PathlossReferenceRSs..maxNrofPUCCH-PathlossReferenceRSs-1-r16)

-- TAG-PUCCH-PATHLOSSREFERENCERS-ID-STOP
-- ASN1STOP
```

## – *PUCCH-PowerControl*

The IE *PUCCH-PowerControl* is used to configure UE-specific parameters for the power control of PUCCH.

### *PUCCH-PowerControl* information element

```
-- ASN1START
-- TAG-PUCCH-POWERCONTROL-START
PUCCH-PowerControl ::=
SEQUENCE {
    deltaF-PUCCH-f0          INTEGER (-16..15)                OPTIONAL, -- Need R
    deltaF-PUCCH-f1          INTEGER (-16..15)                OPTIONAL, -- Need R
    deltaF-PUCCH-f2          INTEGER (-16..15)                OPTIONAL, -- Need R
    deltaF-PUCCH-f3          INTEGER (-16..15)                OPTIONAL, -- Need R
    deltaF-PUCCH-f4          INTEGER (-16..15)                OPTIONAL, -- Need R
    p0-Set                   SEQUENCE (SIZE (1..maxNrofPUCCH-P0-PerSet)) OF P0-PUCCH          OPTIONAL, -- Need M
    pathlossReferenceRSs     SEQUENCE (SIZE (1..maxNrofPUCCH-PathlossReferenceRSs)) OF PUCCH-PathlossReferenceRS          OPTIONAL, -- Need M
    twoPUCCH-PC-AdjustmentStates ENUMERATED {twoStates}          OPTIONAL, -- Need S
    ...,
    [[
    pathlossReferenceRSs-v1610 SetupRelease { PathlossReferenceRSs-v1610 }          OPTIONAL -- Need M
    ]]
}

P0-PUCCH ::=
SEQUENCE {
    p0-PUCCH-Id              P0-PUCCH-Id,
    p0-PUCCH-Value           INTEGER (-16..15)
}

P0-PUCCH-Id ::=
INTEGER (1..8)
```



```

PathlossReferenceRSs-v1610 ::=          SEQUENCE (SIZE (1..maxNrofPUCCH-PathlossReferenceRSsDiff-r16)) OF PUCCH-PathlossReferenceRS-r16

PUCCH-PathlossReferenceRS ::=          SEQUENCE {
  pucch-PathlossReferenceRS-Id
  referenceSignal
  ssb-Index
  csi-RS-Index
}

PUCCH-PathlossReferenceRS-r16 ::=      SEQUENCE {
  pucch-PathlossReferenceRS-Id-r16
  referenceSignal-r16
  ssb-Index-r16
  csi-RS-Index-r16
}

-- TAG-PUCCH-POWERCONTROL-STOP
-- ASN1STOP

```

<i>P0-PUCCH</i> field descriptions
------------------------------------

<b><i>p0-PUCCH-Value</i></b>
------------------------------

P0 value for PUCCH with 1dB step size.
--

<i>PUCCH-PowerControl</i> field descriptions
<b><i>deltaF-PUCCH-f0</i></b> deltaF for PUCCH format 0 with 1dB step size (see TS 38.213 [13], clause 7.2).
<b><i>deltaF-PUCCH-f1</i></b> deltaF for PUCCH format 1 with 1dB step size (see TS 38.213 [13], clause 7.2).
<b><i>deltaF-PUCCH-f2</i></b> deltaF for PUCCH format 2 with 1dB step size (see TS 38.213 [13], clause 7.2).
<b><i>deltaF-PUCCH-f3</i></b> deltaF for PUCCH format 3 with 1dB step size (see TS 38.213 [13], clause 7.2).
<b><i>deltaF-PUCCH-f4</i></b> deltaF for PUCCH format 4 with 1dB step size (see TS 38.213 [13], clause 7.2).
<b><i>p0-Set</i></b> A set with dedicated P0 values for PUCCH, i.e., {P01, P02,... } (see TS 38.213 [13], clause 7.2).
<b><i>pathlossReferenceRSs, pathlossReferenceRSs-v1610</i></b> A set of Reference Signals (e.g. a CSI-RS config or a SS block) to be used for PUCCH pathloss estimation. Up to <i>maxNrofPUCCH-PathlossReference-RSs</i> may be configured. If the field is not configured, the UE uses the SSB as reference signal (see TS 38.213 [13], clause 7.2). The set includes Reference Signals indicated in <i>pathlossReferenceRSs</i> (without suffix) and in <i>pathlossReferenceRSs-v1610</i> .
<b><i>twoPUCCH-PC-AdjustmentStates</i></b> Number of PUCCH power control adjustment states maintained by the UE (i.e., <i>g(i)</i> ). If the field is present ( <i>n2</i> ) the UE maintains two power control states (i.e., <i>g(i,0)</i> and <i>g(i,1)</i> ). If the field is absent, it maintains one power control state (i.e., <i>g(i,0)</i> ) (see TS 38.213 [13], clause 7.2).

## – *PUCCH-SpatialRelationInfo*

The IE *PUCCH-SpatialRelationInfo* is used to configure the spatial setting for PUCCH transmission and the parameters for PUCCH power control, see TS 38.213, [13], clause 9.2.2.

### *PUCCH-SpatialRelationInfo* information element

```

-- ASN1START
-- TAG-PUCCH-SPATIALRELATIONINFO-START

PUCCH-SpatialRelationInfo ::=
    pucch-SpatialRelationInfoId          SEQUENCE {
        servingCellId                    ServCellIndex                               OPTIONAL,  -- Need S
        referenceSignal                   CHOICE {
            ssb-Index                     SSB-Index,
            csi-RS-Index                   NZP-CSI-RS-ResourceId,
            srs                             PUCCH-SRS
        },
        pucch-PathlossReferenceRS-Id      PUCCH-PathlossReferenceRS-Id,
        p0-PUCCH-Id                       P0-PUCCH-Id,
        closedLoopIndex                   ENUMERATED { i0, i1 }
    }

PUCCH-SpatialRelationInfoExt-r16 ::=
    pucch-SpatialRelationInfoId-v1610    PUCCH-SpatialRelationInfoId-v1610        OPTIONAL,  -- Cond SetupOnly
    pucch-PathlossReferenceRS-Id-v1610    PUCCH-PathlossReferenceRS-Id-v1610        OPTIONAL,  --Need R

```

```

}
...
}
PUCCH-SRS ::= SEQUENCE {
    resource                SRS-ResourceId,
    uplinkBWP              BWP-Id
}
-- TAG-PUCCH-SPATIALRELATIONINFO-STOP
-- ASN1STOP

```

#### ***PUCCH-SpatialRelationInfo* field descriptions**

##### ***pucch-PathLossReferenceRS-Id***

When *pucch-PathLossReferenceRS-Id-v1610* is configured, the UE shall ignore *pucch-PathLossReferenceRS-Id* (without suffix).

##### ***pucch-SpatialRelationInfoId***

When *pucch-SpatialRelationInfoId-v1610* is configured, the UE shall ignore *pucch-SpatialRelationInfoId* (without suffix).

##### ***servicingCellId***

If the field is absent, the UE applies the *ServicingCellId* of the serving cell in which this *PUCCH-SpatialRelationInfo* is configured

Conditional Presence	Explanation
<i>SetupOnly</i>	This field is mandatory present upon creation of a <i>PUCCH-SpatialRelationInfo</i> . It is absent, Need M otherwise.

## – *PUCCH-SpatialRelationInfo-Id*

The IE *PUCCH-SpatialRelationInfo-Id* is used to identify a *PUCCH-SpatialRelationInfo*

#### ***PUCCH-SpatialRelationInfo-Id* information element**

```

-- ASN1START
-- TAG-PUCCH-SPATIALRELATIONINFO-START

PUCCH-SpatialRelationInfoId ::=          INTEGER (1..maxNrofSpatialRelationInfos)

PUCCH-SpatialRelationInfoId-r16 ::=     INTEGER (1..maxNrofSpatialRelationInfos-r16)

PUCCH-SpatialRelationInfoId-v1610 ::=   INTEGER (maxNrofSpatialRelationInfos-plus-1..maxNrofSpatialRelationInfos-r16)

-- TAG-PUCCH-SPATIALRELATIONINFO-STOP
-- ASN1STOP

```

## – *PUCCH-TPC-CommandConfig*

The IE *PUCCH-TPC-CommandConfig* is used to configure the UE for extracting TPC commands for PUCCH from a group-TPC messages on DCI.

**PUCCH-TPC-CommandConfig** information element

```

-- ASN1START
-- TAG-PUCCH-TPC-COMMANDCONFIG-START

PUCCH-TPC-CommandConfig ::=
    tpc-IndexPCell          SEQUENCE {
        INTEGER (1..15)     OPTIONAL, -- Cond PDCCH-OfSpCell
        tpc-IndexPUCCH-SCell INTEGER (1..15) OPTIONAL, -- Cond PDCCH-ofSpCellOrPUCCH-SCell
        ...
    }

-- TAG-PUCCH-TPC-COMMANDCONFIG-STOP
-- ASN1STOP

```

**PUCCH-TPC-CommandConfig** field descriptions**tpc-IndexPCell**

An index determining the position of the first bit of TPC command (applicable to the SpCell) inside the DCI format 2-2 payload.

**tpc-IndexPUCCH-SCell**

An index determining the position of the first bit of TPC command (applicable to the PUCCH SCell) inside the DCI format 2-2 payload.

Conditional Presence	Explanation
<i>PDCCH-OfSpCell</i>	The field is mandatory present if the <i>PUCCH-TPC-CommandConfig</i> is provided in the <i>PDCCH-Config</i> for the SpCell. Otherwise, the field is absent, Need R.
<i>PDCCH-ofSpCellOrPUCCH-SCell</i>	The field is mandatory present if the <i>PUCCH-TPC-CommandConfig</i> is provided in the <i>PDCCH-Config</i> for the PUCCH-SCell. The field is optionally present, need R, if the UE is configured with a PUCCH SCell in this cell group and if the <i>PUCCH-TPC-CommandConfig</i> is provided in the <i>PDCCH-Config</i> for the SpCell. Otherwise, the field is absent, Need R.

– **PUSCH-Config**

The IE *PUSCH-Config* is used to configure the UE specific PUSCH parameters applicable to a particular BWP.

**PUSCH-Config** information element

```

-- ASN1START
-- TAG-PUSCH-CONFIG-START

PUSCH-Config ::=
    dataScramblingIdentityPUSCH    INTEGER (0..1023)          OPTIONAL, -- Need S
    txConfig                       ENUMERATED {codebook, nonCodebook} OPTIONAL, -- Need S
    dmrs-UplinkForPUSCH-MappingTypeA SetupRelease { DMRS-UplinkConfig } OPTIONAL, -- Need M
    dmrs-UplinkForPUSCH-MappingTypeB SetupRelease { DMRS-UplinkConfig } OPTIONAL, -- Need M
    pusch-PowerControl             PUSCH-PowerControl          OPTIONAL, -- Need M
    frequencyHopping               ENUMERATED {intraSlot, interSlot} OPTIONAL, -- Need S
    frequencyHoppingOffsetLists    SEQUENCE (SIZE (1..4)) OF INTEGER (1.. maxNrofPhysicalResourceBlocks-1) OPTIONAL, -- Need M

```

```

resourceAllocation      ENUMERATED { resourceAllocationType0, resourceAllocationType1, dynamicSwitch},
pusch-TimeDomainAllocationList SetupRelease { PUSCH-TimeDomainResourceAllocationList }      OPTIONAL, -- Need M
pusch-AggregationFactor ENUMERATED { n2, n4, n8 }      OPTIONAL, -- Need S
mcs-Table               ENUMERATED {qam256, qam64LowSE}      OPTIONAL, -- Need S
mcs-TableTransformPrecoder ENUMERATED {qam256, qam64LowSE}      OPTIONAL, -- Need S
transformPrecoder       ENUMERATED {enabled, disabled}      OPTIONAL, -- Need S
codebookSubset          ENUMERATED {fullyAndPartialAndNonCoherent, partialAndNonCoherent, nonCoherent}
                                                                OPTIONAL, -- Cond codebookBased
maxRank                 INTEGER (1..4)      OPTIONAL, -- Cond codebookBased
rbg-Size                ENUMERATED { config2}      OPTIONAL, -- Need S
uci-OnPUSCH             SetupRelease { UCI-OnPUSCH}      OPTIONAL, -- Need M
tp-pi2BPSK              ENUMERATED {enabled}      OPTIONAL, -- Need S
...
[[
minimumSchedulingOffsetK2-r16 SetupRelease { MinSchedulingOffsetK2-Values-r16 }      OPTIONAL, -- Need M
ul-AccessConfigListDCI-0-1-r16 SetupRelease { UL-AccessConfigListDCI-0-1-r16 }      OPTIONAL, -- Need M
-- Start of the parameters for DCI format 0_2 introduced in V16.1.0
harq-ProcessNumberSizeDCI-0-2-r16 INTEGER (0..4)      OPTIONAL, -- Need R
dmrs-SequenceInitializationDCI-0-2-r16 ENUMERATED {enabled}      OPTIONAL, -- Need S
numberOfBitsForRV-DCI-0-2-r16 INTEGER (0..2)      OPTIONAL, -- Need R
antennaPortsFieldPresenceDCI-0-2-r16 ENUMERATED {enabled}      OPTIONAL, -- Need S
dmrs-UplinkForPUSCH-MappingTypeA-DCI-0-2-r16 SetupRelease { DMRS-UplinkConfig }      OPTIONAL, -- Need M
dmrs-UplinkForPUSCH-MappingTypeB-DCI-0-2-r16 SetupRelease { DMRS-UplinkConfig }      OPTIONAL, -- Need M
frequencyHoppingDCI-0-2-r16 CHOICE {
    pusch-RepTypeA      ENUMERATED {intraSlot, interSlot},
    pusch-RepTypeB      ENUMERATED {interRepetition, interSlot}
}
frequencyHoppingOffsetListsDCI-0-2-r16 SetupRelease { FrequencyHoppingOffsetListsDCI-0-2-r16}      OPTIONAL, -- Need M
codebookSubsetDCI-0-2-r16 ENUMERATED {fullyAndPartialAndNonCoherent, partialAndNonCoherent, nonCoherent}
                                                                OPTIONAL, -- Cond codebookBased
invalidSymbolPatternIndicatorDCI-0-2-r16 ENUMERATED {enabled}      OPTIONAL, -- Need S
maxRankDCI-0-2-r16 INTEGER (1..4)      OPTIONAL, -- Cond codebookBased
mcs-TableDCI-0-2-r16 ENUMERATED {qam256, qam64LowSE}      OPTIONAL, -- Need S
mcs-TableTransformPrecoderDCI-0-2-r16 ENUMERATED {qam256, qam64LowSE}      OPTIONAL, -- Need S
priorityIndicatorDCI-0-2-r16 ENUMERATED {enabled}      OPTIONAL, -- Need S
pusch-RepTypeIndicatorDCI-0-2-r16 ENUMERATED { pusch-RepTypeA, pusch-RepTypeB}      OPTIONAL, -- Need R
resourceAllocationDCI-0-2-r16 ENUMERATED { resourceAllocationType0, resourceAllocationType1, dynamicSwitch}
                                                                OPTIONAL, -- Need M
resourceAllocationType1GranularityDCI-0-2-r16 ENUMERATED { n2,n4,n8,n16 }      OPTIONAL, -- Need S
uci-OnPUSCH-ListDCI-0-2-r16 SetupRelease { UCI-OnPUSCH-ListDCI-0-2-r16}      OPTIONAL, -- Need M
pusch-TimeDomainAllocationListDCI-0-2-r16 SetupRelease { PUSCH-TimeDomainResourceAllocationList-r16 }
                                                                OPTIONAL, -- Need M
-- End of the parameters for DCI format 0_2 introduced in V16.1.0
-- Start of the parameters for DCI format 0_1 introduced in V16.1.0
pusch-TimeDomainAllocationListDCI-0-1-r16 SetupRelease { PUSCH-TimeDomainResourceAllocationList-r16 }
                                                                OPTIONAL, -- Need M
invalidSymbolPatternIndicatorDCI-0-1-r16 ENUMERATED {enabled}      OPTIONAL, -- Need S
priorityIndicatorDCI-0-1-r16 ENUMERATED {enabled}      OPTIONAL, -- Need S
pusch-RepTypeIndicatorDCI-0-1-r16 ENUMERATED { pusch-RepTypeA, pusch-RepTypeB}      OPTIONAL, -- Need R
frequencyHoppingDCI-0-1-r16 ENUMERATED {interRepetition, interSlot}      OPTIONAL, -- Cond RepTypeB
uci-OnPUSCH-ListDCI-0-1-r16 SetupRelease { UCI-OnPUSCH-ListDCI-0-1-r16 }      OPTIONAL, -- Need M
-- End of the parameters for DCI format 0_1 introduced in V16.1.0
invalidSymbolPattern-r16 InvalidSymbolPattern-r16      OPTIONAL, -- Need S
pusch-PowerControl-v1610 SetupRelease {PUSCH-PowerControl-v1610}      OPTIONAL, -- Need M

```

```

    ul-FullPowerTransmission-r16          ENUMERATED {fullpower, fullpowerMode1, fullpowerMode2}          OPTIONAL, -- Need R
    pusch-TimeDomainAllocationListForMultiPUSCH-r16 SetupRelease { PUSCH-TimeDomainResourceAllocationList-r16 }
    numberOfInvalidSymbolsForDL-UL-Switching-r16      INTEGER (1..4)                                OPTIONAL, -- Cond RepTypeB2
  ]]
}

UCI-OnPUSCH ::=
  betaOffsets
    dynamic
    semiStatic
  }
  scaling
    ENUMERATED { f0p5, f0p65, f0p8, f1 }
}

MinSchedulingOffsetK2-Values-r16 ::= SEQUENCE (SIZE (1..maxNrOfMinSchedulingOffsetValues-r16)) OF INTEGER (0..maxK2-SchedulingOffset-r16)

UCI-OnPUSCH-DCI-0-2-r16 ::=
  betaOffsetsDCI-0-2-r16
    dynamicDCI-0-2-r16
      oneBit-r16
      twoBits-r16
    },
    semiStaticDCI-0-2-r16      BetaOffsets
  }
  scalingDCI-0-2-r16          ENUMERATED { f0p5, f0p65, f0p8, f1 }
}

FrequencyHoppingOffsetListsDCI-0-2-r16 ::= SEQUENCE (SIZE (1..4)) OF INTEGER (1.. maxNrOfPhysicalResourceBlocks-1)

UCI-OnPUSCH-ListDCI-0-2-r16 ::= SEQUENCE (SIZE (1..2)) OF UCI-OnPUSCH-DCI-0-2-r16

UCI-OnPUSCH-ListDCI-0-1-r16 ::= SEQUENCE (SIZE (1..2)) OF UCI-OnPUSCH

UL-AccessConfigListDCI-0-1-r16 ::= SEQUENCE (SIZE (1..64)) OF INTEGER (0..63)

-- TAG-PUSCH-CONFIG-STOP
-- ASN1STOP

```

<b>PUSCH-Config field descriptions</b>
<p><b>antennaPortsFieldPresenceDCI-0-2</b> Configure the presence of "Antenna ports" field in DCI format 0_2. When the field is configured, then the "Antenna ports" field is present in DCI format 0_2. Otherwise, the field size is set to 0 for DCI format 0_2 (See TS 38.212 [17], clause 7.3.1.1.3). If neither <i>dmrs-UplinkForPUSCH-MappingTypeA-DCI-0-2</i> nor <i>dmrs-UplinkForPUSCH-MappingTypeB-DCI-0-2</i> is configured, this field is absent.</p>
<p><b>codebookSubset, codebookSubsetDCI-0-2</b> Subset of PMIs addressed by TPMI, where PMIs are those supported by UEs with maximum coherence capabilities (see TS 38.214 [19], clause 6.1.1.1). The field <i>codebookSubset</i> applies to DCI format 0_1 and the field <i>codebookSubsetDCI-0-2</i> applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.1.1).</p>
<p><b>dataScramblingIdentityPUSCH</b> Identifier used to initialize data scrambling (<i>c_init</i>) for PUSCH. If the field is absent, the UE applies the physical cell ID. (see TS 38.211 [16], clause 6.3.1.1).</p>
<p><b>dmrs-SequenceInitializationDCI-0-2</b> Configure whether the field "DMRS Sequence Initialization" is present or not in DCI format 0_2. If the field is absent, then 0 bit for the field "DMRS Sequence Initialization" in DCI format 0_2. If the field is present, then the number of bits is determined in the same way as DCI format 0_1 (see TS 38.212 [17], clause 7.3.1).</p>
<p><b>dmrs-UplinkForPUSCH-MappingTypeA, dmrs-UplinkForPUSCH-MappingTypeA-DCI-0-2</b> DMRS configuration for PUSCH transmissions using PUSCH mapping type A (chosen dynamically via <i>PUSCH-TimeDomainResourceAllocation</i>). Only the fields <i>dmrs-Type</i>, <i>dmrs-AdditionalPosition</i> and <i>maxLength</i> may be set differently for mapping type A and B. The field <i>dmrs-UplinkForPUSCH-MappingTypeA</i> applies to DCI format 0_1 and the field <i>dmrs-UplinkForPUSCH-MappingTypeA-DCI-0-2</i> applies to DCI format 0_2 (see TS 38.212 [17], clause 7.3.1).</p>
<p><b>dmrs-UplinkForPUSCH-MappingTypeB, dmrs-UplinkForPUSCH-MappingTypeB-DCI-0-2</b> DMRS configuration for PUSCH transmissions using PUSCH mapping type B (chosen dynamically via <i>PUSCH-TimeDomainResourceAllocation</i>). Only the fields <i>dmrs-Type</i>, <i>dmrs-AdditionalPosition</i> and <i>maxLength</i> may be set differently for mapping type A and B. The field <i>dmrs-UplinkForPUSCH-MappingTypeB</i> applies to DCI format 0_1 and the field <i>dmrs-UplinkForPUSCH-MappingTypeB-DCI-0-2</i> applies to DCI format 0_2 (see TS 38.212 [17], clause 7.3.1).</p>
<p><b>frequencyHopping</b> The value <i>intraSlot</i> enables 'Intra-slot frequency hopping' and the value <i>interSlot</i> enables 'Inter-slot frequency hopping'. If the field is absent, frequency hopping is not configured for 'pusch-RepTypeA' (see TS 38.214 [19], clause 6.3). The field <i>frequencyHopping</i> applies to DCI format 0_0 and 0_1 for 'pusch-RepTypeA'.</p>
<p><b>frequencyHoppingDCI-0-1</b> Indicates the frequency hopping scheme for DCI format 0_1 when <i>pusch-RepTypeIndicatorDCI-0-1</i> is set to 'pusch-RepTypeB'. The value <i>interRepetition</i> enables 'Inter-repetition frequency hopping', and the value <i>interSlot</i> enables 'Inter-slot frequency hopping'. If the field is absent, frequency hopping is not configured for DCI format 0_1 (see TS 38.214 [19], clause 6.1).</p>
<p><b>frequencyHoppingDCI-0-2</b> Indicate the frequency hopping scheme for DCI format 0_2. The value <i>intraSlot</i> enables 'intra-slot frequency hopping', and the value <i>interRepetition</i> enables 'Inter-repetition frequency hopping', and the value <i>interSlot</i> enables 'Inter-slot frequency hopping'. When <i>pusch-RepTypeIndicatorDCI-0-2</i> is set to 'pusch-RepTypeA', the frequency hopping scheme can be chosen between 'intra-slot frequency hopping' and 'inter-slot frequency hopping' if enabled. When <i>pusch-RepTypeIndicatorDCI-0-2</i> is set to 'pusch-RepTypeB', the frequency hopping scheme can be chosen between 'inter-repetition frequency hopping' and 'inter-slot frequency hopping' if enabled. If the field is absent, frequency hopping is not configured for DCI format 0_2 for 'pusch-RepTypeB' (see TS 38.214 [19], clause 6.3).</p>
<p><b>frequencyHoppingOffsetLists, frequencyHoppingOffsetListsDCI-0-2</b> Set of frequency hopping offsets used when frequency hopping is enabled for granted transmission (not msg3) and type 2 configured grant activation (see TS 38.214 [19], clause 6.3). The field <i>frequencyHoppingOffsetLists</i> applies to DCI format 0_0 and DCI format 0_1 and the field <i>frequencyHoppingOffsetListsDCI-0-2</i> applies to DCI format 0_2 (see TS 38.214 [19], clause 6.3).</p>
<p><b>harq-ProcessNumberSizeDCI-0-2</b> Configure the number of bits for the field "HARQ process number" in DCI format 0_2 (see TS 38.212 [17], clause 7.3.1).</p>
<p><b>invalidSymbolPattern</b> Indicates one pattern for invalid symbols for PUSCH transmission repetition type B applicable to both DCI format 0_1 and 0_2. If <i>InvalidSymbolPattern</i> is not configured, semi-static flexible symbols are used for PUSCH. Segmentation occurs only around semi-static DL symbols (see TS 38.214 [19] clause 6.1).</p>
<p><b>invalidSymbolPatternIndicatorDCI-0-1, invalidSymbolPatternIndicatorDCI-0-2</b> Indicates the presence of an additional bit in the DCI format 0_1/0_2. If <i>invalidSymbolPattern</i> is absent, then both <i>invalidSymbolPatternIndicatorDCI-0-1</i> and <i>invalidSymbolPatternIndicatorDCI-0-2</i> are absent. The field <i>invalidSymbolPatternIndicatorDCI-0-1</i> applies to the DCI format 0_1 and the field <i>invalidSymbolPatternIndicatorDCI-0-1</i> applies to DCI format 0_2 (see TS 38.214 [19] clause 6.1).</p>

<p><b>maxRank, maxRankDCI-0-2</b> Subset of PMIs addressed by TRIs from 1 to ULmaxRank (see TS 38.214 [19], clause 6.1.1.1). The field <i>maxRank</i> applies to DCI format 0_1 and the field <i>maxRankDCI-0-2</i> applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.1.1).</p>
<p><b>mcs-Table, mcs-TableFormat0-2</b> Indicates which MCS table the UE shall use for PUSCH without transform precoder (see TS 38.214 [19], clause 6.1.4.1). If the field is absent the UE applies the value 64QAM. The field <i>mcs-Table</i> applies to DCI format 0_0 and DCI format 0_1 and the field <i>mcs-TableDCI-0-2</i> applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.4.1).</p>
<p><b>mcs-TableTransformPrecoder, mcs-TableTransformPrecoderDCI-0-2</b> Indicates which MCS table the UE shall use for PUSCH with transform precoding (see TS 38.214 [19], clause 6.1.4.1) If the field is absent the UE applies the value 64QAM. The field <i>mcs-TableTransformPrecoder</i> applies to DCI format 0_0 and DCI format 0_1 and the field <i>mcs-TableTransformPrecoderDCI-0-2</i> applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.4.1).</p>
<p><b>minimumSchedulingOffsetK2</b> List of minimum K2 values. Minimum K2 parameter denotes minimum applicable value(s) for the <i>Time domain resource assignment</i> table for PUSCH (see TS 38.214 [19], clause 6.1.2.1).</p>
<p><b>numberOfBitsRV-DCI-0-2</b> Configures the number of bits for "Redundancy version" in the DCI format 0_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.214 [19], clause 6.1.2.1).</p>
<p><b>numberOfInvalidSymbolsForDL-UL-Switching</b> Indicates the number of symbols after the last semi-static DL symbol that are invalid symbols for PUSCH repetition Type B. If it is absent, no symbol is explicitly defined for DL-to-UL switching (see TS 38.214 [19], clause 6.1).</p>
<p><b>priorityIndicatorDCI-0-1, priorityIndicatorDCI-0-2</b> Configures the presence of "priority indicator" in DCI format 0_1/0_2. When the field is absent in the IE, then the UE shall apply 0 bit for "Priority indicator" in DCI format 0_1/0_2. The field <i>priorityIndicatorDCI-0-1</i> applies to DCI format 0_1 and the field <i>priorityIndicatorDCI-0-2</i> applies to DCI format 0_2 (see TS 38.212 [17] clause 7.3.1 and TS 38.213 [13] clause 9).</p>
<p><b>pusch-AggregationFactor</b> Number of repetitions for data (see TS 38.214 [19], clause 6.1.2.1). If the field is absent the UE applies the value 1.</p>
<p><b>pusch-RepTypeIndicatorDCI-0-1, pusch-RepTypeIndicatorDCI-0-2</b> Indicates whether UE follows the behavior for "PUSCH repetition type A" or the behavior for "PUSCH repetition type B" for the PUSCH scheduled by DCI format 0_1/0_2 and for Type 2 CG associated with the activating DCI format 0_1/0_2. The value <i>pusch-RepTypeA</i> enables the 'PUSCH repetition type A' and the value <i>pusch-RepTypeB</i> enables the 'PUSCH repetition type B'. The field <i>pusch-RepTypeIndicatorDCI-0-1</i> applies to DCI format 0_1 and the field <i>pusch-RepTypeIndicatorDCI-0-2</i> applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.2.1).</p>
<p><b>pusch-TimeDomainAllocationList</b> List of time domain allocations for timing of UL assignment to UL data (see TS 38.214 [19], table 6.1.2.1.1-1). The field <i>pusch-TimeDomainAllocationList</i> applies to DCI formats 0_0 or DCI format 0_1 when the field <i>pusch-TimeDomainAllocationListDCI-0-1</i> is not configured (see TS 38.214 [19], table 6.1.2.1.1-1 and table 6.1.2.1.1-1A). The network does not configure the <i>pusch-TimeDomainAllocation</i> (without suffix) simultaneously with the <i>pusch-TimeDomainAllocation-r16</i>.</p>
<p><b>pusch-TimeDomainAllocationListDCI-0-1</b> Configuration of the time domain resource allocation (TDRA) table for DCI format 0_1 (see TS 38.214 [19], clause 6.1, table 6.1.2.1.1-1A).</p>
<p><b>pusch-TimeDomainAllocationListDCI-0-2</b> Configuration of the time domain resource allocation (TDRA) table for DCI format 0_2 (see TS 38.214 [19], clause 6.1.2, table 6.1.2.1.1-1B).</p>
<p><b>pusch-TimeDomainAllocationListForMultiPUSCH</b> Configuration of the time domain resource allocation (TDRA) table for multiple PUSCH (see TS 38.214 [19], clause 6.1.2). The network configures at most 16 rows in this TDRA table in <i>PUSCH-TimeDomainResourceAllocationList-r16</i> configured by this field.</p>
<p><b>rbg-Size</b> Selection between configuration 1 and configuration 2 for RBG size for PUSCH. The UE does not apply this field if <i>resourceAllocation</i> is set to <i>resourceAllocationType1</i>. Otherwise, the UE applies the value <i>config1</i> when the field is absent (see TS 38.214 [19], clause 6.1.2.2.1).</p>
<p><b>resourceAllocation, resourceAllocationDCI-0-2</b> Configuration of resource allocation type 0 and resource allocation type 1 for non-fallback DCI (see TS 38.214 [19], clause 6.1.2). The field <i>resourceAllocation</i> applies to DCI format 0_1 and the field <i>resourceAllocationDCI-0-2</i> applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.2).</p>



<b>resourceAllocationType1GranularityDCI-0-2</b> Configures the scheduling granularity applicable for both the starting point and length indication for resource allocation type 1 in DCI format 0_2. If this field is absent, the granularity is 1 PRB (see TS 38.214 [19], clause 6.1.2.2.2).
<b>tp-pi2BPSK</b> Enables pi/2-BPSK modulation with transform precoding if the field is present and disables it otherwise.
<b>transformPrecoder</b> The UE specific selection of transformer precoder for PUSCH (see TS 38.214 [19], clause 6.1.3). When the field is absent the UE applies the value of the field <i>msg3-transformPrecoder</i> .
<b>txConfig</b> Whether UE uses codebook based or non-codebook based transmission (see TS 38.214 [19], clause 6.1.1). If the field is absent, the UE transmits PUSCH on one antenna port, see TS 38.214 [19], clause 6.1.1.
<b>uci-OnPUSCH-ListDCI-0-1, uci-OnPUSCH-ListDCI-0-2</b> Configuration for up to 2 HARQ-ACK codebooks specific to DCI format 0_1/0_2. The field uci-OnPUSCH-ListDCI-0-1 applies to DCI format 0_1 and the field uci-OnPUSCH-ListDCI-0-2 applies to DCI format 0_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13] clause 9.3).
<b>ul-AccessConfigListDCI-0-1</b> List of the combinations of cyclic prefix extension, channel access priority class (CAPC), and UL channel access type (see TS 38.212 [17], Table 7.3.1.1.2-35).
<b>ul-FullPowerTransmission</b> Configures the UE with UL full power transmission mode as specified in TS 38.213.

#### **UCI-OnPUSCH field descriptions**

<b>betaOffsets</b> Selection between and configuration of dynamic and semi-static beta-offset for DCI formats other than DCI format 0_2. If the field is not configured, the UE applies the value 'semiStatic' (see TS 38.213 [13], clause 9.3).
<b>scaling</b> Indicates a scaling factor to limit the number of resource elements assigned to UCI on PUSCH for DCI formats other than DCI format 0_2. Value <i>f0p5</i> corresponds to 0.5, value <i>f0p65</i> corresponds to 0.65, and so on. The value configured herein is applicable for PUSCH with configured grant (see TS 38.212 [17], clause 6.3).

#### **UCI-OnPUSCH-DCI-0-2 field descriptions**

<b>betaOffsetsDCI-0-2</b> Configuration of beta-offset for DCI format 0_2. If semiStaticDCI-0-2 is chosen, the UE shall apply the value of 0 bit for the field of beta offset indicator in DCI format 0_2. If dynamicDCI-0-2 is chosen, the UE shall apply the value of 1 bit or 2 bits for the field of beta offset indicator in DCI format 0_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13] clause 9.3).
<b>dynamicDCI-0-2</b> Indicates the UE applies the value 'dynamic' for DCI format 0_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 9.3).
<b>semiStaticDCI-0-2</b> Indicates the UE applies the value 'semiStatic' for DCI format 0_2. (see TS 38.212 [17], clause 7.3.1 and see TS 38.213 [13], clause 9.3).
<b>scalingDCI-0-2</b> Indicates a scaling factor to limit the number of resource elements assigned to UCI on PUSCH for DCI format 0_2. Value <i>f0p5</i> corresponds to 0.5, value <i>f0p65</i> corresponds to 0.65, and so on (see TS 38.212 [17], clause 6.3).

Conditional Presence	Explanation
<i>codebookBased</i>	The field is mandatory present if <i>txConfig</i> is set to codebook and absent otherwise.
<i>RepTypeB</i>	The field is optionally present, Need S, if <i>pusch-RepTypeIndicatorDCI-0-1</i> is set to pusch-RepTypeB. It is absent otherwise.
<i>RepTypeB2</i>	The field is optionally present, Need S, if <i>pusch-RepTypeIndicatorDCI-0-1</i> or <i>pusch-RepTypeIndicatorDCI-0-2</i> is set to pusch-RepTypeB. It is absent otherwise.

## – PUSCH-ConfigCommon

The IE *PUSCH-ConfigCommon* is used to configure the cell specific PUSCH parameters.

### *PUSCH-ConfigCommon* information element

```
-- ASN1START
-- TAG-PUSCH-CONFIGCOMMON-START

PUSCH-ConfigCommon ::=
    SEQUENCE {
        groupHoppingEnabledTransformPrecoding  ENUMERATED {enabled}           OPTIONAL, -- Need R
        pusch-TimeDomainAllocationList         PUSCH-TimeDomainResourceAllocationList OPTIONAL, -- Need R
        msg3-DeltaPreamble                     INTEGER (-1..6)                   OPTIONAL, -- Need R
        p0-NominalWithGrant                    INTEGER (-202..24)                OPTIONAL, -- Need R
        ...
    }

-- TAG-PUSCH-CONFIGCOMMON-STOP
-- ASN1STOP
```

<i>PUSCH-ConfigCommon</i> field descriptions
<b><i>groupHoppingEnabledTransformPrecoding</i></b> For DMRS transmission with transform precoder, the NW may configure group hopping by this cell-specific parameter, see TS 38.211 [16], clause 6.4.1.1.1.2.
<b><i>msg3-DeltaPreamble</i></b> Power offset between msg3 and RACH preamble transmission. Actual value = field value * 2 [dB] (see TS 38.213 [13], clause 7.1)
<b><i>p0-NominalWithGrant</i></b> P0 value for PUSCH with grant (except msg3). Value in dBm. Only even values (step size 2) allowed (see TS 38.213 [13], clause 7.1) This field is cell specific
<b><i>pusch-TimeDomainAllocationList</i></b> List of time domain allocations for timing of UL assignment to UL data (see TS 38.214 [19], table 6.1.2.1.1-1).

## – PUSCH-PowerControl

The IE *PUSCH-PowerControl* is used to configure UE specific power control parameter for PUSCH.

### *PUSCH-PowerControl* information element

```
-- ASN1START
-- TAG-PUSCH-POWERCONTROL-START
```

```

PUSCH-PowerControl ::= SEQUENCE {
    tpc-Accumulation          ENUMERATED { disabled }           OPTIONAL, -- Need S
    msg3-Alpha               Alpha                       OPTIONAL, -- Need S
    p0-NominalWithoutGrant   INTEGER (-202..24)           OPTIONAL, -- Need M
    p0-AlphaSets             SEQUENCE (SIZE (1..maxNrofP0-PUSCH-AlphaSets)) OF P0-PUSCH-AlphaSet OPTIONAL, -- Need M
    pathlossReferenceRSToAddModList SEQUENCE (SIZE (1..maxNrofPUSCH-PathlossReferenceRSs)) OF PUSCH-PathlossReferenceRS OPTIONAL, -- Need N
    pathlossReferenceRSToReleaseList SEQUENCE (SIZE (1..maxNrofPUSCH-PathlossReferenceRSs)) OF PUSCH-PathlossReferenceRS-Id OPTIONAL, -- Need N
    twoPUSCH-PC-AdjustmentStates ENUMERATED { twoStates }       OPTIONAL, -- Need S
    deltaMCS                 ENUMERATED { enabled }         OPTIONAL, -- Need S
    sri-PUSCH-MappingToAddModList SEQUENCE (SIZE (1..maxNrofSRI-PUSCH-Mappings)) OF SRI-PUSCH-PowerControl OPTIONAL, -- Need N
    sri-PUSCH-MappingToReleaseList SEQUENCE (SIZE (1..maxNrofSRI-PUSCH-Mappings)) OF SRI-PUSCH-PowerControlId OPTIONAL, -- Need N
}

P0-PUSCH-AlphaSet ::= SEQUENCE {
    p0-PUSCH-AlphaSetId     P0-PUSCH-AlphaSetId,
    p0                      INTEGER (-16..15)           OPTIONAL, -- Need S
    alpha                   Alpha                       OPTIONAL, -- Need S
}

P0-PUSCH-AlphaSetId ::= INTEGER (0..maxNrofP0-PUSCH-AlphaSets-1)

PUSCH-PathlossReferenceRS ::= SEQUENCE {
    pusch-PathlossReferenceRS-Id PUSCH-PathlossReferenceRS-Id,
    referenceSignal              CHOICE {
        ssb-Index                SSB-Index,
        csi-RS-Index              NZP-CSI-RS-ResourceId
    }
}

PUSCH-PathlossReferenceRS-r16 ::= SEQUENCE {
    pusch-PathlossReferenceRS-Id-r16 PUSCH-PathlossReferenceRS-Id-v1610,
    referenceSignal-r16              CHOICE {
        ssb-Index-r16             SSB-Index,
        csi-RS-Index-r16          NZP-CSI-RS-ResourceId
    }
}

PUSCH-PathlossReferenceRS-Id ::= INTEGER (0..maxNrofPUSCH-PathlossReferenceRSs-1)

PUSCH-PathlossReferenceRS-Id-v1610 ::= INTEGER (maxNrofPUSCH-PathlossReferenceRSs..maxNrofPUSCH-PathlossReferenceRSs-1-r16)

SRI-PUSCH-PowerControl ::= SEQUENCE {
    sri-PUSCH-PowerControlId       SRI-PUSCH-PowerControlId,
    sri-PUSCH-PathlossReferenceRS-Id PUSCH-PathlossReferenceRS-Id,
    sri-P0-PUSCH-AlphaSetId       P0-PUSCH-AlphaSetId,
    sri-PUSCH-ClosedLoopIndex     ENUMERATED { i0, i1 }
}

SRI-PUSCH-PowerControlId ::= INTEGER (0..maxNrofSRI-PUSCH-Mappings-1)

```

```

PUSCH-PowerControl-v1610 ::= SEQUENCE {
  pathlossReferenceRSToAddModList2-r16 SEQUENCE (SIZE (1..maxNrofPUSCH-PathlossReferenceRSsDiff-r16)) OF PUSCH-PathlossReferenceRS-r16
  pathlossReferenceRSToReleaseList2-r16 SEQUENCE (SIZE (1..maxNrofPUSCH-PathlossReferenceRSsDiff-r16)) OF PUSCH-PathlossReferenceRS-Id-v1610
  p0-PUSCH-SetList-r16 SEQUENCE (SIZE (1..maxNrofSRI-PUSCH-Mappings)) OF P0-PUSCH-Set-r16
  olpc-ParameterSet SEQUENCE {
    olpc-ParameterSetDCI-0-1-r16 INTEGER (1..2)
    olpc-ParameterSetDCI-0-2-r16 INTEGER (1..2)
  }
  ...
}

P0-PUSCH-Set-r16 ::= SEQUENCE {
  p0-PUSCH-SetId-r16 P0-PUSCH-SetId-r16,
  p0-List-r16 SEQUENCE (SIZE (1..maxNrofP0-PUSCH-Set-r16)) OF P0-PUSCH-r16
  ...
}

P0-PUSCH-SetId-r16 ::= INTEGER (0..maxNrofSRI-PUSCH-Mappings-1)

P0-PUSCH-r16 ::= INTEGER (-16..15)

-- TAG-PUSCH-POWERCONTROL-STOP
-- ASN1STOP

```

#### ***P0-PUSCH-AlphaSet* field descriptions**

##### ***alpha***

alpha value for PUSCH with grant (except msg3) (see TS 38.213 [13], clause 7.1). When the field is absent the UE applies the value 1.

##### ***p0***

P0 value for PUSCH with grant (except msg3) in steps of 1dB (see TS 38.213 [13], clause 7.1). When the field is absent the UE applies the value 0.

#### ***P0-PUSCH-Set* field descriptions**

##### ***p0-List***

Configuration of {p0-PUSCH, P0-PUSCH} sets for PUSCH. If SRI is present in the DCI, then one p0-PUSCH can be configured in P0-PUSCH-Set. If SRI is not present in the DCI, and both *olpc-ParameterSetDCI-0-1* and *olpc-ParameterSetDCI-0-2* are configured to be 1 bit, then one p0-PUSCH can be configured in P0-PUSCH-Set. If SRI is not present in the DCI, and if any of *olpc-ParameterSetDCI-0-1* and *olpc-ParameterSetDCI-0-2* is configured to be 2 bits, then two p0-PUSCH values can be configured in P0-PUSCH-Set (see TS 38.213 [13] clause 7 and TS 38.212 [17] clause 7.3.1).

##### ***p0-PUSCH-SetId***

Configure the index of a p0-PUSCH-Set (see TS 38.213 [13] clause 7 and TS 38.212 [17] clause 7.3.1).

<b>PUSCH-PowerControl field descriptions</b>	
<b>deltaMCS</b>	Indicates whether to apply delta MCS. When the field is absent, the UE applies $K_s = 0$ in $\text{delta\_TFC}$ formula for PUSCH (see TS 38.213 [13], clause 7.1).
<b>msg3-Alpha</b>	Dedicated alpha value for msg3 PUSCH (see TS 38.213 [13], clause 7.1). When the field is absent the UE applies the value 1.
<b>olpc-ParameterSetDCI-0-1, olpc-ParameterSetDCI-0-2</b>	Configures the number of bits for Open-loop power control parameter set indication for DCI format 0_1/0_2 in case SRI is not configured in the DCI. 2 bits is applicable only if SRI is not present in the DCI format 0_1. The field <i>olpc-ParameterSetDCI-0-1</i> applies to DCI format 0_1 and the field <i>olpc-ParameterSetDCI-0-2</i> applies to DCI format 0_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 11).
<b>p0-AlphaSets</b>	configuration {p0-pusch, alpha} sets for PUSCH (except msg3), i.e., { {p0,alpha,index1}, {p0,alpha,index2},...} (see TS 38.213 [13], clause 7.1). When no set is configured, the UE uses the P0-nominal for msg3 PUSCH, P0-UE is set to 0 and alpha is set according to msg3-Alpha configured for msg3 PUSCH.
<b>p0-NominalWithoutGrant</b>	P0 value for UL grant-free/SPS based PUSCH. Value in dBm. Only even values (step size 2) allowed (see TS 38.213 [13], clause 7.1).
<b>p0-PUSCH-SetList</b>	Configure one additional <i>P0-PUSCH-Set</i> per SRI. If present, the one bit or 2 bits in the DCI is used to dynamically indicate among the P0 value from the existing <i>P0-PUSCH-AlphaSet</i> and the P0 value(s) from the <i>P0-PUSCH-Set</i> (See TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 17).
<b>pathlossReferenceRSToAddModList, pathlossReferenceRSToAddModList2</b>	A set of Reference Signals (e.g. a CSI-RS config or a SS block) to be used for PUSCH path loss estimation. The set consists of Reference Signals configured using <i>pathLossReferenceRSToAddModList</i> and Reference Signals configured using <i>pathlossReferenceRSToAddModList2</i> . Up to <i>maxNrofPUSCH-PathlossReferenceRSs</i> may be configured (see TS 38.213 [13], clause 7.1).
<b>sri-PUSCH-MappingToAddModList</b>	A list of <i>SRI-PUSCH-PowerControl</i> elements among which one is selected by the SRI field in DCI (see TS 38.213 [13], clause 7.1).
<b>tpc-Accumulation</b>	If enabled, UE applies TPC commands via accumulation. If not enabled, UE applies the TPC command without accumulation. If the field is absent, TPC accumulation is enabled (see TS 38.213 [13], clause 7.1).
<b>twoPUSCH-PC-AdjustmentStates</b>	Number of PUSCH power control adjustment states maintained by the UE (i.e., $fc(i)$ ). If the field is present ( $n2$ ) the UE maintains two power control states (i.e., $fc(i,0)$ and $fc(i,1)$ ). If the field is absent, it maintains one power control state (i.e., $fc(i,0)$ ) (see TS 38.213 [13], clause 7.1).

<b>SRI-PUSCH-PowerControl field descriptions</b>	
<b>sri-P0-PUSCH-AlphaSetId</b>	The ID of a <i>P0-PUSCH-AlphaSet</i> as configured in <i>p0-AlphaSets</i> in <i>PUSCH-PowerControl</i> .
<b>sri-PUSCH-ClosedLoopIndex</b>	The index of the closed power control loop associated with this <i>SRI-PUSCH-PowerControl</i> .
<b>sri-PUSCH-PathlossReferenceRS-Id</b>	The ID of <i>PUSCH-PathlossReferenceRS</i> as configured in the <i>pathlossReferenceRSToAddModList</i> in <i>PUSCH-PowerControl</i> .
<b>sri-PUSCH-PowerControlId</b>	The ID of this <i>SRI-PUSCH-PowerControl</i> configuration. It is used as the codepoint (payload) in the SRI DCI field.

– **PUSCH-ServingCellConfig**

The IE *PUSCH-ServingCellConfig* is used to configure UE specific PUSCH parameters that are common across the UE's BWPs of one serving cell.

**PUSCH-ServingCellConfig** information element

```

-- ASN1START
-- TAG-PUSCH-SERVINGCELLCONFIG-START

PUSCH-ServingCellConfig ::=
    SEQUENCE {
        codeBlockGroupTransmission          SetupRelease { PUSCH-CodeBlockGroupTransmission }    OPTIONAL,  -- Need M
        rateMatching                        ENUMERATED {limitedBufferRM}                OPTIONAL,  -- Need S
        xOverhead                            ENUMERATED {xoh6, xoh12, xoh18}                OPTIONAL,  -- Need S
        ...
        [[
            maxMIMO-Layers                   INTEGER (1..4)                               OPTIONAL,  -- Need M
            processingType2Enabled           BOOLEAN                                       OPTIONAL,  -- Need M
        ]],
        [[
            maxMIMO-LayersDCI-0-2-r16       SetupRelease { MaxMIMO-LayersDCI-0-2-r16}    OPTIONAL,  -- Need M
        ]]
    }

PUSCH-CodeBlockGroupTransmission ::=
    SEQUENCE {
        maxCodeBlockGroupsPerTransportBlock ENUMERATED {n2, n4, n6, n8},
        ...
    }

MaxMIMO-LayersDCI-0-2-r16 ::=
    INTEGER (1..4)

-- TAG-PUSCH-SERVINGCELLCONFIG-STOP
-- ASN1STOP

```

**PUSCH-CodeBlockGroupTransmission** field descriptions**maxCodeBlockGroupsPerTransportBlock**

Maximum number of code-block-groups (CBGs) per TB (see TS 38.213 [13], clause 9.1).

<i>PUSCH-ServingCellConfig</i> field descriptions
<b><i>codeBlockGroupTransmission</i></b> Enables and configures code-block-group (CBG) based transmission (see TS 38.214 [19], clause 5.1.5).
<b><i>maxMIMO-Layers</i></b> Indicates the maximum MIMO layer to be used for PUSCH in all BWPs of the normal UL of this serving cell (see TS 38.212 [17], clause 5.4.2.1). If present, the network sets <i>maxRank</i> to the same value. For SUL, the maximum number of MIMO layers is always 1, and network does not configure this field. The field <i>maxMIMO-Layers</i> refers to DCI format 0_1.
<b><i>processingType2Enabled</i></b> Enables configuration of advanced processing time capability 2 for PUSCH (see 38.214 [19], clause 6.4).
<b><i>rateMatching</i></b> Enables LBRM (Limited buffer rate-matching). When the field is absent the UE applies FBRM (Full buffer rate-matchingLBRM) (see TS 38.212 [17], clause 5.4.2).
<b><i>xOverhead</i></b> If the field is absent, the UE applies the value 'xoh0' (see TS 38.214 [19], clause 5.1.3.2).
<b><i>maxMIMO-LayersDCI-0-2</i></b> Indicates the maximum MIMO layer to be used for PUSCH for DCI format 0_2 in all BWPs of the normal UL of this serving cell (see TS 38.212 [17], clause 5.4.2.1). If present, the network sets <i>maxRankDCI-0-2</i> to the same value. For SUL, the maximum number of MIMO layers is always 1, and network does not configure this field.

## – *PUSCH-TimeDomainResourceAllocationList*

The IE *PUSCH-TimeDomainResourceAllocation* is used to configure a time domain relation between PDCCH and PUSCH. *PUSCH-TimeDomainResourceAllocationList* contains one or more of such *PUSCH-TimeDomainResourceAllocations*. The network indicates in the UL grant which of the configured time domain allocations the UE shall apply for that UL grant. The UE determines the bit width of the DCI field based on the number of entries in the *PUSCH-TimeDomainResourceAllocationList*. Value 0 in the DCI field refers to the first element in this list, value 1 in the DCI field refers to the second element in this list, and so on.

### *PUSCH-TimeDomainResourceAllocation* information element

```
-- ASN1START
-- TAG-PUSCH-TIMEDOMAINRESOURCEALLOCATIONLIST-START

PUSCH-TimeDomainResourceAllocationList ::= SEQUENCE (SIZE(1..maxNrofUL-Allocations)) OF PUSCH-TimeDomainResourceAllocation

PUSCH-TimeDomainResourceAllocation ::= SEQUENCE {
    k2                                INTEGER(0..32)                                OPTIONAL,    -- Need S
    mappingType                       ENUMERATED {typeA, typeB},
    startSymbolAndLength              INTEGER (0..127)
}

PUSCH-TimeDomainResourceAllocationList-r16 ::= SEQUENCE (SIZE(1..maxNrofUL-Allocations-r16)) OF PUSCH-TimeDomainResourceAllocation-r16

PUSCH-TimeDomainResourceAllocation-r16 ::= SEQUENCE {
    k2-r16                            INTEGER(0..32)                                OPTIONAL,    -- Need S
    pusChAllocationList-r16           SEQUENCE (SIZE(1..maxNrofMultiplePUSCHs-r16)) OF PUSCH-Allocation-r16,
    ...
}

PUSCH-Allocation-r16 ::= SEQUENCE {
    mappingType-r16                   ENUMERATED {typeA, typeB}                                OPTIONAL,    -- Cond NotFormat01-02-Or-TypeA
```

```

startSymbolAndLength-r16          INTEGER (0..127)          OPTIONAL, -- Cond NotFormat01-02-Or-TypeA
startSymbol-r16                   INTEGER (0..13)           OPTIONAL, -- Cond RepTypeB
length-r16                         INTEGER (1..14)           OPTIONAL, -- Cond RepTypeB
numberOfRepetitions-r16           ENUMERATED {n1, n2, n3, n4, n7, n8, n12, n16} OPTIONAL, -- Cond Format01-02
...
}

-- TAG-PUSCH-TIMEDOMAINRESOURCEALLOCATIONLIST-STOP
-- ASN1STOP

```

<b>PUSCH-TimeDomainResourceAllocationList field descriptions</b>	
<b>k2</b>	Corresponds to L1 parameter 'K2' (see TS 38.214 [19], clause 6.1.2.1) When the field is absent the UE applies the value 1 when PUSCH SCS is 15/30 kHz; the value 2 when PUSCH SCS is 60 kHz, and the value 3 when PUSCH SCS is 120KHz.
<b>length</b>	Indicates the length allocated for PUSCH for DCI format 0_1/0_2 (see TS 38.214 [19], clause 6.1.2.1).
<b>mappingType</b>	Mapping type (see TS 38.214 [19], clause 6.1.2.1).
<b>numberOfRepetitions</b>	Number of repetitions for DCI format 0_1/0_2 (see TS 38.214 [19], clause 6.1.2.1).
<b>puschAllocationList</b>	One or multiple PUSCH continuous in time domain which share a common k2 (see TS 38.214 [19], clause 6.1.2.1). This list only has one element in <i>pusch-TimeDomainAllocationListDCI-0-1-r16</i> and in <i>pusch-TimeDomainAllocationListDCI-0-2-r16</i> .
<b>startSymbol</b>	Indicates the index of start symbol for PUSCH for DCI format 0_1/0_2 (see TS 38.214 [19], clause 6.1.2.1).
<b>startSymbolAndLength</b>	An index giving valid combinations of start symbol and length (jointly encoded) as start and length indicator (SLIV). The network configures the field so that the allocation does not cross the slot boundary. (see TS 38.214 [19], clause 6.1.2.1).

<b>Conditional Presence</b>	<b>Explanation</b>
<i>Format01-02</i>	In <i>pusch-TimeDomainAllocationListForMultiPUSCH-r16</i> , the field is absent. In <i>pusch-TimeDomainAllocationListDCI-0-1</i> and in <i>pusch-TimeDomainAllocationListDCI-0-2</i> , the field is mandatory present.
<i>NotFormat01-02-Or-TypeA</i>	In <i>pusch-TimeDomainAllocationListForMultiPUSCH-r16</i> , the field is mandatory present. In <i>pusch-TimeDomainAllocationListDCI-0-1</i> , the field is optionally present if <i>pusch-RepTypeIndicatorDCI-0-1</i> is set to <i>pusch-RepTypeA</i> , Need R. It is absent otherwise, Need R. In <i>pusch-TimeDomainAllocationListDCI-0-2</i> , the field is optionally present if <i>pusch-RepTypeIndicatorDCI-0-2</i> is set to <i>pusch-RepTypeA</i> , Need R. It is absent otherwise, Need R.
<i>RepTypeB</i>	In <i>pusch-TimeDomainAllocationListForMultiPUSCH-r16</i> , the field is absent. In <i>pusch-TimeDomainAllocationListDCI-0-1</i> , the field is optionally present if <i>pusch-RepTypeIndicatorDCI-0-1</i> is set to <i>pusch-RepTypeB</i> , Need R. It is absent otherwise, Need R. In <i>pusch-TimeDomainAllocationListDCI-0-2</i> , the field is optionally present if <i>pusch-RepTypeIndicatorDCI-0-2</i> is set to <i>pusch-RepTypeB</i> , Need R. It is absent otherwise, Need R.



– **PUSCH-TPC-CommandConfig**

The IE *PUSCH-TPC-CommandConfig* is used to configure the UE for extracting TPC commands for PUSCH from a group-TPC messages on DCI.

**PUSCH-TPC-CommandConfig information element**

```
-- ASN1START
-- TAG-PUSCH-TPC-COMMANDCONFIG-START

PUSCH-TPC-CommandConfig ::=          SEQUENCE {
    tpc-Index                INTEGER (1..15)          OPTIONAL,  -- Cond SUL
    tpc-IndexSUL              INTEGER (1..15)          OPTIONAL,  -- Cond SUL-Only
    targetCell                ServCellIndex           OPTIONAL,  -- Need S
    ...
}

-- TAG-PUSCH-TPC-COMMANDCONFIG-STOP
-- ASN1STOP
```

**PUSCH-TPC-CommandConfig field descriptions**

<b>targetCell</b>	The serving cell to which the acquired power control commands are applicable. If the value is absent, the UE applies the TPC commands to the serving cell on which the command has been received.
<b>tpc-Index</b>	An index determining the position of the first bit of TPC command inside the DCI format 2-2 payload.
<b>tpc-IndexSUL</b>	An index determining the position of the first bit of TPC command inside the DCI format 2-2 payload.

Conditional Presence	Explanation
<i>SUL-Only</i>	The field is optionally present, Need R, if this serving cell is configured with a supplementary uplink (SUL). It is absent otherwise.
<i>SUL</i>	The field is optionally present, Need R, if this serving cell is configured with a supplementary uplink (SUL). It is mandatory present otherwise.

– **Q-OffsetRange**

The IE *Q-OffsetRange* is used to indicate a cell, beam or measurement object specific offset to be applied when evaluating candidates for cell re-selection or when evaluating triggering conditions for measurement reporting. The value is in dB. Value *dB-24* corresponds to -24 dB, *dB-22* corresponds to -22 dB and so on.

**Q-OffsetRange information element**

```
-- ASN1START
-- TAG-Q-OFFSETRANGE-START
```

```

Q-OffsetRange ::=
    ENUMERATED {
        dB-24, dB-22, dB-20, dB-18, dB-16, dB-14,
        dB-12, dB-10, dB-8, dB-6, dB-5, dB-4, dB-3,
        dB-2, dB-1, dB0, dB1, dB2, dB3, dB4, dB5,
        dB6, dB8, dB10, dB12, dB14, dB16, dB18,
        dB20, dB22, dB24}

-- TAG-Q-OFFSETRANGE-STOP
-- ASN1STOP

```

### – *Q-QualMin*

The IE *Q-QualMin* is used to indicate for cell selection/ re-selection the required minimum received RSRQ level in the (NR) cell. Corresponds to parameter  $Q_{\text{qualmin}}$  in TS 38.304 [20]. Actual value  $Q_{\text{qualmin}} = \text{field value [dB]}$ .

#### **Q-QualMin information element**

```

-- ASN1START
-- TAG-Q-QUALMIN-START

Q-QualMin ::=
    INTEGER (-43..-12)

-- TAG-Q-QUALMIN-STOP
-- ASN1STOP

```

### – *Q-RxLevMin*

The IE *Q-RxLevMin* is used to indicate for cell selection/ re-selection the required minimum received RSRP level in the (NR) cell. Corresponds to parameter  $Q_{\text{rxlevmin}}$  in TS 38.304 [20]. Actual value  $Q_{\text{rxlevmin}} = \text{field value} * 2 \text{ [dBm]}$ .

#### **Q-RxLevMin information element**

```

-- ASN1START
-- TAG-Q-RXLEVMIN-START

Q-RxLevMin ::=
    INTEGER (-70..-22)

-- TAG-Q-RXLEVMIN-STOP
-- ASN1STOP

```

### – *QuantityConfig*

The IE *QuantityConfig* specifies the measurement quantities and layer 3 filtering coefficients for NR and inter-RAT measurements.

## QuantityConfig information element

```

-- ASN1START
-- TAG-QUANTITYCONFIG-START

QuantityConfig ::=
    quantityConfigNR-List
    ...
    [[
    quantityConfigEUTRA
    ]],
    [[
    quantityConfigUTRA-FDD-r16
    quantityConfigCLI-r16
    ]]
}

QuantityConfigNR ::=
    quantityConfigCell
    quantityConfigRS-Index
}

QuantityConfigRS ::=
    ssb-FilterConfig
    csi-RS-FilterConfig
}

FilterConfig ::=
    filterCoefficientRSRP
    filterCoefficientRSRQ
    filterCoefficientRS-SINR
}

FilterConfigCLI-r16 ::=
    filterCoefficientSRS-RSRP-r16
    filterCoefficientCLI-RSSI-r16
}

QuantityConfigUTRA-FDD-r16 ::=
    filterCoefficientRSCP-r16
    filterCoefficientEcNO-r16
}

-- TAG-QUANTITYCONFIG-STOP
-- ASN1STOP

```

SEQUENCE {			
SEQUENCE (SIZE (1..maxNrofQuantityConfig)) OF QuantityConfigNR	OPTIONAL,	--	Need M
FilterConfig	OPTIONAL	--	Need M
QuantityConfigUTRA-FDD-r16	OPTIONAL,	--	Need M
FilterConfigCLI-r16	OPTIONAL	--	Need M
SEQUENCE {			
QuantityConfigRS,			
QuantityConfigRS	OPTIONAL	--	Need M
SEQUENCE {			
FilterConfig,			
FilterConfig			
SEQUENCE {			
FilterCoefficient	DEFAULT	fc4,	
FilterCoefficient	DEFAULT	fc4,	
FilterCoefficient	DEFAULT	fc4	
SEQUENCE {			
FilterCoefficient	DEFAULT	fc4,	
FilterCoefficient	DEFAULT	fc4	
SEQUENCE {			
FilterCoefficient	DEFAULT	fc4,	
FilterCoefficient	DEFAULT	fc4	

<b>QuantityConfigNR field descriptions</b>
<b>quantityConfigCell</b> Specifies L3 filter configurations for cell measurement results for the configurable RS Types (e.g. SS/PBCH block and CSI-RS) and the configurable measurement quantities (e.g. RSRP, RSRQ and SINR).
<b>quantityConfigRS-Index</b> Specifies L3 filter configurations for measurement results per RS index for the configurable RS Types (e.g. SS/PBCH block and CSI-RS) and the configurable measurement quantities (e.g. RSRP, RSRQ and SINR).

<b>QuantityConfigRS field descriptions</b>
<b>csi-RS-FilterConfig</b> CSI-RS based L3 filter configurations: Specifies L3 filter configurations for CSI-RSRP, CSI-RSRQ and CSI-SINR measurement results from the L1 filter(s), as defined in TS 38.215 [9].
<b>ssb-FilterConfig</b> SS Block based L3 filter configurations: Specifies L3 filter configurations for SS-RSRP, SS-RSRQ and SS-SINR measurement results from the L1 filter(s), as defined in TS 38.215 [9].

<b>QuantityConfigUTRA-FDD field descriptions</b>
<b>filterCoefficientRSCP</b> Specifies L3 filter coefficient for FDD UTRAN CPICH_RSCP measurement results from L1 filter.
<b>filterCoefficientEcN0</b> Specifies L3 filter coefficient for FDD UTRAN CPICH_EcN0 measurement results from L1 filter.

## – RACH-ConfigCommon

The IE *RACH-ConfigCommon* is used to specify the cell specific random-access parameters.

### **RACH-ConfigCommon information element**

```
-- ASN1START
-- TAG-RACH-CONFIGCOMMON-START

RACH-ConfigCommon ::=
    SEQUENCE {
        rach-ConfigGeneric          RACH-ConfigGeneric,
        totalNumberOfRA-Preambles  INTEGER (1..63)                                OPTIONAL, -- Need S
        ssb-perRACH-OccasionAndCB-PreamblesPerSSB CHOICE {
            oneEighth                ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},
            oneFourth                ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},
            oneHalf                  ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},
            one                      ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},
            two                      ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32},
            four                    INTEGER (1..16),
            eight                   INTEGER (1..8),
            sixteen                  INTEGER (1..4)
        }
    }
    OPTIONAL, -- Need M
```

```

groupBconfigured
  ra-Msg3SizeGroupA
  messagePowerOffsetGroupB
  numberOfRA-PreamblesGroupA
}
ra-ContentionResolutionTimer
rsrp-ThresholdSSB
rsrp-ThresholdSSB-SUL
prach-RootSequenceIndex
  1839
  1139
},
msg1-SubcarrierSpacing
restrictedSetConfig
msg3-transformPrecoder
...
[[
ra-PrioritizationForAccessIdentity-r16
  ra-Prioritization-r16
  ra-PrioritizationForAI-r16
}
prach-RootSequenceIndex-r16
  1571
  11151
} OPTIONAL -- Need R
]]
}

-- TAG-RACH-CONFIGCOMMON-STOP
-- ASN1STOP

```

```

SEQUENCE {
  ENUMERATED {b56, b144, b208, b256, b282, b480, b640,
              b800, b1000, b72, spare6, spare5, spare4, spare3, spare2, spare1},
  ENUMERATED {minusinfinity, dB0, dB5, dB8, dB10, dB12, dB15, dB18},
  INTEGER (1..64)
} OPTIONAL, -- Need R

ENUMERATED { sf8, sf16, sf24, sf32, sf40, sf48, sf56, sf64},
RSRP-Range
RSRP-Range
CHOICE {
  INTEGER (0..837),
  INTEGER (0..137)
}

SubcarrierSpacing
ENUMERATED {unrestrictedSet, restrictedSetTypeA, restrictedSetTypeB},
ENUMERATED {enabled}
OPTIONAL, -- Cond L139
OPTIONAL, -- Need R
OPTIONAL, -- Cond SUL

SEQUENCE {
  RA-Prioritization,
  BIT STRING (SIZE (2))
} OPTIONAL, -- Cond InitialBWP-Only

CHOICE {
  INTEGER (0..569),
  INTEGER (0..1149)
}

```

<b>RACH-ConfigCommon field descriptions</b>
<p><b>messagePowerOffsetGroupB</b> Threshold for preamble selection. Value is in dB. Value <i>minusinfinity</i> corresponds to <math>-\infty</math>. Value <i>dB0</i> corresponds to 0 dB, <i>dB5</i> corresponds to 5 dB and so on. (see TS 38.321 [3], clause 5.1.2)</p>
<p><b>msg1-SubcarrierSpacing</b> Subcarrier spacing of PRACH (see TS 38.211 [16], clause 5.3.2). Only the values 15 or 30 kHz (FR1), and 60 or 120 kHz (FR2) are applicable. If absent, the UE applies the SCS as derived from the <i>prach-ConfigurationIndex</i> in <i>RACH-ConfigGeneric</i> (see tables Table 6.3.3.1-1 and Table 6.3.3.2-2, TS 38.211 [16]). The value also applies to contention free random access (<i>RACH-ConfigDedicated</i>), to SI-request and to contention-based beam failure recovery (CB-BFR). But it does not apply for contention free beam failure recovery (CF-BFR) (see <i>BeamFailureRecoveryConfig</i>).</p>
<p><b>msg3-transformPrecoder</b> Enables the transform precoder for Msg3 transmission according to clause 6.1.3 of TS 38.214 [19]. If the field is absent, the UE disables the transformer precoder (see TS 38.213 [13], clause 8.3).</p>
<p><b>numberOfRA-PreamblesGroupA</b> The number of CB preambles per SSB in group A. This determines implicitly the number of CB preambles per SSB available in group B. (see TS 38.321 [3], clause 5.1.1). The setting should be consistent with the setting of <i>ssb-perRACH-OccasionAndCB-PreamblesPerSSB</i>.</p>
<p><b>prach-RootSequenceIndex</b> PRACH root sequence index (see TS 38.211 [16], clause 6.3.3.1). The value range depends on whether <math>L=839</math> or <math>L=139</math> or <math>L=571</math> or <math>L=1151</math>. The length of the root sequence corresponding with the index indicated in this IE should be consistent with the one indicated in <i>prach-ConfigurationIndex</i> in the <i>RACH-ConfigDedicated</i> (if configured). If <i>prach-RootSequenceIndex-r16</i> is signalled, UE shall ignore the <i>prach-RootSequenceIndex</i> (without suffix).</p>
<p><b>ra-ContentionResolutionTimer</b> The initial value for the contention resolution timer (see TS 38.321 [3], clause 5.1.5). Value <i>sf8</i> corresponds to 8 subframes, value <i>sf16</i> corresponds to 16 subframes, and so on.</p>
<p><b>ra-Msg3SizeGroupA</b> Transport Blocks size threshold in bits below which the UE shall use a contention-based RA preamble of group A. (see TS 38.321 [3], clause 5.1.2).</p>
<p><b>ra-PrioritizationForAI</b> Indicates whether the field <i>ra-Prioritization-r16</i> applies for Access Identities. The first/leftmost bit corresponds to Access Identity 1, the next bit corresponds to Access Identity 2. Value 1 indicates that the field <i>ra-Prioritization-r16</i> applies otherwise the field does not apply (see TS 23.501 [32]).</p>
<p><b>ra-Prioritization</b> Parameters which apply for prioritized random access procedure on any UL BWP of SpCell for specific Access Identities (see TS 38.321 [3], clause 5.1.1a).</p>
<p><b>rach-ConfigGeneric</b> RACH parameters for both regular random access and beam failure recovery.</p>
<p><b>restrictedSetConfig</b> Configuration of an unrestricted set or one of two types of restricted sets, see TS 38.211 [16], clause 6.3.3.1.</p>
<p><b>rsrp-ThresholdSSB</b> UE may select the SS block and corresponding PRACH resource for path-loss estimation and (re)transmission based on SS blocks that satisfy the threshold (see TS 38.213 [13]).</p>
<p><b>rsrp-ThresholdSSB-SUL</b> The UE selects SUL carrier to perform random access based on this threshold (see TS 38.321 [3], clause 5.1.1). The value applies to all the BWPs.</p>
<p><b>ssb-perRACH-OccasionAndCB-PreamblesPerSSB</b> The meaning of this field is twofold: the CHOICE conveys the information about the number of SSBs per RACH occasion. Value <i>oneEighth</i> corresponds to one SSB associated with 8 RACH occasions, value <i>oneFourth</i> corresponds to one SSB associated with 4 RACH occasions, and so on. The ENUMERATED part indicates the number of Contention Based preambles per SSB. Value <i>n4</i> corresponds to 4 Contention Based preambles per SSB, value <i>n8</i> corresponds to 8 Contention Based preambles per SSB, and so on. The total number of CB preambles in a RACH occasion is given by <math>CB\text{-preambles-per-SSB} * \max(1, SSB\text{-per-rach-occasion})</math>. See TS 38.213 [13].</p>
<p><b>totalNumberOfRA-Preambles</b> Total number of preambles used for contention based and contention free 4-step or 2-step random access in the RACH resources defined in <i>RACH-ConfigCommon</i>, excluding preambles used for other purposes (e.g. for SI request). If the field is absent, all 64 preambles are available for RA. The setting should be consistent with the setting of <i>ssb-perRACH-OccasionAndCB-PreamblesPerSSB</i>, i.e. it should be a multiple of the number of SSBs per RACH occasion.</p>

Conditional Presence	Explanation
L139	The field is mandatory present if <i>prach-RootSequenceIndex</i> L=139, otherwise the field is absent, Need S.
SUL	The field is mandatory present in <i>initialUplinkBWP</i> in <i>supplementaryUplink</i> ; otherwise, the field is absent.
InitialBWP-Only	This field is optionally present, Need R, if this BWP is the initial BWP of SpCell. Otherwise the field is absent.

## – RACH-ConfigCommonTwoStepRA

The IE *RACH-ConfigCommonTwoStepRA* is used to specify cell specific 2-step random-access type parameters.

### RACH-ConfigCommonTwoStepRA information element

```

-- ASN1START
-- TAG-RACH-CONFIGCOMMONTWOSTEPRA-START

RACH-ConfigCommonTwoStepRA-r16 ::=
    rach-ConfigGenericTwoStepRA-r16
    msgA-TotalNumberOfRA-Preambles-r16
    msgA-SSB-PerRACH-OccasionAndCB-PreamblesPerSSB-r16
        oneEighth
        oneFourth
        oneHalf
        one
        two
        four
        eight
        sixteen
    }
    msgA-CB-PreamblesPerSSB-PerSharedRO-r16
    msgA-SSB-SharedRO-MaskIndex-r16
    groupB-ConfiguredTwoStepRA-r16
    msgA-PRACH-RootSequenceIndex-r16
        1839
        1139
        1571
        11151
    }
    msgA-TransMax-r16
    msgA-RSRP-Threshold-r16
2Step4Step
    msgA-RSRP-ThresholdSSB-r16
    msgA-SubcarrierSpacing-r16
2StepOnlyL139
    msgA-RestrictedSetConfig-r16
    ra-PrioritizationForAccessIdentityTwoStep-r16
        ra-Prioritization-r16
        ra-PrioritizationForAI-r16

```

```

SEQUENCE {
    RACH-ConfigGenericTwoStepRA-r16,
    INTEGER (1..63) OPTIONAL, -- Need S
    CHOICE {
        ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},
        ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},
        ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},
        ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},
        ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32},
        INTEGER (1..16),
        INTEGER (1..8),
        INTEGER (1..4)
    } OPTIONAL, -- Cond 2StepOnly
    INTEGER (1..60) OPTIONAL, -- Cond SharedRO
    INTEGER (1..15) OPTIONAL, -- Need S
    GroupB-ConfiguredTwoStepRA-r16 OPTIONAL, -- Need S
    CHOICE {
        INTEGER (0..837),
        INTEGER (0..137),
        INTEGER (0..569),
        INTEGER (0..1149)
    } OPTIONAL, -- Cond 2StepOnly
    ENUMERATED {n1, n2, n4, n6, n8, n10, n20, n50, n100, n200} OPTIONAL, -- Need R
    RSRP-Range OPTIONAL, -- Cond
    RSRP-Range OPTIONAL, -- Need R
    SubcarrierSpacing OPTIONAL, -- Cond
    ENUMERATED {unrestrictedSet, restrictedSetTypeA, restrictedSetTypeB} OPTIONAL, -- Cond 2StepOnly
    SEQUENCE {
        RA-Prioritization,
        BIT STRING (SIZE (2))
    }

```

```
    }
InitialBWP-Only
  ra-ContentionResolutionTimer-r16      ENUMERATED {sf8, sf16, sf24, sf32, sf40, sf48, sf56, sf64}
  ...
}

GroupB-ConfiguredTwoStepRA-r16 ::=
  ra-MsgA-SizeGroupA
  messagePowerOffsetGroupB
  numberOfRA-PreamblesGroupA
}

-- TAG-RACH-CONFIGCOMMONTWOSTEPRA-STOP
-- ASN1STOP
```

OPTIONAL, -- Cond

OPTIONAL, -- Cond 2StepOnly

SEQUENCE {

ENUMERATED {b56, b144, b208, b256, b282, b480, b640, b800,  
b1000, b72, spare6, spare5, spare4, spare3, spare2, spare1},

ENUMERATED {minusinfinity, dB0, dB5, dB8, dB10, dB12, dB15, dB18},

INTEGER (1..64)



<b><i>RACH-ConfigCommonTwoStepRA</i> field descriptions</b>
<p><b><i>groupB-ConfiguredTwoStepRA</i></b> Preamble grouping for 2-step random access type. If the field is absent then there is only one preamble group configured and only one msgA PUSCH configuration.</p>
<p><b><i>msgA-CB-PreamblesPerSSB-PerSharedRO</i></b> Number of contention-based preambles used for 2-step RA type from the non-CBRA 4-step type preambles associated with each SSB for RO shared with 4-step type RA. The number of preambles for 2-step RA type shall not exceed the number of preambles per SSB minus the number of contention-based preambles per SSB for 4-step type RA. The possible value range for this parameter needs to be aligned with value range for the configured SSBs per RACH occasion in <i>SSB-perRACH-OccasionAndCB-PreamblesPerSSB</i> in <i>RACH-ConfigCommon</i>. The field is only applicable for the case of shared ROs with 4-step type random access.</p>
<p><b><i>msgA-PRACH-RootSequenceIndex</i></b> PRACH root sequence index. If the field is not configured, the UE applies the value in field <i>prach-RootSequenceIndex</i> in <i>RACH-ConfigCommon</i> in the configured BWP. When both 2-step and 4-step type random access is configured, this field is only configured for the case of separate ROs between 2-step and 4-step type random access.</p>
<p><b><i>msgA-RestrictedSetConfig</i></b> Configuration of an unrestricted set or one of two types of restricted sets for 2-step random access type preamble. If the field is not configured, the UE applies the value in field <i>restrictedSetConfig</i> in <i>RACH-ConfigCommon</i> in the configured BWP. When both 2-step and 4-step type random access is configured, this field is only configured for the case of separate ROs between 2-step and 4-step type random access.</p>
<p><b><i>msgA-RSRP-Threshold</i></b> The UE selects 2-step random access type to perform random access based on this threshold (see TS 38.321 [3], clause 5.1.1). This field is only present if both 2-step and 4-step RA type are configured for the BWP.</p>
<p><b><i>msgA-RSRP-ThresholdSSB</i></b> UE may select the SS block and corresponding PRACH resource for path-loss estimation and (re)transmission based on SS blocks that satisfy the threshold (see TS 38.213 [13]).</p>
<p><b><i>msgA-SSB-PerRACH-OccasionAndCB-PreamblesPerSSB</i></b> The meaning of this field is twofold: the CHOICE conveys the information about the number of SSBs per RACH occasion. Value <i>oneEight</i> corresponds to one SSB associated with 8 RACH occasions, value <i>oneFourth</i> corresponds to one SSB associated with 4 RACH occasions, and so on. The ENUMERATED part indicates the number of Contention Based preambles per SSB. Value <i>n4</i> corresponds to 4 Contention Based preambles per SSB, value <i>n8</i> corresponds to 8 Contention Based preambles per SSB, and so on. The total number of CB preambles in a RACH occasion is given by <math>CB-preambles-per-SSB * \max(1, SSB-per-rach-occasion)</math>. If the field is not configured and both 2-step and 4-step are configured for the BWP, the UE applies the value in the field <i>ssb-perRACH-OccasionAndCB-PreamblesPerSSB</i> in <i>RACH-ConfigCommon</i>. The field is not present when RACH occasions are shared between 2-step and 4-step type random access in the BWP.</p>
<p><b><i>msgA-SSB-SharedRO-MaskIndex</i></b> Indicates the subset of 4-step type ROs shared with 2-step random access type for each SSB. This field is configured when there is more than one RO per SSB. If the field is absent, and 4-step and 2-step has shared ROs, then all ROs are shared.</p>
<p><b><i>msgA-SubcarrierSpacing</i></b> Subcarrier spacing of PRACH (see TS 38.211 [16], clause 5.3.2). Only the values 15 or 30 kHz (FR1), and 60 or 120 kHz (FR2) are applicable. The field is only present in case of 2-step only BWP, otherwise the UE applies the SCS as derived from the <i>msg1-SubcarrierSpacing</i> in <i>RACH-ConfigCommon</i>. The value also applies to contention free 2-step random access type (<i>RACH-ConfigDedicated</i>).</p>
<p><b><i>msgA-TotalNumberOfRA-Preambles</i></b> Indicates the total number of preambles used for contention-based and contention-free 2-step random access type when ROs for 2-step are not shared with 4-step. If the field is absent, and 2-step and 4-step does not have shared ROs, all 64 preambles are available for 2-step random access type.</p>
<p><b><i>msgA-TransMax</i></b> Max number of MsgA preamble transmissions performed before switching to 4-step random access (see TS 38.321 [3], clauses 5.1.1). This field is only applicable when 2-step and 4-step RA type are configured and switching to 4-step type RA is supported. If the field is absent, switching from 2-step RA type to 4-step RA type is not allowed.</p>
<p><b><i>ra-PrioritizationForAI</i></b> Indicates whether the field <i>ra-Prioritization-r16</i> applies for Access Identities. The first/leftmost bit corresponds to Access Identity 1, the next bit corresponds to Access Identity 2. Value 1 indicates that the field <i>ra-Prioritization-r16</i> applies, otherwise the field does not apply.</p>

<b><i>ra-ContentionResolutionTimer</i></b> The initial value for the contention resolution timer for fallback RAR in case no 4-step random access type is configured (see TS 38.321 [3], clause 5.1.5). Value <i>sf8</i> corresponds to 8 subframes, value <i>sf16</i> corresponds to 16 subframes, and so on. If both 2-step and 4-step random access type resources are configured on the BWP, then this field is absent.
<b><i>ra-Prioritization</i></b> Parameters which apply for prioritized random access procedure on any UL BWP of SpCell for specific Access Identities (see TS 38.321 [3], clause 5.1.1a).
<b><i>rach-ConfigGenericTwoStepRA</i></b> 2-step random access type parameters for both regular random access and beam failure recovery.

<b><i>GroupB-ConfiguredTwoStepRA</i></b> field descriptions
<b><i>messagePowerOffsetGroupB</i></b> Threshold for preamble selection. Value is in dB. Value <i>minusinfinity</i> corresponds to $-\infty$ . Value <i>dB0</i> corresponds to 0 dB, <i>dB5</i> corresponds to 5 dB and so on. (see TS 38.321 [3], clause 5.1.1).
<b><i>numberOfRA-PreamblesGroupA</i></b> The number of CB preambles per SSB in group A for idle/inactive or connected mode. The setting of the number of preambles for each group should be consistent with <i>ssb-perRACH-OccasionAndCB-PreamblesPerSSB-TwoStepRA</i> or <i>msgA-CB-PreamblesPerSSB</i> if configured.
<b><i>ra-MsgA-SizeGroupA</i></b> Transport block size threshold in bits below which the UE shall use a contention-based RA preamble of group A. (see TS 38.321 [3], clause 5.1.1).

Conditional Presence	Explanation
<i>2StepOnlyL139</i>	The field is mandatory present if <i>prach-RootSequenceIndex</i> L=139 and no 4-step random access type is configured, otherwise the field is absent, Need S.
<i>2StepOnly</i>	The field is mandatory present if there are no 4-step random access configurations configured in the BWP, i.e only 2-step random access type configured in the BWP, otherwise the field is Need S.
<i>SharedRO</i>	The field is mandatory present if the 2-step random access type occasions are shared with 4-step random access type, otherwise the field is not present.
<i>2Step4Step</i>	The field is mandatory present if both 2-step random access type and 4-step random access type are configured in the BWP, otherwise the field is not present.
<i>InitialBWP-Only</i>	This field is optionally present, Need R, if this BWP is the initial BWP of SpCell. Otherwise the field is absent.

## – *RACH-ConfigDedicated*

The IE *RACH-ConfigDedicated* is used to specify the dedicated random access parameters.

### ***RACH-ConfigDedicated*** information element

```
-- ASN1START
-- TAG-RACH-CONFIGDEDICATED-START
```

```
RACH-ConfigDedicated ::= SEQUENCE {
    cfra                CFRA                                OPTIONAL, -- Need S
    ra-Prioritization   RA-Prioritization                  OPTIONAL, -- Need N
    ...
}
```

```

[[
ra-PrioritizationTwoStep-r16    RA-Prioritization                OPTIONAL, -- Need N
cfra-TwoStep-r16                CFRA-TwoStep-r16          OPTIONAL, -- Need S
]]
}

CFRA ::=
    SEQUENCE {
    occasions                      SEQUENCE {
        rach-ConfigGeneric          RACH-ConfigGeneric,
        ssb-perRACH-Occasion        ENUMERATED {oneEighth, oneFourth, oneHalf, one, two, four, eight, sixteen}
    }
    resources                      CHOICE {
        ssb                        SEQUENCE {
            ssb-ResourceList        SEQUENCE (SIZE(1..maxRA-SSB-Resources)) OF CFRA-SSB-Resource,
            ra-ssb-OccasionMaskIndex INTEGER (0..15)
        },
        csirs                      SEQUENCE {
            csirs-ResourceList      SEQUENCE (SIZE(1..maxRA-CSIRS-Resources)) OF CFRA-CSIRS-Resource,
            rsrp-ThresholdCSI-RS    RSRP-Range
        }
    },
    ...,
    [[
totalNumberOfRA-Preambles    INTEGER (1..63)                OPTIONAL -- Cond Occasions
]]
}

CFRA-TwoStep-r16 ::=
    SEQUENCE {
    occasionsTwoStepRA-r16        SEQUENCE {
        rach-ConfigGenericTwoStepRA-r16 RACH-ConfigGenericTwoStepRA-r16,
        ssb-PerRACH-OccasionTwoStepRA-r16 ENUMERATED {oneEighth, oneFourth, oneHalf, one, two, four, eight, sixteen}
    }
    msgA-CFRA-PUSCH-r16          MsgA-PUSCH-Resource-r16,
    msgA-TransMax-r16            ENUMERATED {n1, n2, n4, n6, n8, n10, n20, n50, n100, n200}
    resourcesTwoStep-r16        SEQUENCE {
        ssb-ResourceList            SEQUENCE (SIZE(1..maxRA-SSB-Resources)) OF CFRA-SSB-Resource,
        ra-ssb-OccasionMaskIndex    INTEGER (0..15)
    },
    ...
}

CFRA-SSB-Resource ::=
    SEQUENCE {
    ssb                            SSB-Index,
    ra-PreambleIndex              INTEGER (0..63),
    ...,
    [[
msgA-PUSCH-resource-Index-r16    INTEGER (0..3071)    OPTIONAL -- Cond 2StepCFRA
]]
}

CFRA-CSIRS-Resource ::=
    SEQUENCE {

```

```

csi-RS                CSI-RS-Index,
ra-OccasionList      SEQUENCE (SIZE(1..maxRA-OccasionsPerCSIRS)) OF INTEGER (0..maxRA-Occasions-1),
ra-PreambleIndex     INTEGER (0..63),
...
}
-- TAG-RACH-CONFIGDEDICATED-STOP
-- ASN1STOP

```

#### **CFRA-CSIRS-Resource field descriptions**

**csi-RS**

The ID of a CSI-RS resource defined in the measurement object associated with this serving cell.

**ra-OccasionList**

RA occasions that the UE shall use when performing CF-RA upon selecting the candidate beam identified by this CSI-RS. The network ensures that the RA occasion indexes provided herein are also configured by prach-ConfigurationIndex and msg1-FDM. Each RACH occasion is sequentially numbered, first, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions; second, in increasing order of time resource indexes for time multiplexed PRACH occasions within a PRACH slot and Third, in increasing order of indexes for PRACH slots.

**ra-PreambleIndex**

The RA preamble index to use in the RA occasions associated with this CSI-RS.

#### **CFRA field descriptions**

**occasions**

RA occasions for contention free random access. If the field is absent, the UE uses the RA occasions configured in *RACH-ConfigCommon* in the first active UL BWP.

**ra-ssb-OccasionMaskIndex**

Explicitly signalled PRACH Mask Index for RA Resource selection in TS 38.321 [3]. The mask is valid for all SSB resources signalled in *ssb-ResourceList*.

**rach-ConfigGeneric**

Configuration of contention free random access occasions for CFRA. The UE shall ignore *preambleReceivedTargetPower*, *preambleTransMax*, *powerRampingStep*, *ra-ResponseWindow* signaled within this field and use the corresponding values provided in *RACH-ConfigCommon*.

**ssb-perRACH-Occasion**

Number of SSBs per RACH occasion.

**totalNumberOfRA-Preambles**

Total number of preambles used for contention free random access in the RACH resources defined in CFRA, excluding preambles used for other purposes (e.g. for SI request). If the field is absent but the field *occasions* is present, the UE may assume all the 64 preambles are for RA. The setting should be consistent with the setting of *ssb-perRACH-Occasion*, if present, i.e. it should be a multiple of the number of SSBs per RACH occasion.

<b>CFRA-SSB-Resource field descriptions</b>
<p><b>msgA-PUSCH-resource-Index</b> Identifies the index of the PUSCH resource used for MSGA CFRA. The PUSCH resource index indicates a valid PUSCH occasion (as specified in TS 38.213 [13], subclause 8.1A) and the associated DMRS resources corresponding to a PRACH slot. The PUSCH resource indexes are sequentially numbered and are mapped to valid PUSCH occasions corresponding to a PRACH slot which are ordered, first, in increasing order of frequency resource indexes for frequency multiplexed PUSCH occasions; second, in increasing order of DMRS resource indexes within a PUSCH occasion, where a DMRS resource index <math>DMRS_{id}</math> is determined first in an ascending order of a DMRS port index and then in an ascending order of a DMRS sequence index, third in increasing order of time resource indexes for time multiplexed PUSCH occasions within a PUSCH slot and fourth, in increasing order of indexes for PUSCH slots. For the case of contention free 2-step random access type, if this field is absent, the UE shall use the value 0.</p>
<p><b>ra-PreambleIndex</b> The preamble index that the UE shall use when performing CF-RA upon selecting the candidate beams identified by this SSB.</p>
<p><b>ssb</b> The ID of an SSB transmitted by this serving cell.</p>

<b>CFRA-TwoStep field descriptions</b>
<p><b>msgA-CFRA-PUSCH</b> PUSCH resource configuration(s) for msgA CFRA.</p>
<p><b>msgA-TransMax</b> Max number of MsgA preamble transmissions performed before switching to 4-step type random access (see TS 38.321 [3], clauses 5.1.1). This field is only applicable when 2-step and 4-step RA type are configured and switching to 4-step type RA is supported. If the field is absent in <i>RACH-ConfigDedicated</i>, switching from 2-step RA type to 4-step RA type is not allowed.</p>
<p><b>occasionsTwoStepRA</b> RA occasions for contention free random access. If the field is absent, the UE uses the RA occasions configured in <i>RACH-ConfigCommonTwoStepRA</i> in the first active UL BWP.</p>
<p><b>ra-SSB-OccasionMaskIndex</b> Explicitly signalled PRACH Mask Index for RA Resource selection in TS 38.321 [3]. The mask is valid for all SSB resources signalled in <i>ssb-ResourceList</i>.</p>
<p><b>rach-ConfigGenericTwoStepRA</b> Configuration of contention free random access occasions for CFRA 2-step random access type.</p>
<p><b>ssb-PerRACH-OccasionTwoStep</b> Number of SSBs per RACH occasion for 2-step random access type.</p>

<b>RACH-ConfigDedicated field descriptions</b>
<p><b>cfra</b> Parameters for contention free random access to a given target cell. If this field and <i>cfra-TwoStep</i> are absent, the UE performs contention based random access.</p>
<p><b>cfra-TwoStep</b> Parameters for contention free 2-step random access type to a given target cell. Network ensures that <i>cfra</i> and <i>cfra-TwoStep</i> are not configured at the same time. If this field and <i>cfra</i> are absent, the UE performs contention based random access. This field may only be present if <i>msgA-ConfigCommon</i> is configured on the BWP.</p>
<p><b>ra-prioritization</b> Parameters which apply for prioritized random access procedure to a given target cell (see TS 38.321 [3], clause 5.1.1).</p>
<p><b>ra-PrioritizationTwoStep</b> Parameters which apply for prioritized 2-step random access type procedure to a given target cell (see TS 38.321 [3], clause 5.1.1).</p>

Conditional Presence	Explanation
<i>Mandatory</i>	The field is mandatory present.
<i>Occasions</i>	The field is optionally present, Need S, if the field <i>occasions</i> is present, otherwise it is absent.
<i>2StepCFRA</i>	The field is optionally present for the case of 2-step RA type contention free random access, Need S, otherwise it is absent.

## – RACH-ConfigGeneric

The IE *RACH-ConfigGeneric* is used to specify the random-access parameters both for regular random access as well as for beam failure recovery.

### RACH-ConfigGeneric information element

```

-- ASN1START
-- TAG-RACH-CONFIGGENERIC-START

RACH-ConfigGeneric ::=
    SEQUENCE {
        prach-ConfigurationIndex          INTEGER (0..255),
        msg1-FDM                          ENUMERATED {one, two, four, eight},
        msg1-FrequencyStart                INTEGER (0..maxNrofPhysicalResourceBlocks-1),
        zeroCorrelationZoneConfig          INTEGER(0..15),
        preambleReceivedTargetPower        INTEGER (-202..-60),
        preambleTransMax                   ENUMERATED {n3, n4, n5, n6, n7, n8, n10, n20, n50, n100, n200},
        powerRampingStep                   ENUMERATED {dB0, dB2, dB4, dB6},
        ra-ResponseWindow                  ENUMERATED {s11, s12, s14, s18, s110, s120, s140, s180},
        . . . ,
        [[
        prach-ConfigurationPeriodScaling-IAB-r16    ENUMERATED {scf1,scf2,scf4,scf8,scf16,scf32,scf64}          OPTIONAL, -- Need R
        prach-ConfigurationFrameOffset-IAB-r16     INTEGER (0..63)                                     OPTIONAL, -- Need R
        prach-ConfigurationSOffset-IAB-r16         INTEGER (0..39)                                    OPTIONAL, -- Need R
        ra-ResponseWindow-v1610                    ENUMERATED { s160, s1160}                          OPTIONAL, -- Need R
        prach-ConfigurationIndex-v1610             INTEGER (256..262)                                  OPTIONAL, -- Need R
        ]]
    }

-- TAG-RACH-CONFIGGENERIC-STOP
-- ASN1STOP

```

<b>RACH-ConfigGeneric field descriptions</b>
<b>msg1-FDM</b> The number of PRACH transmission occasions FDMed in one time instance. (see TS 38.211 [16], clause 6.3.3.2).
<b>msg1-FrequencyStart</b> Offset of lowest PRACH transmission occasion in frequency domain with respect to PRB 0. The value is configured so that the corresponding RACH resource is entirely within the bandwidth of the UL BWP. (see TS 38.211 [16], clause 6.3.3.2).
<b>powerRampingStep</b> Power ramping steps for PRACH (see TS 38.321 [3], 5.1.3).
<b>prach-ConfigurationFrameOffset-IAB</b> Scaling factor for ROs defined in the baseline configuration indicated by <i>prach-ConfigurationIndex</i> and is used only by the IAB-MT. (see TS 38.211 [16], clause 6.3.3.2).
<b>prach-ConfigurationIndex</b> PRACH configuration index. For <i>prach-ConfigurationIndex</i> configured under <i>beamFailureRecovery-Config</i> , the <i>prach-ConfigurationIndex</i> can only correspond to the short preamble format, (see TS 38.211 [16], clause 6.3.3.2). If the field <i>prach-ConfigurationIndex-v1610</i> is present, the UE shall ignore the value provided in <i>prach-ConfigurationIndex</i> (without suffix).
<b>prach-ConfigurationPeriodScaling-IAB</b> Scaling factor to extend the periodicity of the baseline configuration indicated by <i>prach-ConfigurationIndex</i> and is used only by the IAB-MT. Value <i>scf1</i> corresponds to scaling factor of 1 and so on. (see TS 38.211 [16], clause 6.3.3.2).
<b>prach-ConfigurationSOffset-IAB</b> Subframe/Slot offset for ROs defined in the baseline configuration indicated by <i>prach-ConfigurationIndex</i> and is used only by the IAB-MT. (see TS 38.211 [16], clause 6.3.3.2).
<b>preambleReceivedTargetPower</b> The target power level at the network receiver side (see TS 38.213 [13], clause 7.4, TS 38.321 [3], clauses 5.1.2, 5.1.3). Only multiples of 2 dBm may be chosen (e.g. -202, -200, -198, ...).
<b>preambleTransMax</b> Max number of RA preamble transmission performed before declaring a failure (see TS 38.321 [3], clauses 5.1.4, 5.1.5).
<b>ra-ResponseWindow</b> Msg2 (RAR) window length in number of slots. The network configures a value lower than or equal to 10 ms when Msg2 is transmitted in licensed spectrum and a value lower than or equal to 40 ms when Msg2 is transmitted with shared spectrum channel access (see TS 38.321 [3], clause 5.1.4). UE ignores the field if included in <i>SCellConfig</i> . If <i>ra-ResponseWindow-v1610</i> is signalled, UE shall ignore the <i>ra-ResponseWindow</i> (without suffix). For operation with shared spectrum channel access and when <i>ra-ResponseWindow</i> value is more than 10 ms, the network always includes the two LSB bits of the SFN corresponding to the PRACH occasion where the preamble is received in the DCI scheduling Msg2 (see TS 38.213 [13]).
<b>zeroCorrelationZoneConfig</b> N-CS configuration, see Table 6.3.3.1-5 in TS 38.211 [16].

## – RACH-ConfigGenericTwoStepRA

The IE *RACH-ConfigGenericTwoStepRA* is used to specify the 2-step random access type parameters.

### **RACH-ConfigGenericTwoStepRA information element**

```
-- ASN1START
-- TAG-RACH-CONFIGGENERIC2WOSTEPRA-START

RACH-ConfigGenericTwoStepRA-r16 ::= SEQUENCE {
    msgA-PRACH-ConfigurationIndex-r16    INTEGER (0..262)                OPTIONAL, -- Cond 2StepOnly
    msgA-RO-FDM-r16                      ENUMERATED {one, two, four, eight}  OPTIONAL, -- Cond 2StepOnly
    msgA-RO-FrequencyStart-r16           INTEGER (0..maxNrofPhysicalResourceBlocks-1)  OPTIONAL, -- Cond 2StepOnly
}
```

```

msgA-ZeroCorrelationZoneConfig-r16      INTEGER (0..15)                                OPTIONAL, -- Cond 2StepOnly
msgA-PreamblePowerRampingStep-r16       ENUMERATED {dB0, dB2, dB4, dB6}              OPTIONAL, -- Cond 2StepOnlyNoCFRA
msgA-PreambleReceivedTargetPower-r16    INTEGER (-202..-60)                          OPTIONAL, -- Cond 2StepOnlyNoCFRA
msgB-ResponseWindow-r16                 ENUMERATED {s11, s12, s14, s18, s110, s120, s140, s180, s1160, s1320}
                                          OPTIONAL, -- Cond NoCFRA
preamblesTransMax-r16                   ENUMERATED {n3, n4, n5, n6, n7, n8, n10, n20, n50, n100, n200}
                                          OPTIONAL, -- Cond 2StepOnlyNoCFRA
...
}
-- TAG-RACH-CONFIGGENERIC-TWOSTEPRA-STOP
-- ASN1STOP

```

### **RACH-ConfigGenericTwoStepRA field descriptions**

#### **msgA-PreamblePowerRampingStep**

Power ramping steps for msgA PRACH. If the field is absent, UE shall use the value of *powerRampingStep* in *RACH-ConfigGeneric* in the configured BWP (see TS 38.321 [3], 5.1.3). This field may only be present if no 4-step type RA is configured in the BWP or in the case of separate ROs with 4-step type RA. The field is absent if *RACH-ConfigGenericTwoStepRA* is included in *CFRA-TwoStep* in *RACH-ConfigDedicated* and then the UE uses the value of *msgA-PreamblePowerRampingStep* in *RACH-ConfigGenericTwoStepRA* configured for CBRA.

#### **msgA-PreambleReceivedTargetPower**

The target power level at the network receiver side (see TS 38.213 [13], clause 7.1.1 and TS 38.321 [3], clause 5.1.1). Only multiples of 2 dBm may be chosen (e.g -202, -200, -198, ...). If the field is absent, UE shall use the value of *preambleReceivedTargetPower* in *RACH-ConfigGeneric* in the configured BWP. This field may only be present if no 4-step type RA is configured in the BWP. The field is absent if *RACH-ConfigGenericTwoStepRA* is included in *CFRA-TwoStep* in *RACH-ConfigDedicated* and then the UE uses the value of *msgA-PreambleReceivedTargetPower* in *RACH-ConfigGenericTwoStepRA* configured for CBRA.

#### **msgA-PRACH-ConfigurationIndex**

Cell-specific PRACH configuration index for 2-step RA type. If the field is absent the UE shall use the value of corresponding 4-step random access parameter in the configured BWP. If the value is in the range of 256 to 262, the field *prach-ConfigurationIndex-v1610* should be considered configured (see TS 38.211 [16], clause 6.3.3.2). This field may only be present if no 4-step type RA is configured in the BWP or in the case of separate ROs with 4-step type RA.

#### **msgA-RO-FDM**

The number of msgA PRACH transmission occasions Frequency-Division Multiplexed in one time instance. If the field is absent, UE shall use value of *msg1-FDM* in *RACH-ConfigGeneric* in the configured BWP (see TS 38.211 [16], clause 6.3.3.2). This field may only be present if no 4-step type RA is configured in the BWP or in the case of separate ROs with 4-step type RA.

#### **msgA-RO-FrequencyStart**

Offset of lowest PRACH transmissions occasion in frequency domain with respect to PRB 0. If the field is absent, UE shall use value of *msg1-FrequencyStart* in *RACH-ConfigGeneric* in the configured BWP (see TS 38.211 [16], clauses 5.3.2 and 6.3.3.2). This field may only be present if no 4-step type RA is configured in the BWP or in the case of separate ROs with 4-step type RA.

#### **msgA-ZeroCorrelationZoneConfig**

N-CS configuration for msgA preamble, see Table 6.3.3.1-5 in TS 38.211 [16]. If the field is absent, UE shall use value *zeroCorrelationZoneConfig* in *RACH-ConfigGeneric* in the configured BWP. This field may only be present if no 4-step type RA is configured in the BWP or in the case of separate ROs with 4-step type RA.

#### **msgB-ResponseWindow**

MsgB monitoring window length in number of slots. The network configures a value lower than or equal to 40ms (see TS 38.321 [3], clause 5.1.1). If the field is absent, the UE use the value of *msgB-ResponseWindow* in *RACH-ConfigGenericTwoStepRA* configured for CBRA.

#### **preambleTransMax**

Max number of RA preamble transmission performed before declaring a failure (see TS 38.321 [3], clauses 5.1.4, 5.1.5). If the field is absent, UE shall use the value of *preambleTransMax* in *RACH-ConfigGeneric* in the configured BWP. The field is absent if *RACH-ConfigGenericTwoStepRA* is included in *CFRA-TwoStep* in *RACH-ConfigDedicated* and then the UE uses the value of *preambleTransMax* in *RACH-ConfigGenericTwoStepRA* configured for CBRA.



Conditional Presence	Explanation
<i>2StepOnly</i>	The field is mandatory present if there are no 4-step random access configurations configured in the BWP, i.e only 2-step random access type configured in the BWP, otherwise the field is Need S
<i>2StepOnlyNoCFRA</i>	The field is mandatory present if <i>RACH-ConfigGenericTwoStepRA</i> is included in the <i>RACH-ConfigCommonTwoStepRA</i> and there are no 4-step random access configurations configured in the BWP (i.e only 2-step random access type configured in the BWP), otherwise (i.e. 4-step random access configuration also exists in the BWP) the field is optional, Need S. When <i>RACH-ConfigGenericTwoStepRA</i> is included in the <i>RACH-ConfigDedicated</i> , this field is absent.
<i>NoCFRA</i>	The field is mandatory present if <i>RACH-ConfigGenericTwoStepRA</i> is not included in <i>CFRA-TwoStep</i> in <i>RACH-ConfigDedicated</i> , otherwise the field is absent, Need S.

## – *RA-Prioritization*

The IE *RA-Prioritization* is used to configure prioritized random access.

### ***RA-Prioritization* information element**

```

-- ASN1START
-- TAG-RA-PRIORITIZATION-START

RA-Prioritization ::= SEQUENCE {
    powerRampingStepHighPriority  ENUMERATED {dB0, dB2, dB4, dB6},
    scalingFactorBI              ENUMERATED {zero, dot25, dot5, dot75}          OPTIONAL,  -- Need R
    ...
}

-- TAG-RA-PRIORITIZATION-STOP
-- ASN1STOP

```

### ***RA-Prioritization* field descriptions**

#### ***powerRampingStepHighPriority***

Power ramping step applied for prioritized random access procedure.

#### ***scalingFactorBI***

Scaling factor for the backoff indicator (BI) for the prioritized random access procedure. (see TS 38.321 [3], clause 5.1.4). Value *zero* corresponds to 0, value *dot25* corresponds to 0.25 and so on.

## – *RadioBearerConfig*

The IE *RadioBearerConfig* is used to add, modify and release signalling and/or data radio bearers. Specifically, this IE carries the parameters for PDCP and, if applicable, SDAP entities for the radio bearers.

### ***RadioBearerConfig* information element**

```

-- ASN1START
-- TAG-RADIOBEARERCONFIG-START

```

```

RadioBearerConfig ::=
  srb-ToAddModList
  srb3-ToRelease
  drb-ToAddModList
  drb-ToReleaseList
  securityConfig
  ...
}

SRB-ToAddModList ::=
SRB-ToAddMod ::=
  srb-Identity
  reestablishPDCP
  discardOnPDCP
  pdcp-Config
  ...
}

DRB-ToAddModList ::=
DRB-ToAddMod ::=
  cnAssociation
    eps-BearerIdentity
    sdap-Config
  }
  drb-Identity
  reestablishPDCP
  recoverPDCP
  pdcp-Config
  ...,
  [[
  daps-Config-r16
  ]]
}

DRB-ToReleaseList ::=
SecurityConfig ::=
  securityAlgorithmConfig
  keyToUse
  ...
}

-- TAG-RADIOBEARERCONFIG-STOP
-- ASN1STOP

```

```

SEQUENCE {
  SRB-ToAddModList
  ENUMERATED{true}
  DRB-ToAddModList
  DRB-ToReleaseList
  SecurityConfig
}

SEQUENCE (SIZE (1..2)) OF SRB-ToAddMod
SEQUENCE {
  SRB-Identity,
  ENUMERATED{true}
  ENUMERATED{true}
  PDCP-Config
}

SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod
SEQUENCE {
  CHOICE {
    INTEGER (0..15),
    SDAP-Config
  }
  DRB-Identity,
  ENUMERATED{true}
  ENUMERATED{true}
  PDCP-Config
  ENUMERATED{true}
}

SEQUENCE (SIZE (1..maxDRB)) OF DRB-Identity
SEQUENCE {
  SecurityAlgorithmConfig
  ENUMERATED{master, secondary}
}

```

```

OPTIONAL, -- Cond HO-Conn
OPTIONAL, -- Need N
OPTIONAL, -- Cond HO-toNR
OPTIONAL, -- Need N
OPTIONAL, -- Need M

OPTIONAL, -- Need N
OPTIONAL, -- Need N
OPTIONAL, -- Cond PDCP

OPTIONAL, -- Cond DRBSetup
OPTIONAL, -- Need N
OPTIONAL, -- Need N
OPTIONAL, -- Cond PDCP

OPTIONAL --Need N

OPTIONAL, -- Cond RBTermChangel
OPTIONAL, -- Cond RBTermChange

```

<b>DRB-ToAddMod field descriptions</b>
<p><b>cnAssociation</b> Indicates if the bearer is associated with the <i>eps-bearerIdentity</i> (when connected to EPC) or <i>sdap-Config</i> (when connected to 5GC).</p>
<p><b>daps-Config</b> Indicates that the bearer is configured as DAPS bearer. This field is optional present, need N, in case <i>masterCellGroup</i> includes <i>ReconfigurationWithSync</i>, MR-DC is not configured and <i>ethernetHeaderCompression</i> is not configured for the DRB. Otherwise the field is absent.</p>
<p><b>drb-Identity</b> In case of DC, the DRB identity is unique within the scope of the UE, i.e. an MCG DRB cannot use the same value as a split DRB. For a split DRB the same identity is used for the MCG and SCG parts of the configuration.</p>
<p><b>eps-BearerIdentity</b> The EPS bearer ID determines the EPS bearer.</p>
<p><b>reestablishPDCP</b> Indicates that PDCP should be re-established. Network sets this to <i>true</i> whenever the security key used for this radio bearer changes. Key change could for example be due to termination point change for the bearer, reconfiguration with sync, resuming an RRC connection, or the first reconfiguration after reestablishment. It is also applicable for LTE procedures when NR PDCP is configured. Network doesn't include this field for DRB if the bearer is configured as DAPS bearer.</p>
<p><b>recoverPDCP</b> Indicates that PDCP should perform recovery according to TS 38.323 [5]. Network doesn't include this field if the bearer is configured as DAPS bearer.</p>
<p><b>sdap-Config</b> The SDAP configuration determines how to map QoS flows to DRBs when NR or E-UTRA connects to the 5GC and presence/absence of UL/DL SDAP headers.</p>

<b>RadioBearerConfig field descriptions</b>
<p><b>securityConfig</b> Indicates the security algorithm and key to use for the signalling and data radio bearers configured with the list in this IE <i>RadioBearerConfig</i>. When the field is not included after AS security has been activated, the UE shall continue to use the currently configured <i>keyToUse</i> and security algorithm for the radio bearers reconfigured with the lists in this IE <i>RadioBearerConfig</i>. The field is not included when configuring SRB1 before AS security is activated.</p>
<p><b>srb3-ToRelease</b> Release SRB3. SRB3 release can only be done over SRB1 and only at SCG release and reconfiguration with sync.</p>

<b>SecurityConfig field descriptions</b>
<p><b>keyToUse</b> Indicates if the bearers configured with the list in this IE <i>RadioBearerConfig</i> are using the master key or the secondary key for deriving ciphering and/or integrity protection keys. For MR-DC, network should not configure SRB1 and SRB2 with secondary key and SRB3 with the master key. When the field is not included, the UE shall continue to use the currently configured <i>keyToUse</i> for the radio bearers reconfigured with the lists in this IE <i>RadioBearerConfig</i>.</p>
<p><b>securityAlgorithmConfig</b> Indicates the security algorithm for the signalling and data radio bearers configured with the list in this IE <i>RadioBearerConfig</i>. When the field is not included, the UE shall continue to use the currently configured security algorithm for the radio bearers reconfigured with the lists in this IE <i>RadioBearerConfig</i>.</p>

<b>SRB-ToAddMod field descriptions</b>
<p><b>discardOnPDCP</b> Indicates that PDCP should discard stored SDU and PDU according to TS 38.323 [5].</p>
<p><b>reestablishPDCP</b> Indicates that PDCP should be re-established. Network sets this to <i>true</i> whenever the security key used for this radio bearer changes. Key change could for example be due to reconfiguration with sync, for SRB2 when resuming an RRC connection, or at the first reconfiguration after RRC connection reestablishment in NR. For LTE SRBs using NR PDCP, it could be for handover, RRC connection reestablishment or resume. Network doesn't include this field if any DAPS bearer is configured.</p>
<p><b>srb-Identity</b> Value 1 is applicable for SRB1 only. Value 2 is applicable for SRB2 only. Value 3 is applicable for SRB3 only.</p>

<b>Conditional Presence</b>	<b>Explanation</b>
<i>RBTermChange</i>	The field is mandatory present in case of set up of signalling and data radio bearer and change of termination point for the radio bearer between MN and SN. It is optionally present otherwise, Need S.
<i>RBTermChange1</i>	The field is mandatory present in case of: <ul style="list-style-type: none"> <li>- set up of signalling and data radio bearer,</li> <li>- change of termination point for the radio bearer between MN and SN,</li> <li>- handover from E-UTRA/EPC or E-UTRA/5GC to NR,</li> <li>- handover from NR or E-UTRA/EPC to E-UTRA/5GC if the UE supports NGEN-DC.</li> </ul> It is optionally present otherwise, Need S.
<i>PDCP</i>	The field is mandatory present if the corresponding DRB is being setup or corresponding DRB is reconfigured with NR PDCP or corresponding SRB associated with two RLC entities is being setup or if the number of RLC bearers associated with the DRB or SRB is changed. The field is optionally present, Need S, if the corresponding SRB associated with one RLC entity is being setup or corresponding SRB is reconfigured with NR PDCP; otherwise the field is optionally present, need M.
<i>DRBSetup</i>	The field is mandatory present if the corresponding DRB is being setup; otherwise the field is optionally present, need M.
<i>HO-Conn</i>	The field is mandatory present <ul style="list-style-type: none"> <li>- in case of inter-system handover from E-UTRA/EPC to E-UTRA/5GC or NR,</li> <li>- or when the <i>fullConfig</i> is included in the <i>RRCReconfiguration</i> message and NE-DC/NR-DC is not configured,</li> <li>- or in case of <i>RRCSetup</i>.</li> </ul> Otherwise the field is optionally present, need N. Upon <i>RRCSetup</i> , only SRB1 can be present.
<i>HO-toNR</i>	The field is mandatory present <ul style="list-style-type: none"> <li>- in case of inter-system handover from E-UTRA/EPC to E-UTRA/5GC or NR,</li> <li>- or when the <i>fullConfig</i> is included in the <i>RRCReconfiguration</i> message and NE-DC/NR-DC is not configured.</li> </ul> In case of <i>RRCSetup</i> , the field is absent; otherwise the field is optionally present, need N.

## – *RadioLinkMonitoringConfig*

The IE *RadioLinkMonitoringConfig* is used to configure radio link monitoring for detection of beam- and/or cell radio link failure. See also TS 38.321 [3], clause 5.1.1.

### ***RadioLinkMonitoringConfig* information element**

```
-- ASN1START
-- TAG-RADIOLINKMONITORINGCONFIG-START
```

```

RadioLinkMonitoringConfig ::= SEQUENCE {
    failureDetectionResourcesToAddModList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF RadioLinkMonitoringRS
    failureDetectionResourcesToReleaseList SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF RadioLinkMonitoringRS-Id
    beamFailureInstanceMaxCount ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10}
    beamFailureDetectionTimer ENUMERATED {pbfd1, pbfd2, pbfd3, pbfd4, pbfd5, pbfd6, pbfd8, pbfd10}
    ...
}

RadioLinkMonitoringRS ::= SEQUENCE {
    radioLinkMonitoringRS-Id RadioLinkMonitoringRS-Id,
    purpose ENUMERATED {beamFailure, rlf, both},
    detectionResource CHOICE {
        ssb-Index SSB-Index,
        csi-RS-Index NZZP-CSI-RS-ResourceId
    },
    ...
}

-- TAG-RADIOLINKMONITORINGCONFIG-STOP
-- ASN1STOP

```

#### **RadioLinkMonitoringConfig field descriptions**

##### ***beamFailureDetectionTimer***

Timer for beam failure detection (see TS 38.321 [3], clause 5.17). See also the *BeamFailureRecoveryConfig* IE. Value in number of "Q<sub>out,LR</sub> reporting periods of Beam Failure Detection" Reference Signal (see TS 38.213 [13], clause 6). Value *pbfd1* corresponds to 1 Q<sub>out,LR</sub> reporting period of Beam Failure Detection Reference Signal, value *pbfd2* corresponds to 2 Q<sub>out,LR</sub> reporting periods of Beam Failure Detection Reference Signal and so on.

##### ***beamFailureInstanceMaxCount***

This field determines after how many beam failure events the UE triggers beam failure recovery (see TS 38.321 [3], clause 5.17). Value n1 corresponds to 1 beam failure instance, value n2 corresponds to 2 beam failure instances and so on.

##### ***failureDetectionResourcesToAddModList***

A list of reference signals for detecting beam failure and/or cell level radio link failure (RLF). The limits of the reference signals that the network can configure are specified in TS 38.213 [13], table 5-1. The network configures at most two detectionResources per BWP for the purpose *beamFailure* or *both*. If no RSs are provided for the purpose of beam failure detection, the UE performs beam monitoring based on the activated *TCI-State* for PDCCH as described in TS 38.213 [13], clause 6. If no RSs are provided in this list for the purpose of RLF detection, the UE performs Cell-RLM based on the activated *TCI-State* of PDCCH as described in TS 38.213 [13], clause 5. The network ensures that the UE has a suitable set of reference signals for performing cell-RLM.

#### **RadioLinkMonitoringRS field descriptions**

##### ***detectionResource***

A reference signal that the UE shall use for radio link monitoring or beam failure detection (depending on the indicated *purpose*). Only periodic 1-port CSI-RS for BM can be configured on SCell for beam failure detection purpose.

##### ***purpose***

Determines whether the UE shall monitor the associated reference signal for the purpose of cell- and/or beam failure detection. For SCell, network only configures the value to *beamFailure*.

## – *RadioLinkMonitoringRS-Id*

The IE *RadioLinkMonitoringRS-Id* is used to identify one *RadioLinkMonitoringRS*.

### ***RadioLinkMonitoringRS-Id* information element**

```
-- ASN1START
-- TAG-RADIOLINKMONITORINGRS-ID-START

RadioLinkMonitoringRS-Id ::=          INTEGER (0..maxNrofFailureDetectionResources-1)

-- TAG-RADIOLINKMONITORINGRS-ID-STOP
-- ASN1STOP
```

## – *RAN-AreaCode*

The IE *RAN-AreaCode* is used to identify a RAN area within the scope of a tracking area.

### ***RAN-AreaCode* information element**

```
-- ASN1START
-- TAG-RAN-AREACODE-START

RAN-AreaCode ::=                      INTEGER (0..255)

-- TAG-RAN-AREACODE-STOP
-- ASN1STOP
```

## – *RateMatchPattern*

The IE *RateMatchPattern* is used to configure one rate matching pattern for PDSCH, see TS 38.214 [19], clause 5.1.4.1.

### ***RateMatchPattern* information element**

```
-- ASN1START
-- TAG-RATEMATCHPATTERN-START

RateMatchPattern ::=
    rateMatchPatternId                SEQUENCE {
        patternType                   CHOICE {
            bitmaps                    SEQUENCE {
                resourceBlocks         BIT STRING (SIZE (275)),
                symbolsInResourceBlock CHOICE {
                    oneSlot            BIT STRING (SIZE (14)),
                    twoSlots           BIT STRING (SIZE (28))
                }
            }
        }
    }

-- TAG-RATEMATCHPATTERN-STOP
```

```

    },
    periodicityAndPattern          CHOICE {
        n2                        BIT STRING (SIZE (2)),
        n4                        BIT STRING (SIZE (4)),
        n5                        BIT STRING (SIZE (5)),
        n8                        BIT STRING (SIZE (8)),
        n10                       BIT STRING (SIZE (10)),
        n20                       BIT STRING (SIZE (20)),
        n40                       BIT STRING (SIZE (40))
    }
    ...
},
controlResourceSet              ControlResourceSetId
},
subcarrierSpacing              SubcarrierSpacing
dummy                          ENUMERATED { dynamic, semiStatic },
...
[[
controlResourceSet-r16        ControlResourceSetId-r16
]]
}

-- TAG-RATEMATCHPATTERN-STOP
-- ASN1STOP

```

OPTIONAL, -- Need S

OPTIONAL, -- Cond CellLevel

OPTIONAL -- Need R

<b>RateMatchPattern field descriptions</b>	
<b>bitmaps</b> Indicates rate matching pattern by a pair of bitmaps <i>resourceBlocks</i> and <i>symbolsInResourceBlock</i> to define the rate match pattern within one or two slots, and a third bitmap <i>periodicityAndPattern</i> to define the repetition pattern with which the pattern defined by the above bitmap pair occurs.	
<b>controlResourceSet</b> This ControlResourceSet is used as a PDSCH rate matching pattern, i.e., PDSCH reception rate matches around it. In frequency domain, the resource is determined by the frequency domain resource of the CORESET with the corresponding CORESET ID. Time domain resource is determined by the parameters of the associated search space of the CORESET. If the field <i>controlResourceSetId-r16</i> is present, UE shall ignore the <i>controlResourceSetId</i> (without suffix).	
<b>periodicityAndPattern</b> A time domain repetition pattern at which the pattern defined by <i>symbolsInResourceBlock</i> and <i>resourceBlocks</i> recurs. This slot pattern repeats itself continuously. Absence of this field indicates the value <i>n1</i> , i.e., the <i>symbolsInResourceBlock</i> recurs every 14 symbols (see TS 38.214 [19], clause 5.1.4.1).	
<b>resourceBlocks</b> A resource block level bitmap in the frequency domain. A bit in the bitmap set to 1 indicates that the UE shall apply rate matching in the corresponding resource block in accordance with the <i>symbolsInResourceBlock</i> bitmap. If used as cell-level rate matching pattern, the bitmap identifies "common resource blocks (CRB)". If used as BWP-level rate matching pattern, the bitmap identifies "physical resource blocks" inside the BWP. The first/ leftmost bit corresponds to resource block 0, and so on (see TS 38.214 [19], clause 5.1.4.1).	
<b>subcarrierSpacing</b> The SubcarrierSpacing for this resource pattern. If the field is absent, the UE applies the SCS of the associated BWP. The value <i>kHz15</i> corresponds to $\mu=0$ , the value <i>kHz30</i> corresponds to $\mu=1$ , and so on. Only the values 15 kHz, 30 kHz or 60 kHz (FR1), and 60 kHz or 120 kHz (FR2) are applicable (see TS 38.214 [19], clause 5.1.4.1).	
<b>symbolsInResourceBlock</b> A symbol level bitmap in time domain. It indicates with a bit set to true that the UE shall rate match around the corresponding symbol. This pattern recurs (in time domain) with the configured <i>periodicityAndPattern</i> (see TS 38.214 [19], clause 5.1.4.1). For <i>oneSlot</i> , if ECP is configured, the first 12 bits represent the symbols within the slot and the last two bits within the bitstring are ignored by the UE; Otherwise, the 14 bits represent the symbols within the slot. For <i>twoSlots</i> , if ECP is configured, the first 12 bits represent the symbols within the first slot and the next 12 bits represent the symbols in the second slot and the last four bits within the bit string are ignored by the UE; Otherwise, the first 14 bits represent the symbols within the first slot and the next 14 bits represent the symbols in the second slot. For the bits representing symbols in a slot, the most significant bit of the bit string represents the first symbol in the slot and the second most significant bit represents the second symbol in the slot and so on.	

Conditional Presence	Explanation
<i>CellLevel</i>	The field is mandatory present if the <i>RateMatchPattern</i> is defined on cell level. The field is absent when the <i>RateMatchPattern</i> is defined on BWP level. If the <i>RateMatchPattern</i> is defined on BWP level, the UE applies the SCS of the BWP.

– **RateMatchPatternId**

The IE *RateMatchPatternId* identifies one RateMatchPattern (see TS 38.214 [19], clause 5.1.4.2).

**RateMatchPatternId information element**

-- ASN1START  
-- TAG-RATEMATCHPATTERNID-START



```
RateMatchPatternId ::=                INTEGER (0..maxNrofRateMatchPatterns-1)

-- TAG-RATEMATCHPATTERNID-STOP
-- ASN1STOP
```

## – *RateMatchPatternLTE-CRS*

The IE *RateMatchPatternLTE-CRS* is used to configure a pattern to rate match around LTE CRS. See TS 38.214 [19], clause 5.1.4.2.

### *RateMatchPatternLTE-CRS* information element

```
-- ASN1START
-- TAG-RATEMATCHPATTERNLTE-CRS-START

RateMatchPatternLTE-CRS ::=          SEQUENCE {
  carrierFreqDL                       INTEGER (0..16383),
  carrierBandwidthDL                  ENUMERATED {n6, n15, n25, n50, n75, n100, spare2, spare1},
  mbsfn-SubframeConfigList            EUTRA-MBSFN-SubframeConfigList                OPTIONAL, -- Need M
  nrofCRS-Ports                       ENUMERATED {n1, n2, n4},
  v-Shift                             ENUMERATED {n0, n1, n2, n3, n4, n5}
}

LTE-CRS-PatternList-r16 ::=          SEQUENCE (SIZE (1..maxLTE-CRS-Patterns-r16)) OF RateMatchPatternLTE-CRS

-- TAG-RATEMATCHPATTERNLTE-CRS-STOP
-- ASN1STOP
```

#### *RateMatchPatternLTE-CRS* field descriptions

<b><i>carrierBandwidthDL</i></b>
BW of the LTE carrier in number of PRBs (see TS 38.214 [19], clause 5.1.4.2).
<b><i>carrierFreqDL</i></b>
Center of the LTE carrier (see TS 38.214 [19], clause 5.1.4.2).
<b><i>mbsfn-SubframeConfigList</i></b>
LTE MBSFN subframe configuration (see TS 38.214 [19], clause 5.1.4.2).
<b><i>nrofCRS-Ports</i></b>
Number of LTE CRS antenna port to rate-match around (see TS 38.214 [19], clause 5.1.4.2).
<b><i>v-Shift</i></b>
Shifting value v-shift in LTE to rate match around LTE CRS (see TS 38.214 [19], clause 5.1.4.2).

## – *ReferenceTimeInfo*

The IE *ReferenceTimeInfo* contains timing information for 5G internal system clock used for, e.g., time stamping, see TS 23.501 [32], clause 5.27.1.2.

**ReferenceTimeInfo** information element

```

-- ASN1START
-- TAG-REFERENCETIMEINFO-START

ReferenceTimeInfo-r16 ::= SEQUENCE {
    time-r16                               ReferenceTime-r16,
    uncertainty-r16                         INTEGER (0..32767)           OPTIONAL, -- Need S
    timeInfoType-r16                       ENUMERATED {localClock}  OPTIONAL, -- Need S
    referenceSFN-r16                       INTEGER (0..1023)        OPTIONAL, -- Cond RefTime
}

ReferenceTime-r16 ::= SEQUENCE {
    refDays-r16                            INTEGER (0..72999),
    refSeconds-r16                         INTEGER (0..86399),
    refMilliSeconds-r16                   INTEGER (0..999),
    refTenNanoSeconds-r16                 INTEGER (0..99999)
}

-- TAG-REFERENCETIMEINFO-STOP
-- ASN1STOP

```

**ReferenceTimeInfo** field descriptions**referenceSFN**

This field indicates the reference SFN corresponding to the reference time information. If *referenceTimeInfo* field is received in *DLInformationTransfer* message, this field indicates the SFN of PCell.

**time**

This field indicates time reference with 10ns granularity. The indicated time is referenced at the network, i.e., without compensating for RF propagation delay. The indicated time in 10ns unit from the origin is  $refDays * 86400 * 1000 * 100000 + refSeconds * 1000 * 100000 + refMilliSeconds * 100000 + refTenNanoSeconds$ . The *refDays* field specifies the sequential number of days (with day count starting at 0) from the origin of the *time* field.

If the *referenceTimeInfo* field is received in *DLInformationTransfer* message, the time field indicates the *time* at the ending boundary of the system frame indicated by *referenceSFN*. The UE considers this frame (indicated by *referenceSFN*) to be the frame which is nearest to the frame where the message is received (which can be either in the past or in the future).

If the *referenceTimeInfo* field is received in *SIB9*, the *time* field indicates the time at the SFN boundary at or immediately after the ending boundary of the SI-window in which *SIB9* is transmitted.

If *referenceTimeInfo* field is received in *SIB9*, this field is excluded when determining changes in system information, i.e. changes of time should neither result in system information change notifications nor in a modification of *valueTag* in *SIB1*.

**timeInfoType**

If *timeInfoType* is not included, the *time* indicates the GPS time and the origin of the *time* field is 00:00:00 on Gregorian calendar date 6 January, 1980 (start of GPS time). If *timeInfoType* is set to *localClock*, the origin of the *time* is unspecified.

**uncertainty**

This field indicates the uncertainty of the reference time information provided by the time field. The uncertainty is 25ns multiplied by this field. If this field is absent, the uncertainty is unspecified.

Conditional Presence	Explanation
<i>RefTime</i>	The field is mandatory present if <i>referenceTimeInfo</i> is included in <i>DLInformationTransfer</i> message; otherwise the field is absent.

## – *RejectWaitTime*

The IE *RejectWaitTime* is used to provide the value in seconds for timer T302.

### ***RejectWaitTime* information element**

```
-- ASN1START
-- TAG-REJECTWAITTIME-START

RejectWaitTime ::=                INTEGER (1..16)

-- TAG-REJECTWAITTIME-STOP
-- ASN1STOP
```

## – *RepetitionSchemeConfig*

The IE *RepetitionSchemeConfig* is used to configure the UE with repetition schemes as specified in TS 38.214 [19] clause 5.1.

### ***RepetitionSchemeConfig* information element**

```
-- ASN1START
-- TAG-REPETITIONSchemeCONFIG-START

RepetitionSchemeConfig-r16 ::= CHOICE {
    fdm-TDM-r16                SetupRelease { FDM-TDM-r16 },
    slotBased-r16              SetupRelease { SlotBased-r16 }
}

FDM-TDM-r16 ::=                SEQUENCE {
    repetitionScheme-r16       ENUMERATED {fdmSchemeA, fdmSchemeB,tdmSchemeA },
    startingSymbolOffsetK-r16  INTEGER (0..7)                                OPTIONAL -- Need R
}

SlotBased-r16 ::=              SEQUENCE {
    tciMapping-r16             ENUMERATED {cyclicMapping, sequentialMapping},
    sequenceOffsetforRV-r16    INTEGER (1..3)
}

-- TAG-REPETITIONSchemeCONFIG-STOP
-- ASN1STOP
```

<i>RepetitionSchemeConfig</i> field descriptions
<b><i>fdm-TDM</i></b> Configures UE with a repetition scheme among <i>fdmSchemeA</i> , <i>fdmSchemeB</i> and <i>tdmSchemeA</i> as specified in clause 5.1 of TS 38.214 [19].
<b><i>sequenceOffsetforRV</i></b> For slot-based repetition scheme, selected RV sequence is applied to transmission occasions associated to the first TCI state. The RV sequence associated to the second TCI state is determined by a RV offset from that selected RV sequence.
<b><i>slotBased</i></b> Configures UE with slot-based repetition scheme. Network always configures this field when the parameter <i>repetitionNumber</i> is present in IE <i>PDSCH-TimeDomainResourceAllocationList</i>
<b><i>startingSymbolOffsetK</i></b> The starting symbol of the second transmission occasion has K symbol offset relative to the last symbol of the first transmission occasion. When UE is configured with <i>tdmSchemeA</i> , the parameter <i>startingSymbolOffsetK</i> is present, otherwise absent.
<b><i>tcIMapping</i></b> Enables TCI state mapping method to PDSCH transmission occasions.

## – *ReportConfigId*

The IE *ReportConfigId* is used to identify a measurement reporting configuration.

### ***ReportConfigId* information element**

```
-- ASN1START
-- TAG-REPORTCONFIGID-START

ReportConfigId ::=                INTEGER (1..maxReportConfigId)

-- TAG-REPORTCONFIGID-STOP
-- ASN1STOP
```

## – *ReportConfigInterRAT*

The IE *ReportConfigInterRAT* specifies criteria for triggering of an inter-RAT measurement reporting event. The inter-RAT measurement reporting events for E-UTRA and UTRA-FDD are labelled *BN* with *N* equal to 1, 2 and so on.

Event B1: Neighbour becomes better than absolute threshold;

Event B2: PCell becomes worse than absolute threshold1 AND Neighbour becomes better than another absolute threshold2;

### ***ReportConfigInterRAT* information element**

```
-- ASN1START
-- TAG-REPORTCONFIGINTERRAT-START

ReportConfigInterRAT ::=          SEQUENCE {
```

```

reportType
  periodical
  eventTriggered
  reportCGI
  ...
  reportSFTD
}
}

ReportCGI-EUTRA ::=
  cellForWhichToReportCGI
  ...
  [[
  useAutonomousGaps-r16
  ]]
}

ReportSFTD-EUTRA ::=
  reportSFTD-Meas
  reportRSRP
  ...
}

EventTriggerConfigInterRAT ::=
  eventId
  eventB1
    b1-ThresholdEUTRA
    reportOnLeave
    hysteresis
    timeToTrigger
    ...
  },
  eventB2
    b2-Threshold1
    b2-Threshold2EUTRA
    reportOnLeave
    hysteresis
    timeToTrigger
    ...
  },
  ...
  [[
  eventB1-UTRA-FDD-r16
    b1-ThresholdUTRA-FDD-r16
    reportOnLeave-r16
    hysteresis-r16
    timeToTrigger-r16
    ...
  ]],
  eventB2-UTRA-FDD-r16
    b2-Threshold1-r16
    b2-Threshold2UTRA-FDD-r16
    reportOnLeave-r16
    hysteresis-r16
}

```

CHOICE {  
 PeriodicalReportConfigInterRAT,  
 EventTriggerConfigInterRAT,  
 ReportCGI-EUTRA,  
 ReportsSFTD-EUTRA

SEQUENCE {  
 EUTRA-PhysCellId,  
 ENUMERATED {setup} OPTIONAL -- Need R

SEQUENCE {  
 BOOLEAN,  
 BOOLEAN,

SEQUENCE {  
 CHOICE {  
 SEQUENCE {  
 MeasTriggerQuantityEUTRA,  
 BOOLEAN,  
 Hysteresis,  
 TimeToTrigger,  
 SEQUENCE {  
 MeasTriggerQuantity,  
 MeasTriggerQuantityEUTRA,  
 BOOLEAN,  
 Hysteresis,  
 TimeToTrigger,  
 SEQUENCE {  
 MeasTriggerQuantityUTRA-FDD-r16,  
 BOOLEAN,  
 Hysteresis,  
 TimeToTrigger,  
 SEQUENCE {  
 MeasTriggerQuantity,  
 MeasTriggerQuantityUTRA-FDD-r16,  
 BOOLEAN,  
 Hysteresis,

```

        timeToTrigger-r16                TimeToTrigger,
        ...
    }
  ]]
},
rsType                                NR-RS-Type,

reportInterval                        ReportInterval,
reportAmount                          ENUMERATED {r1, r2, r4, r8, r16, r32, r64, infinity},
reportQuantity                        MeasReportQuantity,
maxReportCells                        INTEGER (1..maxCellReport),
...
[[
reportQuantityUTRA-FDD-r16           MeasReportQuantityUTRA-FDD-r16      OPTIONAL  -- Need R
]]

}

PeriodicalReportConfigInterRAT ::=      SEQUENCE {
  reportInterval                      ReportInterval,
  reportAmount                        ENUMERATED {r1, r2, r4, r8, r16, r32, r64, infinity},
  reportQuantity                      MeasReportQuantity,
  maxReportCells                      INTEGER (1..maxCellReport),
  ...
  [[
  reportQuantityUTRA-FDD-r16          MeasReportQuantityUTRA-FDD-r16      OPTIONAL  -- Need R
  ]]
}

MeasTriggerQuantityUTRA-FDD-r16 ::=     CHOICE{
  ultra-FDD-RSCP-r16                  INTEGER (-5..91),
  ultra-FDD-EcN0-r16                  INTEGER (0..49)
}

MeasReportQuantityUTRA-FDD-r16 ::=     SEQUENCE {
  cpich-RSCP                          BOOLEAN,
  cpich-EcN0                          BOOLEAN
}

-- TAG-REPORTCONFIGINTERRAT-STOP
-- ASN1STOP

```

<b>ReportConfigInterRAT field descriptions</b>
--

<b>reportType</b>
-------------------

Type of the configured measurement report. In EN-DC, network does not configure report of type <i>ReportCGI-EUTRA</i> .
---

<b>ReportCGI-EUTRA field descriptions</b>
<p><b>useAutonomousGaps</b> Indicates whether or not the UE is allowed to use autonomous gaps in acquiring system information from the E-UTRAN neighbour cell. When the field is included, the UE applies the corresponding value for T321.</p>
<b>EventTriggerConfigInterRAT field descriptions</b>
<p><b>b2-Threshold1</b> NR threshold to be used in inter RAT measurement report triggering condition for event B2.</p>
<p><b>bN-ThresholdEUTRA</b> E-UTRA threshold value associated with the selected trigger quantity (RSRP, RSRQ, SINR) to be used in inter RAT measurement report triggering condition for event number bN. In the same <i>eventB2</i>, the network configures the same CHOICE name (<i>rsrp</i>, <i>rsrq</i> or <i>sinr</i>) for the <i>MeasTriggerQuantity</i> of the <i>b2-Threshold1</i> and for the <i>MeasTriggerQuantityEUTRA</i> of the <i>b2-Threshold2EUTRA</i>.</p>
<p><b>eventId</b> Choice of inter RAT event triggered reporting criteria.</p>
<p><b>maxReportCells</b> Max number of non-serving cells to include in the measurement report.</p>
<p><b>reportAmount</b> Number of measurement reports applicable for <i>eventTriggered</i> as well as for <i>periodical</i> report types</p>
<p><b>reportOnLeave</b> Indicates whether or not the UE shall initiate the measurement reporting procedure when the leaving condition is met for a cell in <i>cellsTriggeredList</i>, as specified in 5.5.4.1.</p>
<p><b>reportQuantity, reportQuantityUTRA-FDD</b> The cell measurement quantities to be included in the measurement report. If the field <i>eventB1-UTRA-FDD</i> or <i>eventB2-UTRA-FDD</i> is present, the UE shall ignore the value(s) provided in <i>reportQuantity</i>.</p>
<p><b>timeToTrigger</b> Time during which specific criteria for the event needs to be met in order to trigger a measurement report.</p>
<p><b>bN-ThresholdUTRA-FDD</b> UTRA-FDD threshold value associated with the selected trigger quantity (RSCP, EcN0) to be used in inter RAT measurement report triggering condition for event number bN. <i>utra-FDD-RSCP</i> corresponds to CPICH_RSCP in TS 25.133 [46] for FDD. <i>utra-FDD-EcN0</i> corresponds to CPICH_Ec/No in TS 25.133 [46] for FDD. For <i>utra-FDD-RSCP</i>: The actual value is field value – 115 dBm. For <i>utra-FDD-EcN0</i>: The actual value is (field value – 49)/2 dB.</p>
<b>PeriodicalReportConfigInterRAT field descriptions</b>
<p><b>maxReportCells</b> Max number of non-serving cells to include in the measurement report.</p>
<p><b>reportAmount</b> Number of measurement reports applicable for <i>eventTriggered</i> as well as for <i>periodical</i> report types</p>
<p><b>reportQuantity, reportQuantityUTRA-FDD</b> The cell measurement quantities to be included in the measurement report. If the field <i>reportQuantityUTRA-FDD</i> is present, the UE shall ignore the value(s) provided in <i>reportQuantity</i>.</p>

## – *ReportConfigNR*

The IE *ReportConfigNR* specifies criteria for triggering of an NR measurement reporting event or of a CHO or CPC event. For events labelled AN with N equal to 1, 2 and so on, measurement reporting events and CHO or CPC events are based on cell measurement results, which can either be derived based on SS/PBCH block or CSI-RS.

Event A1: Serving becomes better than absolute threshold;

Event A2: Serving becomes worse than absolute threshold;

Event A3: Neighbour becomes amount of offset better than PCell/PSCell;

Event A4: Neighbour becomes better than absolute threshold;

Event A5: PCell/PSCell becomes worse than absolute threshold1 AND Neighbour/SCell becomes better than another absolute threshold2;

Event A6: Neighbour becomes amount of offset better than SCell;

CondEvent A3: Conditional reconfiguration candidate becomes amount of offset better than PCell/PSCell;

CondEvent A5: PCell/PSCell becomes worse than absolute threshold1 AND Conditional reconfiguration candidate becomes better than another absolute threshold2;

For event I1, measurement reporting event is based on CLI measurement results, which can either be derived based on SRS-RSRP or CLI-RSSI.

Event I1: Interference becomes higher than absolute threshold.

### ***ReportConfigNR* information element**

```
-- ASN1START
-- TAG-REPORTCONFIGNR-START

ReportConfigNR ::=
    reportType
        periodical
        eventTriggered
        . . .
    reportCGI
    reportSFTD
    condTriggerConfig-r16
    cli-Periodical-r16
    cli-EventTriggered-r16
}

SEQUENCE {
    CHOICE {
        PeriodicalReportConfig,
        EventTriggerConfig,

        ReportCGI,
        ReportSFTD-NR,
        CondTriggerConfig-r16,
        CLI-PeriodicalReportConfig-r16,
        CLI-EventTriggerConfig-r16
    }
}

ReportCGI ::=
    cellForWhichToReportCGI
        PhysCellId,
        . . .
    [[
    useAutonomousGaps-r16
    ]]
    ENUMERATED {setup} OPTIONAL -- Need R
```



```

}

ReportSFTD-NR ::=
    reportSFTD-Meas          SEQUENCE {
        reportRSRP          BOOLEAN,
        ...,
        [[
            reportSFTD-NeighMeas    ENUMERATED {true}          OPTIONAL, -- Need R
            drx-SFTD-NeighMeas      ENUMERATED {true}          OPTIONAL, -- Need R
            cellsForWhichToReportSFTD SEQUENCE (SIZE (1..maxCellSFTD)) OF PhysCellId OPTIONAL -- Need R
        ]]
    }

CondTriggerConfig-r16 ::=
    condEventId              SEQUENCE {
        CHOICE {
            condEventA3        SEQUENCE {
                a3-Offset      MeasTriggerQuantityOffset,
                hysteresis     Hysteresis,
                timeToTrigger  TimeToTrigger
            },
            condEventA5        SEQUENCE {
                a5-Threshold1  MeasTriggerQuantity,
                a5-Threshold2  MeasTriggerQuantity,
                hysteresis     Hysteresis,
                timeToTrigger  TimeToTrigger
            },
            ...
        },
        rsType-r16            NR-RS-Type,
        ...
    }

EventTriggerConfig ::=
    eventId                  SEQUENCE {
        CHOICE {
            eventA1            SEQUENCE {
                a1-Threshold   MeasTriggerQuantity,
                reportOnLeave   BOOLEAN,
                hysteresis     Hysteresis,
                timeToTrigger  TimeToTrigger
            },
            eventA2            SEQUENCE {
                a2-Threshold   MeasTriggerQuantity,
                reportOnLeave   BOOLEAN,
                hysteresis     Hysteresis,
                timeToTrigger  TimeToTrigger
            },
            eventA3            SEQUENCE {
                a3-Offset      MeasTriggerQuantityOffset,
                reportOnLeave   BOOLEAN,
                hysteresis     Hysteresis,
                timeToTrigger  TimeToTrigger,
                useWhiteCellList BOOLEAN
            },
            eventA4            SEQUENCE {

```

```

        a4-Threshold          MeasTriggerQuantity,
        reportOnLeave         BOOLEAN,
        hysteresis           Hysteresis,
        timeToTrigger        TimeToTrigger,
        useWhiteCellList     BOOLEAN
    },
    eventA5                  SEQUENCE {
        a5-Threshold1        MeasTriggerQuantity,
        a5-Threshold2        MeasTriggerQuantity,
        reportOnLeave         BOOLEAN,
        hysteresis           Hysteresis,
        timeToTrigger        TimeToTrigger,
        useWhiteCellList     BOOLEAN
    },
    eventA6                  SEQUENCE {
        a6-Offset            MeasTriggerQuantityOffset,
        reportOnLeave         BOOLEAN,
        hysteresis           Hysteresis,
        timeToTrigger        TimeToTrigger,
        useWhiteCellList     BOOLEAN
    },
    ...
},
rsType                     NR-RS-Type,
reportInterval             ReportInterval,
reportAmount               ENUMERATED {r1, r2, r4, r8, r16, r32, r64, infinity},
reportQuantityCell         MeasReportQuantity,
maxReportCells             INTEGER (1..maxCellReport),
reportQuantityRS-Indexes  MeasReportQuantity                OPTIONAL, -- Need R
maxNrofRS-IndexesToReport INTEGER (1..maxNrofIndexesToReport)  OPTIONAL, -- Need R
includeBeamMeasurements   BOOLEAN,
reportAddNeighMeas        ENUMERATED {setup}                OPTIONAL, -- Need R
...,
[[
measRSSI-ReportConfig-r16 MeasRSSI-ReportConfig-r16                OPTIONAL, -- Need R
useT312-r16                BOOLEAN                            OPTIONAL, -- Need M
includeCommonLocationInfo-r16 ENUMERATED {true}                OPTIONAL, -- Need R
includeBT-Meas-r16         SetupRelease {BT-NameList-r16}        OPTIONAL, -- Need M
includeWLAN-Meas-r16       SetupRelease {WLAN-NameList-r16}      OPTIONAL, -- Need M
includeSensor-Meas-r16     SetupRelease {Sensor-NameList-r16}    OPTIONAL, -- Need M
]]
}

PeriodicalReportConfig ::=
    rsType                     NR-RS-Type,
    reportInterval             ReportInterval,
    reportAmount               ENUMERATED {r1, r2, r4, r8, r16, r32, r64, infinity},
    reportQuantityCell         MeasReportQuantity,
    maxReportCells             INTEGER (1..maxCellReport),
    reportQuantityRS-Indexes  MeasReportQuantity                OPTIONAL, -- Need R
    maxNrofRS-IndexesToReport INTEGER (1..maxNrofIndexesToReport)  OPTIONAL, -- Need R
    includeBeamMeasurements   BOOLEAN,
    useWhiteCellList          BOOLEAN,
    ...

```

```

[[
measRSSI-ReportConfig-r16          MeasRSSI-ReportConfig-r16          OPTIONAL, -- Need R
includeCommonLocationInfo-r16     ENUMERATED {true}                    OPTIONAL, -- Need R
includeBT-Meas-r16                 SetupRelease {BT-NameList-r16}       OPTIONAL, -- Need M
includeWLAN-Meas-r16              SetupRelease {WLAN-NameList-r16}     OPTIONAL, -- Need M
includeSensor-Meas-r16            SetupRelease {Sensor-NameList-r16}   OPTIONAL, -- Need M
ul-DelayValueConfig-r16           SetupRelease { UL-DelayValueConfig-r16 } OPTIONAL, -- Need M
reportAddNeighMeas-r16            ENUMERATED {setup}                   OPTIONAL, -- Need R
]]
}

NR-RS-Type ::= ENUMERATED {ssb, csi-rs}

MeasTriggerQuantity ::= CHOICE {
  rsrp          RSRP-Range,
  rsrq          RSRQ-Range,
  sinr          SINR-Range
}

MeasTriggerQuantityOffset ::= CHOICE {
  rsrp          INTEGER (-30..30),
  rsrq          INTEGER (-30..30),
  sinr          INTEGER (-30..30)
}

MeasReportQuantity ::= SEQUENCE {
  rsrp          BOOLEAN,
  rsrq          BOOLEAN,
  sinr          BOOLEAN
}

MeasRSSI-ReportConfig-r16 ::= SEQUENCE {
  channelOccupancyThreshold-r16
}

CLI-EventTriggerConfig-r16 ::= SEQUENCE {
  eventId-r16
  eventI1-r16
  {
    i1-Threshold-r16
    reportOnLeave-r16
    hysteresis-r16
    timeToTrigger-r16
  },
  ...
},
  reportInterval-r16
  reportAmount-r16
  maxReportCLI-r16
  ...
}

CLI-PeriodicalReportConfig-r16 ::= SEQUENCE {
  reportInterval-r16

```

```

    reportAmount-r16          ENUMERATED {r1, r2, r4, r8, r16, r32, r64, infinity},
    reportQuantityCLI-r16     MeasReportQuantityCLI-r16,
    maxReportCLI-r16         INTEGER (1..maxCLI-Report-r16),
    ...
}

MeasTriggerQuantityCLI-r16 ::= CHOICE {
    srs-RSRP-r16              SRS-RSRP-Range-r16,
    cli-RSSI-r16              CLI-RSSI-Range-r16
}

MeasReportQuantityCLI-r16 ::= ENUMERATED {srs-rsrp, cli-rssi}

-- TAG-REPORTCONFIGNR-STOP
-- ASN1STOP

```

#### **CondTriggerConfig field descriptions**

##### **a3-Offset**

Offset value(s) to be used in NR conditional reconfiguration triggering condition for cond event a3. The actual value is field value \* 0.5 dB.

##### **a5-Threshold1/ a5-Threshold2**

Threshold value associated to the selected trigger quantity (e.g. RSRP, RSRQ, SINR) per RS Type (e.g. SS/PBCH block, CSI-RS) to be used in NR conditional reconfiguration triggering condition for cond event a5. In the same *condeventA5*, the network configures the same quantity for the *MeasTriggerQuantity* of the *a5-Threshold1* and for the *MeasTriggerQuantity* of the *a5-Threshold2*.

##### **condEventId**

Choice of NR conditional reconfiguration event triggered criteria.

##### **timeToTrigger**

Time during which specific criteria for the event needs to be met in order to execute the conditional reconfiguration evaluation.

#### **ReportConfigNR field descriptions**

##### **reportType**

Type of the configured measurement report. In EN-DC, network does not configure report of type *reportCGI* using SRB3. The *condTriggerConfig* is used for CHO or CPC configuration.

#### **ReportCGI field descriptions**

##### **useAutonomousGaps**

Indicates whether or not the UE is allowed to use autonomous gaps in acquiring system information from the NR neighbour cell. When the field is included, the UE applies the corresponding value for T321.

<b>EventTriggerConfig field descriptions</b>
<p><b>a3-Offset/a6-Offset</b> Offset value(s) to be used in NR measurement report triggering condition for event a3/a6. The actual value is field value * 0.5 dB.</p>
<p><b>aN-ThresholdM</b> Threshold value associated to the selected trigger quantity (e.g. RSRP, RSRQ, SINR) per RS Type (e.g. SS/PBCH block, CSI-RS) to be used in NR measurement report triggering condition for event number aN. If multiple thresholds are defined for event number aN, the thresholds are differentiated by M. The network configures aN-Threshold1 only for events A1, A2, A4, A5 and a5-Threshold2 only for event A5. In the same eventA5, the network configures the same quantity for the <i>MeasTriggerQuantity</i> of the a5-Threshold1 and for the <i>MeasTriggerQuantity</i> of the a5-Threshold2.</p>
<p><b>channelOccupancyThreshold</b> RSSI threshold which is used for channel occupancy evaluation.</p>
<p><b>eventId</b> Choice of NR event triggered reporting criteria.</p>
<p><b>maxNrofRS-IndexesToReport</b> Max number of RS indexes to include in the measurement report for A1-A6 events.</p>
<p><b>maxReportCells</b> Max number of non-serving cells to include in the measurement report.</p>
<p><b>reportAddNeighMeas</b> Indicates that the UE shall include the best neighbour cells per serving frequency.</p>
<p><b>reportAmount</b> Number of measurement reports applicable for <i>eventTriggered</i> as well as for <i>periodical</i> report types.</p>
<p><b>reportOnLeave</b> Indicates whether or not the UE shall initiate the measurement reporting procedure when the leaving condition is met for a cell in <i>cellsTriggeredList</i>, as specified in 5.5.4.1.</p>
<p><b>reportQuantityCell</b> The cell measurement quantities to be included in the measurement report.</p>
<p><b>reportQuantityRS-Indexes</b> Indicates which measurement information per RS index the UE shall include in the measurement report.</p>
<p><b>timeToTrigger</b> Time during which specific criteria for the event needs to be met in order to trigger a measurement report.</p>
<p><b>ul-DelayValueConfig</b> If the field is present, the UE shall perform the actual PDCP queuing delay measurement per DRB as specified in TS 38.314 [53] and the UE shall ignore the fields <i>reportQuantityCell</i> and <i>maxReportCells</i>. The applicable values for the corresponding <i>reportInterval</i> are (one of the) {ms120, ms240, ms480, ms640, ms1024, ms2048, ms5120, ms10240, ms20480, ms40960, min1, min6, min12, min30}. The <i>reportInterval</i> indicates the periodicity for performing and reporting of UL PDCP Delay per DRB measurement as specified in TS 38.314 [53].</p>
<p><b>useT312</b> If value <i>TRUE</i> is configured, the UE shall use the timer T312 with the value <i>t312</i> as specified in the corresponding <i>measObjectNR</i>. If value <i>FALSE</i> is configured, the timer T312 is considered as disabled. Network configures value <i>TRUE</i> only if <i>reportType</i> is set to <i>eventTriggered</i>.</p>
<p><b>useWhiteCellList</b> Indicates whether only the cells included in the white-list of the associated <i>measObject</i> are applicable as specified in 5.5.4.1.</p>

<b>CLI-EventTriggerConfig field descriptions</b>
<b><i>i1-Threshold</i></b> Threshold value associated to the selected trigger quantity (e.g. SRS-RSRP, CLI-RSSI) to be used in CLI measurement report triggering condition for event i1.
<b><i>eventId</i></b> Choice of CLI event triggered reporting criteria.
<b><i>maxReportCLI</i></b> Max number of CLI measurement resource to include in the measurement report.
<b><i>reportAmount</i></b> <i>Number</i> of measurement reports.
<b><i>reportOnLeave</i></b> Indicates whether or not the UE shall initiate the measurement reporting procedure when the leaving condition is met for a CLI measurement resource in <i>srsTriggeredList</i> or <i>rssiTriggeredList</i> , as specified in 5.5.4.1.
<b><i>timeToTrigger</i></b> Time during which specific criteria for the event needs to be met in order to trigger a measurement report.

<b>CLI-PeriodicalReportConfig field descriptions</b>
<b><i>maxReportCLI</i></b> Max number of CLI measurement resource to include in the measurement report.
<b><i>reportAmount</i></b> <i>Number</i> of measurement reports.
<b><i>reportQuantityCLI</i></b> The CLI measurement quantities to be included in the measurement report.

<b>PeriodicalReportConfig field descriptions</b>
<b><i>maxNrofRS-IndexesToReport</i></b> Max number of RS indexes to include in the measurement report.
<b><i>maxReportCells</i></b> Max number of non-serving cells to include in the measurement report.
<b><i>reportAddNeighMeas</i></b> Indicates that the UE shall include the best neighbour cells per serving frequency.
<b><i>reportAmount</i></b> <i>Number</i> of measurement reports applicable for <i>eventTriggered</i> as well as for <i>periodical</i> report types
<b><i>reportQuantityCell</i></b> The cell measurement quantities to be included in the measurement report.
<b><i>reportQuantityRS-Indexes</i></b> Indicates which measurement information per RS index the UE shall include in the measurement report.
<b><i>useWhiteCellList</i></b> Indicates whether only the cells included in the white-list of the associated measObject are applicable as specified in 5.5.4.1.

<b>ReportSFTD-NR field descriptions</b>
<b>cellForWhichToReportSFTD</b> Indicates the target NR neighbour cells for SFTD measurement between PCell and NR neighbour cells.
<b>drx-SFTD-NeighMeas</b> Indicates that the UE shall use available idle periods (i.e. DRX off periods) for the SFTD measurement in NR standalone. The network only includes <i>drx-SFTD-NeighMeas</i> field when <i>reprtSFTD-NeighMeas</i> is set to true.
<b>reportSFTD-Meas</b> Indicates whether UE is required to perform SFTD measurement between PCell and NR PSCell in NR-DC.
<b>reportSFTD-NeighMeas</b> Indicates whether UE is required to perform SFTD measurement between PCell and NR neighbour cells in NR standalone. The network does not include this field if <i>reportSFTD-Meas</i> is set to <i>true</i> .
<b>reportRSRP</b> Indicates whether UE is required to include RSRP result of NR PSCell or NR neighbour cells in SFTD measurement result, derived based on SSB. If it is set to true, the network should ensure that <i>ssb-ConfigMobility</i> is included in the measurement object for NR PSCell or NR neighbour cells.
<b>other field descriptions</b>
<b>MeasTriggerQuantity</b> SINR is applicable only for CONNECTED mode events.

## – *ReportConfigNR-SL*

The IE *ReportConfigNR-SL* specifies criteria for triggering of a CBR measurement reporting event for NR sidelink communication. Measurement reporting events are based on CBR measurement results on the corresponding transmission resource pools. These events are labelled CN with N equal to 1 and 2.

Event C1: CBR of NR sidelink communication becomes better than absolute threshold;

Event C2: CBR of NR sidelink communication becomes worse than absolute threshold;

### **ReportConfigNR-SL information element**

```
-- ASN1START
-- TAG-REPORTCONFIGNR-SL-START

ReportConfigNR-SL-r16 ::=
    SEQUENCE {
        reportType-r16          CHOICE {
            periodical-r16     PeriodicalReportConfigNR-SL-r16,
            eventTriggered-r16  EventTriggerConfigNR-SL-r16
        }
    }

EventTriggerConfigNR-SL-r16 ::=
    SEQUENCE {
        eventId-r16            CHOICE {
            eventC1            SEQUENCE {
                c1-Threshold-r16  SL-CBR-r16,
                hysteresis-r16    Hysteresis,
                timeToTrigger-r16 TimeToTrigger
            }
        }
    }
```

```

    },
    eventC2-r16          SEQUENCE {
        c2-Threshold-r16  SL-CBR-r16,
        hysteresis-r16    Hysteresis,
        timeToTrigger-r16 TimeToTrigger
    },
    ...
},
reportInterval-r16      ReportInterval,
reportAmount-r16       ENUMERATED {r1, r2, r4, r8, r16, r32, r64, infinity},
reportQuantity-r16     MeasReportQuantity-r16,
...
}

PeriodicalReportConfigNR-SL-r16 ::= SEQUENCE {
    reportInterval-r16      ReportInterval,
    reportAmount-r16       ENUMERATED {r1, r2, r4, r8, r16, r32, r64, infinity},
    reportQuantity-r16     MeasReportQuantity-r16,
    ...
}

MeasReportQuantity-r16 ::= SEQUENCE {
    cbr-r16                BOOLEAN,
    ...
}

-- TAG-REPORTCONFIGNR-SL-STOP
-- ASN1STOP

```

<b>ReportConfigNR-SL field descriptions</b>
<p><b>reportType</b> Type of the configured CBR measurement report for NR sidelink communication.</p>

<b>EventTriggerConfig field descriptions</b>
<p><b>cN-Threshold</b> Threshold used for events C1 and C2 specified in subclauses 5.5.4.11 and 5.5.4.12, respectively.</p>
<p><b>eventId</b> Choice of NR event triggered reporting criteria.</p>
<p><b>reportAmount</b> Number of measurement reports applicable for <i>eventTriggered</i> as well as for <i>periodical</i> report types.</p>
<p><b>reportQuantity</b> The sidelink measurement quantities to be included in the measurement report. In this release, this is set as the CBR measurement result.</p>
<p><b>timeToTrigger</b> Time during which specific criteria for the event needs to be met in order to trigger a measurement report.</p>
<p><b>SL-CBR</b> Value 0 corresponds to 0, value 1 to 0.01, value 2 to 0.02, and so on.</p>



<i>PeriodicalReportConfigNR-SL</i> field descriptions	
<b>reportAmount</b>	Number of measurement reports applicable for <i>eventTriggered</i> as well as for <i>periodical</i> report types.
<b>reportQuantity</b>	The sidelink measurement quantities to be included in the measurement report. In this release, this is set as the CBR measurement result.

## – *ReportConfigToAddModList*

The IE *ReportConfigToAddModList* concerns a list of reporting configurations to add or modify.

### **ReportConfigToAddModList information element**

```
-- ASN1START
-- TAG-REPORTCONFIGTOADDMODLIST-START

ReportConfigToAddModList ::=          SEQUENCE (SIZE (1..maxReportConfigId)) OF ReportConfigToAddMod

ReportConfigToAddMod ::=              SEQUENCE {
    reportConfigId                      ReportConfigId,
    reportConfig                         CHOICE {
        reportConfigNR                  ReportConfigNR,
        . . . ,
        reportConfigInterRAT            ReportConfigInterRAT,
        reportConfigNR-SL-r16           ReportConfigNR-SL-r16
    }
}

-- TAG-REPORTCONFIGTOADDMODLIST-STOP
-- ASN1STOP
```

## – *ReportInterval*

The IE *ReportInterval* indicates the interval between periodical reports. The *ReportInterval* is applicable if the UE performs periodical reporting (i.e. when *reportAmount* exceeds 1), for *triggerTypeevent* as well as for *triggerTypeperiodical*. Value *ms120* corresponds to 120 ms, value *ms240* corresponds to 240 ms and so on, while value *min1* corresponds to 1 min, *min6* corresponds to 6 min and so on.

### **ReportInterval information element**

```
-- ASN1START
-- TAG-REPORTINTERVAL-START

ReportInterval ::=                    ENUMERATED {ms120, ms240, ms480, ms640, ms1024, ms2048, ms5120, ms10240, ms20480, ms40960,
                                                min1,min6, min12, min30 }

-- TAG-REPORTINTERVAL-STOP
-- ASN1STOP
```

## – *ReselectionThreshold*

The IE *ReselectionThreshold* is used to indicate an Rx level threshold for cell reselection. Actual value of threshold = field value \* 2 [dB].

### ***ReselectionThreshold* information element**

```
-- ASN1START
-- TAG-RESELECTIONTHRESHOLD-START

ReselectionThreshold ::=                INTEGER (0..31)

-- TAG-RESELECTIONTHRESHOLD-STOP
-- ASN1STOP
```

## – *ReselectionThresholdQ*

The IE *ReselectionThresholdQ* is used to indicate a quality level threshold for cell reselection. Actual value of threshold = field value [dB].

### ***ReselectionThresholdQ* information element**

```
-- ASN1START
-- TAG-RESELECTIONTHRESHOLDQ-START

ReselectionThresholdQ ::=              INTEGER (0..31)

-- TAG-RESELECTIONTHRESHOLDQ-STOP
-- ASN1STOP
```

## – *ResumeCause*

The IE *ResumeCause* is used to indicate the resume cause in *RRCResumeRequest* and *RRCResumeRequest1*.

### ***ResumeCause* information element**

```
-- ASN1START
-- TAG-RESUMECAUSE-START

ResumeCause ::=                        ENUMERATED {emergency, highPriorityAccess, mt-Access, mo-Signalling,
mo-Data, mo-VoiceCall, mo-VideoCall, mo-SMS, rna-Update, mps-PriorityAccess,
mcs-PriorityAccess, spare1, spare2, spare3, spare4, spare5 }

-- TAG-RESUMECAUSE-STOP
-- ASN1STOP
```

## – RLC-BearerConfig

The IE *RLC-BearerConfig* is used to configure an RLC entity, a corresponding logical channel in MAC and the linking to a PDCP entity (served radio bearer).

### RLC-BearerConfig information element

```

-- ASN1START
-- TAG-RLC-BEARERCONFIG-START

RLC-BearerConfig ::=
    logicalChannelIdentity          SEQUENCE {
        servedRadioBearer          CHOICE {
            srb-Identity           SRB-Identity,
            drb-Identity           DRB-Identity
        }
        reestablishRLC             ENUMERATED {true}
        rlc-Config                 RLC-Config
        mac-LogicalChannelConfig   LogicalChannelConfig
        ...
        [[
            rlc-Config-v1610       RLC-Config-v1610
        ]]
    }

-- TAG-RLC-BEARERCONFIG-STOP
-- ASN1STOP
OPTIONAL, -- Cond LCH-SetupOnly
OPTIONAL, -- Need N
OPTIONAL, -- Cond LCH-Setup
OPTIONAL, -- Cond LCH-Setup
OPTIONAL  -- Need R

```

#### RLC-BearerConfig field descriptions

##### **logicalChannelIdentity**

ID used commonly for the MAC logical channel and for the RLC bearer.

##### **reestablishRLC**

Indicates that RLC should be re-established. Network sets this to *true* at least whenever the security key used for the radio bearer associated with this RLC entity changes. For SRB2 and DRBs, it is also set to *true* during the resumption of the RRC connection or the first reconfiguration after reestablishment.

##### **rlc-Config**

Determines the RLC mode (UM, AM) and provides corresponding parameters. RLC mode reconfiguration can only be performed by DRB release/addition or full configuration. The network may configure *rlc-Config-v1610* only when *rlc-Config* (without suffix) is set to *am*.

##### **servedRadioBearer**

Associates the RLC Bearer with an SRB or a DRB. The UE shall deliver DL RLC SDUs received via the RLC entity of this RLC bearer to the PDCP entity of the *servedRadioBearer*. Furthermore, the UE shall advertise and deliver uplink PDCP PDUs of the uplink PDCP entity of the *servedRadioBearer* to the uplink RLC entity of this RLC bearer unless the uplink scheduling restrictions (*moreThanOneRLC* in *PDCP-Config* and the restrictions in *LogicalChannelConfig*) forbid it to do so.

Conditional Presence	Explanation
<i>LCH-Setup</i>	This field is mandatory present upon creation of a new logical channel for a DRB. This field is optionally present, Need S, upon creation of a new logical channel for an SRB. It is optionally present, Need M, otherwise.
<i>LCH-SetupOnly</i>	This field is mandatory present upon creation of a new logical channel. It is absent, Need M otherwise.

## – *RLC-Config*

The IE *RLC-Config* is used to specify the RLC configuration of SRBs and DRBs.

### *RLC-Config* information element

```

-- ASN1START
-- TAG-RLC-CONFIG-START

RLC-Config ::=
    CHOICE {
        am
            SEQUENCE {
                ul-AM-RLC
                dl-AM-RLC
            },
        um-Bi-Directional
            SEQUENCE {
                ul-UM-RLC
                dl-UM-RLC
            },
        um-Uni-Directional-UL
            SEQUENCE {
                ul-UM-RLC
            },
        um-Uni-Directional-DL
            SEQUENCE {
                dl-UM-RLC
            },
        ...
    }

UL-AM-RLC ::=
    SEQUENCE {
        sn-FieldLength
        t-PollRetransmit
        pollPDU
        pollByte
        maxRetxThreshold
    }
    OPTIONAL, -- Cond Reestab

DL-AM-RLC ::=
    SEQUENCE {
        sn-FieldLength
        t-Reassembly
        t-StatusProhibit
    }
    OPTIONAL, -- Cond Reestab

UL-UM-RLC ::=
    SEQUENCE {
        sn-FieldLength
    }
    OPTIONAL -- Cond Reestab

```

```

DL-UM-RLC ::=
    sn-FieldLength
    t-Reassembly
}

T-PollRetransmit ::=
    ENUMERATED {
        ms5, ms10, ms15, ms20, ms25, ms30, ms35,
        ms40, ms45, ms50, ms55, ms60, ms65, ms70,
        ms75, ms80, ms85, ms90, ms95, ms100, ms105,
        ms110, ms115, ms120, ms125, ms130, ms135,
        ms140, ms145, ms150, ms155, ms160, ms165,
        ms170, ms175, ms180, ms185, ms190, ms195,
        ms200, ms205, ms210, ms215, ms220, ms225,
        ms230, ms235, ms240, ms245, ms250, ms300,
        ms350, ms400, ms450, ms500, ms800, ms1000,
        ms2000, ms4000, msl-v1610, ms2-v1610, ms3-v1610,
        ms4-v1610, spare1}

PollPDU ::=
    ENUMERATED {
        p4, p8, p16, p32, p64, p128, p256, p512, p1024, p2048, p4096, p6144, p8192, p12288, p16384, p20480,
        p24576, p28672, p32768, p40960, p49152, p57344, p65536, infinity, spare8, spare7, spare6, spare5, spare4,
        spare3, spare2, spare1}

PollByte ::=
    ENUMERATED {
        kB1, kB2, kB5, kB8, kB10, kB15, kB25, kB50, kB75,
        kB100, kB125, kB250, kB375, kB500, kB750, kB1000,
        kB1250, kB1500, kB2000, kB3000, kB4000, kB4500,
        kB5000, kB5500, kB6000, kB6500, kB7000, kB7500,
        mB8, mB9, mB10, mB11, mB12, mB13, mB14, mB15,
        mB16, mB17, mB18, mB20, mB25, mB30, mB40, infinity,
        spare20, spare19, spare18, spare17, spare16,
        spare15, spare14, spare13, spare12, spare11,
        spare10, spare9, spare8, spare7, spare6, spare5,
        spare4, spare3, spare2, spare1}

T-Reassembly ::=
    ENUMERATED {
        ms0, ms5, ms10, ms15, ms20, ms25, ms30, ms35,
        ms40, ms45, ms50, ms55, ms60, ms65, ms70,
        ms75, ms80, ms85, ms90, ms95, ms100, ms110,
        ms120, ms130, ms140, ms150, ms160, ms170,
        ms180, ms190, ms200, spare1}

T-StatusProhibit ::=
    ENUMERATED {
        ms0, ms5, ms10, ms15, ms20, ms25, ms30, ms35,
        ms40, ms45, ms50, ms55, ms60, ms65, ms70,
        ms75, ms80, ms85, ms90, ms95, ms100, ms105,
        ms110, ms115, ms120, ms125, ms130, ms135,
        ms140, ms145, ms150, ms155, ms160, ms165,
        ms170, ms175, ms180, ms185, ms190, ms195,
        ms200, ms205, ms210, ms215, ms220, ms225,
        ms230, ms235, ms240, ms245, ms250, ms300,
        ms350, ms400, ms450, ms500, ms800, ms1000,
        ms1200, ms1600, ms2000, ms2400, spare2, spare1}

```

```

SN-FieldLengthUM ::=          ENUMERATED {size6, size12}
SN-FieldLengthAM ::=          ENUMERATED {size12, size18}

RLC-Config-v1610 ::=          SEQUENCE {
    dl-AM-RLC-v1610            DL-AM-RLC-v1610
}

DL-AM-RLC-v1610 ::=          SEQUENCE {
    t-StatusProhibit-v1610    T-StatusProhibit-v1610                OPTIONAL,  -- Need N
    ...
}

T-StatusProhibit-v1610 ::=    ENUMERATED { ms1, ms2, ms3, ms4, spare4, spare3, spare2, spare1}

-- TAG-RLC-CONFIG-STOP
-- ASN1STOP

```

#### RLC-Config field descriptions

<b>maxRetxThreshold</b>
Parameter for RLC AM in TS 38.322 [4]. Value <i>t1</i> corresponds to 1 retransmission, value <i>t2</i> corresponds to 2 retransmissions and so on.
<b>pollByte</b>
Parameter for RLC AM in TS 38.322 [4]. Value <i>kB25</i> corresponds to 25 kBytes, value <i>kB50</i> corresponds to 50 kBytes and so on. <i>infinity</i> corresponds to an infinite amount of kBytes.
<b>pollPDU</b>
Parameter for RLC AM in TS 38.322 [4]. Value <i>p4</i> corresponds to 4 PDUs, value <i>p8</i> corresponds to 8 PDUs and so on. <i>infinity</i> corresponds to an infinite number of PDUs.
<b>sn-FieldLength</b>
Indicates the RLC SN field size, see TS 38.322 [4], in bits. Value <i>size6</i> means 6 bits, value <i>size12</i> means 12 bits, value <i>size18</i> means 18 bits. The value of <i>sn-FieldLength</i> for a DRB shall be changed only using reconfiguration with sync. The network configures only value <i>size12</i> in <i>SN-FieldLengthAM</i> for SRB.
<b>t-PollRetransmit</b>
Timer for RLC AM in TS 38.322 [4], in milliseconds. Value <i>ms5</i> means 5 ms, value <i>ms10</i> means 10 ms and so on.
<b>t-Reassembly</b>
Timer for reassembly in TS 38.322 [4], in milliseconds. Value <i>ms0</i> means 0 ms, value <i>ms5</i> means 5 ms and so on.
<b>t-StatusProhibit</b>
Timer for status reporting in TS 38.322 [4], in milliseconds. Value <i>ms0</i> means 0 ms, value <i>ms5</i> means 5 ms and so on. If <i>t-StatusProhibit-v1610</i> is present, the UE shall ignore <i>t-StatusProhibit</i> (without suffix).

Conditional Presence	Explanation
<i>Reestab</i>	The field is mandatory present at bearer setup. It is optionally present, need M, at RLC re-establishment. Otherwise it is absent. Need M.

#### – RLF-TimersAndConstants

The IE *RLF-TimersAndConstants* is used to configure UE specific timers and constants.

**RLF-TimersAndConstants information element**

```

-- ASN1START
-- TAG-RLF-TIMERSANDCONSTANTS-START

RLF-TimersAndConstants ::=          SEQUENCE {
    t310                             ENUMERATED {ms0, ms50, ms100, ms200, ms500, ms1000, ms2000, ms4000, ms6000},
    n310                             ENUMERATED {n1, n2, n3, n4, n6, n8, n10, n20},
    n311                             ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10},
    . . . ,
    [[
    t311                             ENUMERATED {ms1000, ms3000, ms5000, ms10000, ms15000, ms20000, ms30000}
    ]]
}

-- TAG-RLF-TIMERSANDCONSTANTS-STOP
-- ASN1STOP

```

**RLF-TimersAndConstants field descriptions*****n3xy***

Constants are described in clause 7.3. Value *n1* corresponds to 1, value *n2* corresponds to 2 and so on.

***t3xy***

Timers are described in clause 7.1. Value *ms0* corresponds to 0 ms, value *ms50* corresponds to 50 ms and so on.

– ***RNTI-Value***

The IE *RNTI-Value* represents a Radio Network Temporary Identity.

***RNTI-Value* information element**

```

-- ASN1START
-- TAG-RNTI-VALUE-START

RNTI-Value ::=                      INTEGER (0..65535)

-- TAG-RNTI-VALUE-STOP
-- ASN1STOP

```

– ***RSRP-Range***

The IE *RSRP-Range* specifies the value range used in RSRP measurements and thresholds. For measurements, integer value for RSRP measurements is according to Table 10.1.6.1-1 in TS 38.133 [14]. For thresholds, the actual value is (IE value – 156) dBm, except for the IE value 127, in which case the actual value is infinity.

***RSRP-Range*** information element

```

-- ASN1START
-- TAG-RSRP-RANGE-START

RSRP-Range ::=
    INTEGER(0..127)

-- TAG-RSRP-RANGE-STOP
-- ASN1STOP

```

– ***RSRQ-Range***

The IE *RSRQ-Range* specifies the value range used in RSRQ measurements and thresholds. For measurements, integer value for RSRQ measurements is according to Table 10.1.11.1-1 in TS 38.133 [14]. For thresholds, the actual value is (IE value – 87) / 2 dB.

***RSRQ-Range*** information element

```

-- ASN1START
-- TAG-RSRQ-RANGE-START

RSRQ-Range ::=
    INTEGER(0..127)

-- TAG-RSRQ-RANGE-STOP
-- ASN1STOP

```

– ***RSSI-Range***

The IE *RSSI-Range* specifies the value range used in RSSI measurements and thresholds for NR operation with shared spectrum channel access. The integer value for RSSI measurements is derived from the mapping table as defined in in TS 38.133 [14].

***RSSI-Range*** information element

```

-- ASN1START
-- TAG-RSSI-RANGE-START

RSSI-Range-r16 ::=
    INTEGER(0..76)

-- TAG-RSSI-RANGE-STOP
-- ASN1STOP

```

– ***SCellIndex***

The IE *SCellIndex* concerns a short identity, used to identify an SCell or PSCell. The value range is shared across the Cell Groups.



**SCellIndex** information element

```

-- ASN1START
-- TAG-SCCELLINDEX-START

SCellIndex ::=
    INTEGER (1..31)

-- TAG-SCCELLINDEX-STOP
-- ASN1STOP

```

– **SchedulingRequestConfig**

The IE *SchedulingRequestConfig* is used to configure the parameters, for the dedicated scheduling request (SR) resources.

**SchedulingRequestConfig** information element

```

-- ASN1START
-- TAG-SCHEDULINGREQUESTCONFIG-START

SchedulingRequestConfig ::=
    SEQUENCE {
        schedulingRequestToAddModList
            SEQUENCE (SIZE (1..maxNrofSR-ConfigPerCellGroup)) OF SchedulingRequestToAddMod
            OPTIONAL, -- Need N
        schedulingRequestToReleaseList
            SEQUENCE (SIZE (1..maxNrofSR-ConfigPerCellGroup)) OF SchedulingRequestId
            OPTIONAL -- Need N
    }

SchedulingRequestToAddMod ::=
    SEQUENCE {
        schedulingRequestId
            SchedulingRequestId,
        sr-ProhibitTimer
            ENUMERATED {ms1, ms2, ms4, ms8, ms16, ms32, ms64, ms128}
            OPTIONAL, -- Need S
        sr-TransMax
            ENUMERATED {n4, n8, n16, n32, n64, spare3, spare2, spare1}
    }

-- TAG-SCHEDULINGREQUESTCONFIG-STOP
-- ASN1STOP

```

**SchedulingRequestConfig** field descriptions**schedulingRequestToAddModList**

List of Scheduling Request configurations to add or modify.

**schedulingRequestToReleaseList**

List of Scheduling Request configurations to release.

<b>SchedulingRequestToAddMod field descriptions</b>
<p><b>schedulingRequestId</b> Used to modify a SR configuration and to indicate, in <i>LogicalChannelConfig</i>, the SR configuration to which a logical channel is mapped and to indicate, in <i>SchedulingRequestResourceConfig</i>, the SR configuration for which a scheduling request resource is used.</p>
<p><b>sr-ProhibitTimer</b> Timer for SR transmission on PUCCH in TS 38.321 [3]. Value is in ms. Value <i>ms1</i> corresponds to 1ms, value <i>ms2</i> corresponds to 2ms, and so on. When the field is absent, the UE applies the value 0.</p>
<p><b>sr-TransMax</b> Maximum number of SR transmissions as described in TS 38.321 [3]. Value <i>n4</i> corresponds to 4, value <i>n8</i> corresponds to 8, and so on.</p>

## – SchedulingRequestId

The IE *SchedulingRequestId* is used to identify a Scheduling Request instance in the MAC layer.

### **SchedulingRequestId information element**

```
-- ASN1START
-- TAG-SCHEDULINGREQUESTID-START

SchedulingRequestId ::=          INTEGER (0..7)

-- TAG-SCHEDULINGREQUESTID-STOP
-- ASN1STOP
```

## – SchedulingRequestResourceConfig

The IE *SchedulingRequestResourceConfig* determines physical layer resources on PUCCH where the UE may send the dedicated scheduling request (D-SR) (see TS 38.213 [13], clause 9.2.4).

### **SchedulingRequestResourceConfig information element**

```
-- ASN1START
-- TAG-SCHEDULINGREQUESTRESOURCECONFIG-START

SchedulingRequestResourceConfig ::= SEQUENCE {
    schedulingRequestResourceId      SchedulingRequestResourceId,
    schedulingRequestID              SchedulingRequestId,
    periodicityAndOffset             CHOICE {
        sym2                        NULL,
        sym6or7                     NULL,
        s11                          NULL, -- Recurs in every slot
        s12                          INTEGER (0..1),
        s14                          INTEGER (0..3),
        s15                          INTEGER (0..4),
        s18                          INTEGER (0..7),
        s110                         INTEGER (0..9),
    }
}
```

```

    s116                INTEGER (0..15),
    s120                INTEGER (0..19),
    s140                INTEGER (0..39),
    s180                INTEGER (0..79),
    s1160               INTEGER (0..159),
    s1320               INTEGER (0..319),
    s1640               INTEGER (0..639)
  }
  resource              PUCCH-ResourceId OPTIONAL, -- Need M
                       OPTIONAL        -- Need M
}

SchedulingRequestResourceConfig-v1610 ::= SEQUENCE {
  phy-PriorityIndex-r16 ENUMERATED {p0, p1} OPTIONAL, -- Need M
  ...
}

-- TAG-SCHEDULINGREQUESTRESOURCECONFIG-STOP
-- ASN1STOP

```

#### ***SchedulingRequestResourceConfig* field descriptions**

##### ***periodicityAndOffset***

SR periodicity and offset in number of symbols or slots (see TS 38.213 [13], clause 9.2.4) The following periodicities may be configured depending on the chosen subcarrier spacing:

SCS = 15 kHz: 2sym, 7sym, 1sl, 2sl, 4sl, 5sl, 8sl, 10sl, 16sl, 20sl, 40sl, 80sl

SCS = 30 kHz: 2sym, 7sym, 1sl, 2sl, 4sl, 8sl, 10sl, 16sl, 20sl, 40sl, 80sl, 160sl

SCS = 60 kHz: 2sym, 7sym/6sym, 1sl, 2sl, 4sl, 8sl, 16sl, 20sl, 40sl, 80sl, 160sl, 320sl

SCS = 120 kHz: 2sym, 7sym, 1sl, 2sl, 4sl, 8sl, 16sl, 40sl, 80sl, 160sl, 320sl, 640sl

sym6or7 corresponds to 6 symbols if extended cyclic prefix and a SCS of 60 kHz are configured, otherwise it corresponds to 7 symbols.

For periodicities 2sym, 7sym and sl1 the UE assumes an offset of 0 slots.

##### ***phy-PriorityIndex***

Indicates whether this scheduling request resource is *high* or *low* priority in PHY prioritization/multiplexing handling (see TS 38.213 [13], clause 9.2.4). Value *p0* indicates low priority and value *p1* indicates high priority.

##### ***resource***

ID of the PUCCH resource in which the UE shall send the scheduling request. The actual *PUCCH-Resource* is configured in *PUCCH-Config* of the same UL BWP and serving cell as this *SchedulingRequestResourceConfig*. The network configures a *PUCCH-Resource* of *PUCCH-format0* or *PUCCH-format1* (other formats not supported) (see TS 38.213 [13], clause 9.2.4)

##### ***schedulingRequestID***

The ID of the *SchedulingRequestConfig* that uses this scheduling request resource.

#### – ***SchedulingRequestResourceId***

The IE *SchedulingRequestResourceId* is used to identify scheduling request resources on PUCCH.

#### ***SchedulingRequestResourceId* information element**

-- ASN1START

```
-- TAG-SCHEDULINGREQUESTRESOURCEID-START
SchedulingRequestResourceId ::=      INTEGER (1..maxNrofSR-Resources)
-- TAG-SCHEDULINGREQUESTRESOURCEID-STOP
-- ASN1STOP
```

## – *ScramblingId*

The IE *ScramblingID* is used for scrambling channels and reference signals.

### ***ScramblingId* information element**

```
-- ASN1START
-- TAG-SCRAMBLINGID-START
ScramblingId ::=                      INTEGER(0..1023)
-- TAG-SCRAMBLINGID-STOP
-- ASN1STOP
```

## – *SCS-SpecificCarrier*

The IE *SCS-SpecificCarrier* provides parameters determining the location and width of the actual carrier or the carrier bandwidth. It is defined specifically for a numerology (subcarrier spacing (SCS)) and in relation (frequency offset) to Point A.

### ***SCS-SpecificCarrier* information element**

```
-- ASN1START
-- TAG-SCS-SPECIFICCARRIER-START
SCS-SpecificCarrier ::=                SEQUENCE {
  offsetToCarrier                      INTEGER (0..2199),
  subcarrierSpacing                    SubcarrierSpacing,
  carrierBandwidth                     INTEGER (1..maxNrofPhysicalResourceBlocks),
  ...,
  [[
  txDirectCurrentLocation              INTEGER (0..4095)                OPTIONAL          -- Need S
  ]]
}
-- TAG-SCS-SPECIFICCARRIER-STOP
-- ASN1STOP
```

<b>SCS-SpecificCarrier field descriptions</b>
<p><b>carrierBandwidth</b> Width of this carrier in number of PRBs (using the <i>subcarrierSpacing</i> defined for this carrier) (see TS 38.211 [16], clause 4.4.2).</p>
<p><b>offsetToCarrier</b> Offset in frequency domain between Point A (lowest subcarrier of common RB 0) and the lowest usable subcarrier on this carrier in number of PRBs (using the <i>subcarrierSpacing</i> defined for this carrier). The maximum value corresponds to 275*8-1. See TS 38.211 [16], clause 4.4.2.</p>
<p><b>txDirectCurrentLocation</b> Indicates the downlink Tx Direct Current location for the carrier. A value in the range 0..3299 indicates the subcarrier index within the carrier. The values in the value range 3301..4095 are reserved and ignored by the UE. If this field is absent for downlink within <i>ServingCellConfigCommon</i> and <i>ServingCellConfigCommonSIB</i>, the UE assumes the default value of 3300 (i.e. "Outside the carrier"). (see TS 38.211 [16], clause 4.4.2). Network does not configure this field via <i>ServingCellConfig</i> or for uplink carriers.</p>
<p><b>subcarrierSpacing</b> Subcarrier spacing of this carrier. It is used to convert the <i>offsetToCarrier</i> into an actual frequency. Only the values 15 kHz, 30 kHz or 60 kHz (FR1), and 60 kHz or 120 kHz (FR2) are applicable.</p>

## – SDAP-Config

The IE *SDAP-Config* is used to set the configurable SDAP parameters for a data radio bearer. All configured instances of *SDAP-Config* with the same value of *pdu-Session* correspond to the same SDAP entity as specified in TS 37.324 [24].

### **SDAP-Config information element**

```

-- ASN1START
-- TAG-SDAP-CONFIG-START

SDAP-Config ::=
    pdu-Session
    sdap-HeaderDL
    sdap-HeaderUL
    defaultDRB
    mappedQoS-FlowsToAdd
    mappedQoS-FlowsToRelease
    ...
}

QFI ::=
    INTEGER (0..maxQFI)

PDU-SessionID ::=
    INTEGER (0..255)

-- TAG-SDAP-CONFIG-STOP
-- ASN1STOP

```

<b>SDAP-Config field descriptions</b>
<p><b>defaultDRB</b> Indicates whether or not this is the default DRB for this PDU session. Among all configured instances of <i>SDAP-Config</i> with the same value of <i>pdu-Session</i>, this field shall be set to <i>true</i> in at most one instance of <i>SDAP-Config</i> and to <i>false</i> in all other instances.</p>
<p><b>mappedQoS-FlowsToAdd</b> Indicates the list of QFIs of UL QoS flows of the PDU session to be additionally mapped to this DRB. A QFI value can be included at most once in all configured instances of <i>SDAP-Config</i> with the same value of <i>pdu-Session</i>. For QoS flow remapping, the QFI value of the remapped QoS flow is only included in <i>mappedQoS-FlowsToAdd</i> in <i>sdap-Config</i> corresponding to the new DRB and not included in <i>mappedQoS-FlowsToRelease</i> in <i>sdap-Config</i> corresponding to the old DRB.</p>
<p><b>mappedQoS-FlowsToRelease</b> Indicates the list of QFIs of QoS flows of the PDU session to be released from existing QoS flow to DRB mapping of this DRB.</p>
<p><b>pdu-Session</b> Identity of the PDU session whose QoS flows are mapped to the DRB.</p>
<p><b>sdap-HeaderUL</b> Indicates whether or not a SDAP header is present for UL data on this DRB. The field cannot be changed after a DRB is established. The network sets this field to <i>present</i> if the field <i>defaultDRB</i> is set to <i>true</i>.</p>
<p><b>sdap-HeaderDL</b> Indicates whether or not a SDAP header is present for DL data on this DRB. The field cannot be changed after a DRB is established.</p>

## – SearchSpace

The IE *SearchSpace* defines how/where to search for PDCCH candidates. Each search space is associated with one *ControlResourceSet*. For a scheduled cell in the case of cross carrier scheduling, except for *nrofCandidates*, all the optional fields are absent (regardless of their presence conditions).

### SearchSpace information element

```
-- ASN1START
-- TAG-SEARCHSPACE-START

SearchSpace ::=
    searchSpaceId
    controlResourceSetId
    monitoringSlotPeriodicityAndOffset
    s11
    s12
    s14
    s15
    s18
    s110
    s116
    s120
    s140
    s180
    s1160
    s1320
    s1640
    s11280
    s12560
    }

SEQUENCE {
    SearchSpaceId,
    ControlResourceSetId
    CHOICE {
        NULL,
        INTEGER (0..1),
        INTEGER (0..3),
        INTEGER (0..4),
        INTEGER (0..7),
        INTEGER (0..9),
        INTEGER (0..15),
        INTEGER (0..19),
        INTEGER (0..39),
        INTEGER (0..79),
        INTEGER (0..159),
        INTEGER (0..319),
        INTEGER (0..639),
        INTEGER (0..1279),
        INTEGER (0..2559)
    }
}

OPTIONAL, -- Cond SetupOnly
OPTIONAL, -- Cond Setup
```

duration	INTEGER (2..2559)	OPTIONAL,	-- Need R
monitoringSymbolsWithinSlot	BIT STRING (SIZE (14))	OPTIONAL,	-- Cond Setup
nrofCandidates	SEQUENCE {		
aggregationLevel1	ENUMERATED {n0, n1, n2, n3, n4, n5, n6, n8},		
aggregationLevel2	ENUMERATED {n0, n1, n2, n3, n4, n5, n6, n8},		
aggregationLevel4	ENUMERATED {n0, n1, n2, n3, n4, n5, n6, n8},		
aggregationLevel8	ENUMERATED {n0, n1, n2, n3, n4, n5, n6, n8},		
aggregationLevel16	ENUMERATED {n0, n1, n2, n3, n4, n5, n6, n8}		
}		OPTIONAL,	-- Cond Setup
searchSpaceType	CHOICE {		
common	SEQUENCE {		
dci-Format0-0-AndFormat1-0	SEQUENCE {		
...			
}		OPTIONAL,	-- Need R
dci-Format2-0	SEQUENCE {		
nrofCandidates-SFI	SEQUENCE {		
aggregationLevel1	ENUMERATED {n1, n2}	OPTIONAL,	-- Need R
aggregationLevel2	ENUMERATED {n1, n2}	OPTIONAL,	-- Need R
aggregationLevel4	ENUMERATED {n1, n2}	OPTIONAL,	-- Need R
aggregationLevel8	ENUMERATED {n1, n2}	OPTIONAL,	-- Need R
aggregationLevel16	ENUMERATED {n1, n2}	OPTIONAL,	-- Need R
},			
...			
}		OPTIONAL,	-- Need R
dci-Format2-1	SEQUENCE {		
...			
}		OPTIONAL,	-- Need R
dci-Format2-2	SEQUENCE {		
...			
}		OPTIONAL,	-- Need R
dci-Format2-3	SEQUENCE {		
dummy1	ENUMERATED {s11, s12, s14, s15, s18, s110, s116, s120}	OPTIONAL,	-- Cond Setup
dummy2	ENUMERATED {n1, n2},		
...			
}		OPTIONAL,	-- Need R
},			
ue-Specific	SEQUENCE {		
dci-Formats	ENUMERATED {formats0-0-And-1-0, formats0-1-And-1-1},		
...			
[[			
dci-Formats-MT-r16	ENUMERATED {formats2-5}	OPTIONAL,	-- Need R
dci-FormatsSL-r16	ENUMERATED {formats0-0-And-1-0, formats0-1-And-1-1, formats3-0, formats3-1, formats3-0-And-3-1}	OPTIONAL,	-- Need R
dci-FormatsExt-r16	ENUMERATED {formats0-2-And-1-2, formats0-1-And-1-1And-0-2-And-1-2}	OPTIONAL,	-- Need R
]]			
}		OPTIONAL,	-- Cond Setup2
}			
SearchSpaceExt-r16 ::=	SEQUENCE {		
controlResourceSetId-r16	ControlResourceSetId-r16	OPTIONAL,	-- Cond SetupOnly2
searchSpaceType-r16	SEQUENCE {		
common-r16	SEQUENCE {		

<pre> dci-Format2-4-r16   nrofCandidates-CI-r16     aggregationLevel1-r16     aggregationLevel2-r16     aggregationLevel4-r16     aggregationLevel8-r16     aggregationLevel16-r16   },   ... } dci-Format2-5-r16   nrofCandidates-IAB-r16     aggregationLevel1-r16     aggregationLevel2-r16     aggregationLevel4-r16     aggregationLevel8-r16     aggregationLevel16-r16   },   ... } dci-Format2-6-r16   ... } } searchSpaceGroupIdList-r16 freqMonitorLocations-r16 } </pre>	<pre> SEQUENCE {   SEQUENCE {     ENUMERATED {n1, n2}     ENUMERATED {n1, n2}     ENUMERATED {n1, n2}     ENUMERATED {n1, n2}     ENUMERATED {n1, n2}   } }  SEQUENCE {   SEQUENCE {     ENUMERATED {n1, n2}     ENUMERATED {n1, n2}     ENUMERATED {n1, n2}     ENUMERATED {n1, n2}     ENUMERATED {n1, n2}   } }  SEQUENCE { }  SEQUENCE (SIZE (1.. 2)) OF INTEGER (0..1) BIT STRING (SIZE (5)) </pre>	<pre> OPTIONAL, -- Need R OPTIONAL, -- Need R OPTIONAL, -- Need R OPTIONAL, -- Need R OPTIONAL, -- Need R OPTIONAL, -- Need R OPTIONAL, -- Need R OPTIONAL, -- Need R OPTIONAL, -- Need R OPTIONAL, -- Need R OPTIONAL, -- Need R OPTIONAL, -- Need R OPTIONAL, -- Need R OPTIONAL, -- Need R OPTIONAL, -- Need R OPTIONAL, -- Cond Setup3 OPTIONAL, -- Need R OPTIONAL, -- Need R </pre>
<pre> -- TAG-SEARCHSPACE-STOP -- ASN1STOP </pre>		



<b>SearchSpace field descriptions</b>
<p><b>common</b> Configures this search space as common search space (CSS) and DCI formats to monitor.</p>
<p><b>controlResourceSetId</b> The CORESET applicable for this SearchSpace. Value 0 identifies the common CORESET#0 configured in MIB and in <i>ServingCellConfigCommon</i>. Values 1..<i>maxNrofControlResourceSets</i>-1 identify CORESETs configured in System Information or by dedicated signalling. The CORESETs with <i>non-zero controlResourceSetId</i> are configured in the same BWP as this <i>SearchSpace</i>. If the field <i>controlResourceSetId-r16</i> is present, UE shall ignore the <i>controlResourceSetId</i> (without suffix).</p>
<p><b>dummy1, dummy2</b> This field is not used in the specification. If received it shall be ignored by the UE.</p>
<p><b>dci-Format0-0-AndFormat1-0</b> If configured, the UE monitors the DCI formats 0_0 and 1_0 according to TS 38.213 [13], clause 10.1.</p>
<p><b>dci-Format2-0</b> If configured, UE monitors the DCI format 2_0 according to TS 38.213 [13], clause 10.1, 11.1.1.</p>
<p><b>dci-Format2-1</b> If configured, UE monitors the DCI format 2_1 according to TS 38.213 [13], clause 10.1, 11.2.</p>
<p><b>dci-Format2-2</b> If configured, UE monitors the DCI format 2_2 according to TS 38.213 [13], clause 10.1, 11.3.</p>
<p><b>dci-Format2-3</b> If configured, UE monitors the DCI format 2_3 according to TS 38.213 [13], clause 10.1, 11.4.</p>
<p><b>dci-Format2-4</b> If configured, UE monitors the DCI format 2_4 according to TS 38.213 [13], clause 11.2A.</p>
<p><b>dci-Format2-5</b> If configured, IAB-MT monitors the DCI format 2_5 according to TS 38.213 [13], clause 14.</p>
<p><b>dci-Format2-6</b> If configured, UE monitors the DCI format 2_6 according to TS 38.213 [13], clause 10.1, 11.5. DCI format 2_6 can only be configured on the SpCell.</p>
<p><b>dci-Formats</b> Indicates whether the UE monitors in this USS for DCI formats 0-0 and 1-0 or for formats 0-1 and 1-1.</p>
<p><b>dci-FormatsExt</b> If this field is present, the field <i>dci-Formats</i> is ignored and <i>dci-FormatsExt</i> is used instead to indicate whether the UE monitors in this USS for DCI format 0_2 and 1_2 or formats 0_1 and 1_1 and 0_2 and 1_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 10.1).</p>
<p><b>dci-Formats-MT</b> Indicates whether the IAB-MT monitors the DCI formats 2-5 according to TS 38.213 [13], clause 14.</p>
<p><b>dci-FormatsSL</b> Indicates whether the UE monitors in this USS for DCI formats 0-0 and 1-0 or for formats 0-1 and 1-1 or for format 3-0 of dynamic grant or for format 3-1 or for formats 3-0 of dynamic grant and 3-1.</p>
<p><b>duration</b> Number of consecutive slots that a SearchSpace lasts in every occasion, i.e., upon every period as given in the <i>periodicityAndOffset</i>. If the field is absent, the UE applies the value 1 slot, except for DCI format 2_0. The UE ignores this field for DCI format 2_0. The maximum valid duration is <i>periodicity</i>-1 (<i>periodicity</i> as given in the <i>monitoringSlotPeriodicityAndOffset</i>). For IAB-MT, duration indicates number of consecutive slots that a SearchSpace lasts in every occasion, i.e., upon every period as given in the <i>periodicityAndOffset</i>. If the field is absent, the IAB-MT applies the value 1 slot, except for DCI format 2_0 and DCI format 2_5. The IAB-MT ignores this field for DCI format 2_0 and DCI format 2_5. The maximum valid duration is <i>periodicity</i>-1 (<i>periodicity</i> as given in the <i>monitoringSlotPeriodicityAndOffset</i>).</p>
<p><b>freqMonitorLocations</b> Value 1 indicates that a frequency domain resource allocation replicated from the pattern configured in the associated CORESET is mapped to the RB set. LSB corresponds to lowest RB set in the BWP. For a RB set indicated in the bitmap, the first PRB of the frequency domain monitoring location confined within the RB set is aligned with {the first PRB of the RB set + <i>rb-Offset</i> provided by the associated CORESET.</p>

<p><b>monitoringSlotPeriodicityAndOffset</b> Slots for PDCCH Monitoring configured as periodicity and offset. If the UE is configured to monitor DCI format 2_1, only the values 'sl1', 'sl2' or 'sl4' are applicable. If the UE is configured to monitor DCI format 2_0, only the values 'sl1', 'sl2', 'sl4', 'sl5', 'sl8', 'sl10', 'sl16', and 'sl20' are applicable (see TS 38.213 [13], clause 10). If the UE is configured to monitor DCI format 2_4, only the values 'sl1', 'sl2', 'sl4', 'sl5', 'sl8' and 'sl10' are applicable. For IAB-MT, If the IAB-MT is configured to monitor DCI format 2_1, only the values 'sl1', 'sl2' or 'sl4' are applicable. If the IAB-MT is configured to monitor DCI format 2_0 or DCI format 2_5, only the values 'sl1', 'sl2', 'sl4', 'sl5', 'sl8', 'sl10', 'sl16', and 'sl20' are applicable (see TS 38.213, clause 10).</p>
<p><b>monitoringSymbolsWithinSlot</b> The first symbol(s) for PDCCH monitoring in the slots configured for PDCCH monitoring (see <i>monitoringSlotPeriodicityAndOffset</i> and <i>duration</i>). The most significant (left) bit represents the first OFDM in a slot, and the second most significant (left) bit represents the second OFDM symbol in a slot and so on. The bit(s) set to one identify the first OFDM symbol(s) of the control resource set within a slot. If the cyclic prefix of the BWP is set to extended CP, the last two bits within the bit string shall be ignored by the UE or IAB-MT. For DCI format 2_0, the first one symbol applies if the <i>duration</i> of CORESET (in the IE <i>ControlResourceSet</i>) identified by <i>controlResourceSetId</i> indicates 3 symbols, the first two symbols apply if the <i>duration</i> of CORESET identified by <i>controlResourceSetId</i> indicates 2 symbols, and the first three symbols apply if the <i>duration</i> of CORESET identified by <i>controlResourceSetId</i> indicates 1 symbol. See TS 38.213 [13], clause 10. For IAB-MT: For DCI format 2_0 or DCI format 2_5, the first one symbol applies if the duration of CORESET (in the IE <i>ControlResourceSet</i>) identified by <i>controlResourceSetId</i> indicates 3 symbols, the first two symbols apply if the <i>duration</i> of CORESET identified by <i>controlResourceSetId</i> indicates 2 symbols, and the first three symbols apply if the <i>duration</i> of CORESET identified by <i>controlResourceSetId</i> indicates 1 symbol. See TS 38.213 [13], clause 10.</p>
<p><b>nrofCandidates-CI</b> The number of PDCCH candidates specifically for format 2-4 for the configured aggregation level. If an aggregation level is absent, the UE does not search for any candidates with that aggregation level. The network configures only one aggregationLevel and the corresponding number of candidates (see TS 38.213 [13], clause 10.1).</p>
<p><b>nrofCandidates-SFI</b> The number of PDCCH candidates specifically for format 2-0 for the configured aggregation level. If an aggregation level is absent, the UE does not search for any candidates with that aggregation level. The network configures only one aggregationLevel and the corresponding number of candidates (see TS 38.213 [13], clause 11.1.1). For a search space configured with <i>freqMonitorLocations-r16</i>, only value 'n1' is valid.</p>
<p><b>nrofCandidates</b> Number of PDCCH candidates per aggregation level. The number of candidates and aggregation levels configured here applies to all formats unless a particular value is specified or a format-specific value is provided (see inside <i>searchSpaceType</i>). If configured in the <i>SearchSpace</i> of a cross carrier scheduled cell, this field determines the number of candidates and aggregation levels to be used on the linked scheduling cell (see TS 38.213 [13], clause 10).</p>
<p><b>searchSpaceGroupIDList</b> List of search space group IDs which the search space is associated with. The network configures at most 2 search space groups per BWP where the group ID is either 0 or 1.</p>
<p><b>searchSpaceId</b> Identity of the search space. SearchSpaceId = 0 identifies the <i>searchSpaceZero</i> configured via PBCH (MIB) or <i>ServingCellConfigCommon</i> and may hence not be used in the <i>SearchSpace</i> IE. The <i>searchSpaceId</i> is unique among the BWPs of a Serving Cell. In case of cross carrier scheduling, search spaces with the same <i>searchSpaceId</i> in scheduled cell and scheduling cell are linked to each other. The UE applies the search space for the scheduled cell only if the DL BWPs in which the linked search spaces are configured in scheduling cell and scheduled cell are both active. For an IAB-MT, the search space defines how/where to search for PDCCH candidates for an IAB-MT. Each search space is associated with one ControlResourceSet. For a scheduled cell in the case of cross carrier scheduling, except for nrofCandidates, all the optional fields are absent.</p>
<p><b>searchSpaceType</b> Indicates whether this is a common search space (present) or a UE specific search space as well as DCI formats to monitor for.</p>
<p><b>ue-Specific</b> Configures this search space as UE specific search space (USS). The UE monitors the DCI format with CRC scrambled by C-RNTI, CS-RNTI (if configured), and SP-CSI-RNTI (if configured)</p>

Conditional Presence	Explanation
<i>Setup</i>	This field is mandatory present upon creation of a new <i>SearchSpace</i> . It is optionally present, Need M, otherwise.
<i>Setup2</i>	This field is mandatory present when a new <i>SearchSpace</i> is set up, if the same <i>SearchSpace</i> ID is not included in <i>searchSpacesToAddModListExt-r16</i> of the parent IE with the field <i>searchSpaceType-r16</i> included. Otherwise it is optionally present, Need M.
<i>Setup3</i>	This field is mandatory present when a new <i>SearchSpace</i> is set up, if the same <i>SearchSpace</i> ID is not included in <i>searchSpacesToAddModListExt</i> (without suffix) of the parent IE with the field <i>searchSpaceType</i> (without suffix) included. Otherwise it is optionally present, Need M.
<i>SetupOnly</i>	This field is mandatory present upon creation of a new <i>SearchSpace</i> . It is absent, Need M, otherwise.
<i>SetupOnly2</i>	In PDCCH-Config, the field is optionally present upon creation of a new <i>SearchSpace</i> and absent, Need M upon reconfiguration of an existing <i>SearchSpace</i> . In PDCCH-ConfigCommon, the field is absent.

### – *SearchSpaceId*

The IE *SearchSpaceId* is used to identify Search Spaces. The ID space is used across the BWPs of a Serving Cell. The search space with the *SearchSpaceId* = 0 identifies the search space configured via PBCH (MIB) and in *ServingCellConfigCommon* (*searchSpaceZero*). The number of Search Spaces per BWP is limited to 10 including the common and UE specific Search Spaces.

#### **SearchSpaceId information element**

```
-- ASN1START
-- TAG-SEARCHSPACEID-START

SearchSpaceId ::=
    INTEGER (0..maxNrofSearchSpaces-1)

-- TAG-SEARCHSPACEID-STOP
-- ASN1STOP
```

### – *SearchSpaceZero*

The IE *SearchSpaceZero* is used to configure SearchSpace#0 of the initial BWP (see TS 38.213 [13], clause 13).

#### **SearchSpaceZero information element**

```
-- ASN1START
-- TAG-SEARCHSPACEZERO-START

SearchSpaceZero ::=
    INTEGER (0..15)

-- TAG-SEARCHSPACEZERO-STOP
-- ASN1STOP
```

## – SecurityAlgorithmConfig

The IE *SecurityAlgorithmConfig* is used to configure AS integrity protection algorithm and AS ciphering algorithm for SRBs and DRBs.

### SecurityAlgorithmConfig information element

```
-- ASN1START
-- TAG-SECURITYALGORITHMCONFIG-START

SecurityAlgorithmConfig ::=          SEQUENCE {
    cipheringAlgorithm                CipheringAlgorithm,
    integrityProtAlgorithm            IntegrityProtAlgorithm          OPTIONAL,  -- Need R
    ...
}

IntegrityProtAlgorithm ::=          ENUMERATED {
    nia0, nia1, nia2, nia3, spare4, spare3,
    spare2, spare1, ...}

CipheringAlgorithm ::=              ENUMERATED {
    nea0, nea1, nea2, nea3, spare4, spare3,
    spare2, spare1, ...}

-- TAG-SECURITYALGORITHMCONFIG-STOP
-- ASN1STOP
```

#### SecurityAlgorithmConfig field descriptions

##### ***cipheringAlgorithm***

Indicates the ciphering algorithm to be used for SRBs and DRBs, as specified in TS 33.501 [11]. The algorithms *nea0-nea3* are identical to the LTE algorithms *eea0-3*. The algorithms configured for all bearers using master key shall be the same, and the algorithms configured for all bearers using secondary key, if any, shall be the same. If UE is connected to E-UTRA/EPC, this field indicates the ciphering algorithm to be used for RBs configured with NR PDCP, as specified in TS 33.501 [11].

##### ***integrityProtAlgorithm***

Indicates the integrity protection algorithm to be used for SRBs and DRBs, as specified in TS 33.501 [11]. The algorithms *nia0-nia3* are identical to the E-UTRA algorithms *eia0-3*. The algorithms configured for all bearers using master key shall be the same and the algorithms configured for all bearers using secondary key, if any, shall be the same. The network does not configure *nia0* except for unauthenticated emergency sessions for unauthenticated UEs in LSM (limited service mode). If UE is connected to E-UTRA/EPC, this field indicates the integrity protection algorithm to be used for SRBs configured with NR PDCP, as specified in TS 33.501 [11]. The network does not configure *nia0* for SRB3.

## – SemiStaticChannelAccessConfig

The IE *SemiStaticChannelAccessConfig* is used to configure channel access parameters when the network is operating in semi-static channel access mode (see clause 4.3 TS 37.213 [48]).

### SemiStaticChannelAccessConfig information element

```
-- ASN1START
```

```

-- TAG-SEMISTATICCHANNELACCESSCONFIG-START
SemiStaticChannelAccessConfig ::= SEQUENCE {
  period          ENUMERATED {ms1, ms2, ms2dot5, ms4, ms5, ms10}
}
-- TAG-SEMISTATICCHANNELACCESSCONFIG-STOP
-- ASN1STOP

```

<i>SemiStaticChannelAccessConfig</i> field descriptions
---

<p><b>period</b> Indicates the periodicity of the semi-static channel access mode (see TS 37.213 [48], clause 4.3). Value ms1 corresponds to 1 ms, value ms2 corresponds to 2 ms, value ms2dot5 corresponds to 2.5 ms, and so on.</p>
---

## – *Sensor-LocationInfo*

The IE *Sensor-LocationInfo* is used by the UE to provide sensor information.

### *Sensor-LocationInfo* information element

```

-- ASN1START
-- TAG-SENSORLOCATIONINFO-START
Sensor-LocationInfo-r16 ::= SEQUENCE {
  sensor-MeasurementInformation-r16  OCTET STRING  OPTIONAL,
  sensor-MotionInformation-r16      OCTET STRING  OPTIONAL,
  ...
}
-- TAG-SENSORLOCATIONINFO-STOP
-- ASN1STOP

```

<i>Sensor-LocationInfo</i> field descriptions
---

<p><b>sensor-MeasurementInformation</b> This field provides barometric pressure measurements as <i>Sensor-MeasurementInformation</i> defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.</p>
<p><b>sensor-MotionInformation</b> This field provides motion sensor measurements as <i>Sensor-MotionInformation</i> defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.</p>

## – *ServCellIndex*

The IE *ServCellIndex* concerns a short identity, used to identify a serving cell (i.e. the PCell, the PSCell or an SCell). Value 0 applies for the PCell, while the *SCellIndex* that has previously been assigned applies for SCells.

**ServCellIndex** information element

```

-- ASN1START
-- TAG-SERVCELLINDEX-START

ServCellIndex ::=
    INTEGER (0..maxNrofServingCells-1)

-- TAG-SERVCELLINDEX-STOP
-- ASN1STOP

```

## – ServingCellConfig

The IE *ServingCellConfig* is used to configure (add or modify) the UE with a serving cell, which may be the SpCell or an SCell of an MCG or SCG. The parameters herein are mostly UE specific but partly also cell specific (e.g. in additionally configured bandwidth parts). Reconfiguration between a PUCCH and PUCCHless SCell is only supported using an SCell release and add.

**ServingCellConfig** information element

```

-- ASN1START
-- TAG-SERVINGCELLCONFIG-START

ServingCellConfig ::=
    SEQUENCE {
        tdd-UL-DL-ConfigurationDedicated
            TDD-UL-DL-ConfigDedicated
            OPTIONAL, -- Cond TDD
        initialDownlinkBWP
            BWP-DownlinkDedicated
            OPTIONAL, -- Need M
        downlinkBWP-ToReleaseList
            SEQUENCE (SIZE (1..maxNrofBWPs)) OF BWP-Id
            OPTIONAL, -- Need N
        downlinkBWP-ToAddModList
            SEQUENCE (SIZE (1..maxNrofBWPs)) OF BWP-Downlink
            OPTIONAL, -- Need N
        firstActiveDownlinkBWP-Id
            BWP-Id
            OPTIONAL, -- Cond SyncAndCellAdd
        bwp-InactivityTimer
            ENUMERATED {ms2, ms3, ms4, ms5, ms6, ms8, ms10, ms20, ms30,
                ms40, ms50, ms60, ms80, ms100, ms200, ms300, ms500,
                ms750, ms1280, ms1920, ms2560, spare10, spare9, spare8,
                spare7, spare6, spare5, spare4, spare3, spare2, spare1 }
            OPTIONAL, --Need R
        defaultDownlinkBWP-Id
            BWP-Id
            OPTIONAL, -- Need S
        uplinkConfig
            UplinkConfig
            OPTIONAL, -- Need M
        supplementaryUplink
            UplinkConfig
            OPTIONAL, -- Need M
        pdccch-ServingCellConfig
            SetupRelease { PDCCH-ServingCellConfig }
            OPTIONAL, -- Need M
        pdsch-ServingCellConfig
            SetupRelease { PDSCH-ServingCellConfig }
            OPTIONAL, -- Need M
        csi-MeasConfig
            SetupRelease { CSI-MeasConfig }
            OPTIONAL, -- Need M
        sCellDeactivationTimer
            ENUMERATED {ms20, ms40, ms80, ms160, ms200, ms240,
                ms320, ms400, ms480, ms520, ms640, ms720,
                ms840, ms1280, spare2, spare1}
            OPTIONAL, -- Cond ServingCellWithoutPUCCH
        crossCarrierSchedulingConfig
            CrossCarrierSchedulingConfig
            OPTIONAL, -- Need M
        tag-Id
            TAG-Id,
        dummy
            ENUMERATED {enabled}
            OPTIONAL, -- Need R
        pathlossReferenceLinking
            ENUMERATED {spCell, sCell}
            OPTIONAL, -- Cond SCellOnly
        servingCellMO
            MeasObjectId
            OPTIONAL, -- Cond MeasObject
        ...,
        [[
            lte-CRS-ToMatchAround
                SetupRelease { RateMatchPatternLTE-CRS }
                OPTIONAL, -- Need M
            rateMatchPatternToAddModList
                SEQUENCE (SIZE (1..maxNrofRateMatchPatterns)) OF RateMatchPattern
                OPTIONAL, -- Need N
            rateMatchPatternToReleaseList
                SEQUENCE (SIZE (1..maxNrofRateMatchPatterns)) OF RateMatchPatternId
                OPTIONAL, -- Need N
        ]]
    }

```

```

downlinkChannelBW-PerSCS-List      SEQUENCE (SIZE (1..maxSCSs)) OF SCS-SpecificCarrier      OPTIONAL      -- Need S
]],
[[
supplementaryUplinkRelease          ENUMERATED {true}                                          OPTIONAL,      -- Need N
tdd-UL-DL-ConfigurationDedicated-IAB-MT-r16  TDD-UL-DL-ConfigDedicated-IAB-MT-r16      OPTIONAL,      -- Cond TDD_IAB
dormantBWP-Config-r16              SetupRelease { DormantBWP-Config-r16 }      OPTIONAL,      -- Need M
ca-SlotOffset-r16                  CHOICE {
  refSCS15kHz                        INTEGER (-2..2),
  refSCS30kHz                        INTEGER (-5..5),
  refSCS60kHz                        INTEGER (-10..10),
  refSCS120kHz                       INTEGER (-20..20)
}
channelAccessConfig-r16            SetupRelease { ChannelAccessConfig-r16 }      OPTIONAL,      -- Cond AsyncCA
intraCellGuardBandsDL-List-r16     SEQUENCE (SIZE (1..maxSCSs)) OF IntraCellGuardBandsPerSCS-r16      OPTIONAL,      -- Need S
intraCellGuardBandsUL-List-r16     SEQUENCE (SIZE (1..maxSCSs)) OF IntraCellGuardBandsPerSCS-r16      OPTIONAL,      -- Need S
csi-RS-ValidationWith-DCI-r16      ENUMERATED {enabled}                                      OPTIONAL,      -- Need R
lte-CRS-PatternList1-r16           SetupRelease { LTE-CRS-PatternList-r16 }      OPTIONAL,      -- Need M
lte-CRS-PatternList2-r16           SetupRelease { LTE-CRS-PatternList-r16 }      OPTIONAL,      -- Need M
crs-RateMatch-PerCORESETPoolIndex-r16  ENUMERATED {enabled}                                      OPTIONAL,      -- Need R
enableTwoDefaultTCI-States-r16     ENUMERATED {enabled}                                      OPTIONAL,      -- Need R
enableDefaultTCI-StatePerCoresetPoolIndex-r16  ENUMERATED {enabled}                                      OPTIONAL,      -- Need R
enableBeamSwitchTiming-r16         ENUMERATED {true}                                         OPTIONAL,      -- Need R
cbg-TxDiffTBsProcessingType1-r16    ENUMERATED {enabled}                                      OPTIONAL,      -- Need R
cbg-TxDiffTBsProcessingType2-r16    ENUMERATED {enabled}                                      OPTIONAL,      -- Need R
]]
}

UplinkConfig ::=
  SEQUENCE {
    initialUplinkBWP                BWP-UplinkDedicated                                      OPTIONAL,      -- Need M
    uplinkBWP-ToReleaseList          SEQUENCE (SIZE (1..maxNrofBWPs)) OF BWP-Id              OPTIONAL,      -- Need N
    uplinkBWP-ToAddModList           SEQUENCE (SIZE (1..maxNrofBWPs)) OF BWP-Uplink          OPTIONAL,      -- Need N
    firstActiveUplinkBWP-Id         BWP-Id                                                    OPTIONAL,      -- Cond SyncAndCellAdd
    pusch-ServingCellConfig          SetupRelease { PUSCH-ServingCellConfig }                OPTIONAL,      -- Need M
    carrierSwitching                 SetupRelease { SRS-CarrierSwitching }                   OPTIONAL,      -- Need M
    ...,
    [[
    powerBoostPi2BPSK                BOOLEAN                                                    OPTIONAL,      -- Need M
    uplinkChannelBW-PerSCS-List      SEQUENCE (SIZE (1..maxSCSs)) OF SCS-SpecificCarrier      OPTIONAL,      -- Need S
    ]],
    [[
    enablePL-RS-UpdateForPUSCH-SRS-r16  ENUMERATED {enabled}                                      OPTIONAL,      -- Need R
    enableDefaultBeamPL-ForPUSCH0-0-r16  ENUMERATED {enabled}                                      OPTIONAL,      -- Need R
    enableDefaultBeamPL-ForPUCCH-r16    ENUMERATED {enabled}                                      OPTIONAL,      -- Need R
    enableDefaultBeamPL-ForSRS-r16     ENUMERATED {enabled}                                      OPTIONAL,      -- Need R
    uplinkTxSwitching-r16             SetupRelease { UplinkTxSwitching-r16 }                  OPTIONAL,      -- Need M
    mpr-PowerBoost-FR2-r16           ENUMERATED {true}                                        OPTIONAL,      -- Need R
    ]]]
}

ChannelAccessConfig-r16 ::=
  SEQUENCE {
    maxEnergyDetectionThreshold-r16    INTEGER(-85..-52),
    energyDetectionThresholdOffset-r16  INTEGER (-20..-13),
    ul-toDL-COT-SharingED-Threshold-r16  INTEGER (-85..-52)      OPTIONAL,      -- Need R
    absenceOfAnyOtherTechnology-r16     ENUMERATED {true}      OPTIONAL,      -- Need R
  }

```

```

}

IntraCellGuardBandsPerSCS-r16 ::= SEQUENCE {
    guardBandSCS-r16          SubcarrierSpacing,
    intraCellGuardBands-r16 SEQUENCE (SIZE (1..4)) OF GuardBand-r16
}

GuardBand-r16 ::= SEQUENCE {
    startCRB-r16              INTEGER (0..274),
    nrofCRBs-r16              INTEGER (0..15)
}

DormancyGroupID-r16 ::= INTEGER (0..4)

DormantBWP-Config-r16 ::= SEQUENCE {
    dormantBWP-Id-r16         BWP-Id                                OPTIONAL, -- Need M
    withinActiveTimeConfig-r16 SetupRelease { WithinActiveTimeConfig-r16 } OPTIONAL, -- Need M
    outsideActiveTimeConfig-r16 SetupRelease { OutsideActiveTimeConfig-r16 } OPTIONAL, -- Need M
}

WithinActiveTimeConfig-r16 ::= SEQUENCE {
    firstWithinActiveTimeBWP-Id-r16 BWP-Id                                OPTIONAL, -- Need M
    dormancyGroupWithinActiveTime-r16 DormancyGroupID-r16                OPTIONAL, -- Need R
}

OutsideActiveTimeConfig-r16 ::= SEQUENCE {
    firstOutsideActiveTimeBWP-Id-r16 BWP-Id                                OPTIONAL, -- Need M
    dormancyGroupOutsideActiveTime-r16 DormancyGroupID-r16                OPTIONAL, -- Need R
}

UplinkTxSwitching-r16 ::= SEQUENCE {
    uplinkTxSwitchingPeriodLocation-r16 BOOLEAN,
    uplinkTxSwitchingCarrier-r16      ENUMERATED {carrier1, carrier2}
}

-- TAG-SERVINGCELLCONFIG-STOP
-- ASN1STOP

```



<b>ServingCellConfig field descriptions</b>
<p><b>absenceOfAnyOtherTechnology</b> Presence of this field indicates absence on a long term basis (e.g. by level of regulation) of any other technology sharing the carrier; absence of this field indicates the potential presence of any other technology sharing the carrier, as specified in TS 37.213 [48] clause Y.</p>
<p><b>bwp-InactivityTimer</b> The duration in ms after which the UE falls back to the default Bandwidth Part (see TS 38.321 [3], clause 5.15). When the network releases the timer configuration, the UE stops the timer without switching to the default BWP.</p>
<p><b>ca-SlotOffset</b> Slot offset between the primary cell (PCell/PSCell) and the SCell in unaligned frame boundary with slot alignment and partial SFN alignment inter-band CA. Based on this field, the UE determines the time offset of the SCell as specified in clause 4.5 of TS 38.211 [16]. The granularity of this field is determined by the reference SCS for the slot offset (i.e. the maximum of PCell/PSCell lowest SCS among all the configured SCSs in DL/UL <i>SCS-SpecificCarrierList</i> in <i>ServingCellConfigCommon</i> or <i>ServingCellConfigCommonSIB</i> and this serving cell's lowest SCS among all the configured SCSs in DL/UL <i>SCS-SpecificCarrierList</i> in <i>ServingCellConfigCommon</i> or <i>ServingCellConfigCommonSIB</i>). The Network configures at most single non-zero offset duration in ms (independent on SCS) among CCs in the unaligned CA configuration. If the field is absent, the UE applies the value of 0. The slot offset value can only be changed with SCell release and add.</p>
<p><b>cbg-TxDiffTbsProcessingType1, cbg-TxDiffTbsProcessingType2</b> Indicates whether processing types 1 and 2 based CBG based operation is enabled according to Rel-16 UE capabilities.</p>
<p><b>channelAccessConfig</b> List of parameters used for access procedures of operation with shared spectrum channel access (see TS 37.213 [48]).</p>
<p><b>crossCarrierSchedulingConfig</b> Indicates whether this serving cell is cross-carrier scheduled by another serving cell or whether it cross-carrier schedules another serving cell.</p>
<p><b>csi-RS-ValidationWith-DCI</b> Determines how the UE performs periodic and semi-persistent CSI-RS reception in a slot (see TS 38.213 [13], clause 11.1).</p>
<p><b>crs-RateMatch-PerCORESETPoolIndex</b> Indicates how UE performs rate matching when both lte-CRS-PatternList1-r16 and lte-CRS-PatternList2-r16 are configured as specified in TS 38.314, clause 5.1.4.2.</p>
<p><b>defaultDownlinkBWP-Id</b> The initial bandwidth part is referred to by BWP-Id = 0. ID of the downlink bandwidth part to be used upon expiry of the BWP inactivity timer. This field is UE specific. When the field is absent the UE uses the initial BWP as default BWP. (see TS 38.213 [13], clause 12 and TS 38.321 [3], clause 5.15).</p>
<p><b>dormantBWP-Config</b> The dormant BWP configuration for an SCell. This field can be configured only for a (non-PUCCH) SCell.</p>
<p><b>downlinkBWP-ToAddModList</b> List of additional downlink bandwidth parts to be added or modified. (see TS 38.213 [13], clause 12).</p>
<p><b>downlinkBWP-ToReleaseList</b> List of additional downlink bandwidth parts to be released. (see TS 38.213 [13], clause 12).</p>
<p><b>downlinkChannelBW-PerSCS-List</b> A set of UE specific channel bandwidth and location configurations for different subcarrier spacings (numerologies). Defined in relation to Point A. The UE uses the configuration provided in this field only for the purpose of channel bandwidth and location determination. If absent, UE uses the configuration indicated in <i>scs-SpecificCarrierList</i> in <i>DownlinkConfigCommon</i> / <i>DownlinkConfigCommonSIB</i>. Network only configures channel bandwidth that corresponds to the channel bandwidth values defined in TS 38.101-1 [15] and TS 38.101-2 [39].</p>
<p><b>enableBeamSwitchTiming</b> Indicates the aperiodic CSI-RS triggering with beam switching triggering behaviour as defined in clause 5.2.1.5.1 of TS 38.214 [19].</p>
<p><b>enableDefaultTCI-StatePerCoresetPoolIndex</b> Presence of this field indicates the UE shall follow the release 16 behavior of default TCI state per CORESETPoolIndex when the UE is configured by higher layer parameter PDCCH-Config that contains two different values of CORESETPoolIndex in ControlResourceSet is enabled.</p>

<b>enableTwoDefaultTCI-States</b> Presence of this field indicates the UE shall follow the release 16 behavior of two default TCI states for PDSCH when at least one TCI codepoint is mapped to two TCI states is enabled
<b>energyDetectionThresholdOffset</b> Indicates the offset to the default maximum energy detection threshold value. Unit in dB. Value -13 corresponds to -13dB, value -12 corresponds to -12dB, and so on (i.e. in steps of 1dB) as specified in TS 37.213 [48].
<b>firstActiveDownlinkBWP-Id</b> If configured for an SpCell, this field contains the ID of the DL BWP to be activated upon performing the RRC (re-)configuration. If the field is absent, the RRC (re-)configuration does not impose a BWP switch. If configured for an SCell, this field contains the ID of the downlink bandwidth part to be used upon activation of an SCell. The initial bandwidth part is referred to by BWP-Id = 0. Upon PCell change and PSCell addition/change, the network sets the <i>firstActiveDownlinkBWP-Id</i> and <i>firstActiveUplinkBWP-Id</i> to the same value.
<b>initialDownlinkBWP</b> The dedicated (UE-specific) configuration for the initial downlink bandwidth-part (i.e. DL BWP#0). If any of the optional IEs are configured within this IE, the UE considers the BWP#0 to be an RRC configured BWP (from UE capability viewpoint). Otherwise, the UE does not consider the BWP#0 as an RRC configured BWP (from UE capability viewpoint). Network always configures the UE with a value for this field if no other BWPs are configured. NOTE1
<b>intraCellGuardBandsDL-List, intraCellGuardBandsUL-List</b> List of intra-cell guard bands in a serving cell for operation with shared spectrum channel access. If not configured, the guard bands are defined according to 38.101-1 [15], see TS 38.214 [19], clause 7. For operation in licensed spectrum, this field is absent, and no UE action is required.
<b>lte-CRS-PatternList</b> A list of LTE CRS patterns around which the UE shall do rate matching for PDSCH. The LTE CRS patterns in this list shall be non-overlapping in frequency. The network does not configure this field and <i>lte-CRS-ToMatchAround</i> simultaneously.
<b>lte-CRS-PatternList2</b> A list of LTE CRS patterns around which the UE shall do rate matching for PDSCH scheduled with a DCI detected on a CORESET with CORESETPoolIndex configured with 1. This list is configured only if CORESETPoolIndex configured with 1. The first LTE CRS pattern in this list shall be fully overlapping in frequency with the first LTE CRS pattern in <i>lte-CRS-PatternList</i> , The second LTE CRS pattern in this list shall be fully overlapping in frequency with the second LTE CRS pattern in <i>lte-CRS-PatternList</i> , and so on. Network configures this field only if the field <i>lte-CRS-ToMatchAround</i> is not configured and there is at least one ControlResourceSet in one DL BWP of this serving cell with <i>coresetPoolIndex</i> set to 1.
<b>lte-CRS-ToMatchAround</b> Parameters to determine an LTE CRS pattern that the UE shall rate match around.
<b>maxEnergyDetectionThreshold</b> Indicates the absolute maximum energy detection threshold value. Unit in dBm. Value -85 corresponds to -85 dBm, value -84 corresponds to -84 dBm, and so on (i.e. in steps of 1dBm) as specified in TS 37.213 [48]. If the field is not configured, the UE shall use a default maximum energy detection threshold value as specified in TS 37.213 [48].
<b>pathlossReferenceLinking</b> Indicates whether UE shall apply as pathloss reference either the downlink of SpCell (PCell for MCG or PSCell for SCG) or of SCell that corresponds with this uplink (see TS 38.213 [13], clause 7).
<b>pdsch-ServingCellConfig</b> PDSCH related parameters that are not BWP-specific.
<b>rateMatchPatternToAddModList</b> Resources patterns which the UE should rate match PDSCH around. The UE rate matches around the union of all resources indicated in the rate match patterns. Rate match patterns defined here on cell level apply only to PDSCH of the same numerology. See TS 38.214 [19], clause 5.1.2.2.3.
<b>sCellDeactivationTimer</b> SCell deactivation timer in TS 38.321 [3]. If the field is absent, the UE applies the value infinity.

<p><b>servicingCellMO</b>  <i>measObjectId</i> of the <i>MeasObjectNR</i> in <i>MeasConfig</i> which is associated to the serving cell. For this <i>MeasObjectNR</i>, the following relationship applies between this <i>MeasObjectNR</i> and <i>frequencyInfoDL</i> in <i>ServingCellConfigCommon</i> of the serving cell: if <i>ssbFrequency</i> is configured, its value is the same as the <i>absoluteFrequencySSB</i> and if <i>csi-rs-ResourceConfigMobility</i> is configured, the value of its <i>subcarrierSpacing</i> is present in one entry of the <i>scs-SpecificCarrierList</i>, <i>csi-RS-CellListMobility</i> includes an entry corresponding to the serving cell (with <i>cellId</i> equal to <i>physCellId</i> in <i>ServingCellConfigCommon</i>) and the frequency range indicated by the <i>csi-rs-MeasurementBW</i> of the entry in <i>csi-RS-CellListMobility</i> is included in the frequency range indicated by in the entry of the <i>scs-SpecificCarrierList</i>.</p>
<p><b>supplementaryUplink</b>  Network may configure this field only when <i>supplementaryUplinkConfig</i> is configured in <i>ServingCellConfigCommon</i> or <i>ServingCellConfigCommonSIB</i>.</p>
<p><b>supplementaryUplinkRelease</b>  If this field is included, the UE shall release the uplink configuration configured by <i>supplementaryUplink</i>. The network only includes either <i>supplementaryUplinkRelease</i> or <i>supplementaryUplink</i> at a time.</p>
<p><b>tag-Id</b>  Timing Advance Group ID, as specified in TS 38.321 [3], which this cell belongs to.</p>
<p><b>tdd-UL-DL-ConfigurationDedicated-iab-mt</b>  Resource configuration per IAB-MT D/U/F overrides all symbols (with a limitation that effectively only flexible symbols can be overwritten in Rel-16) per slot over the number of slots as provided by <i>TDD-UL-DL ConfigurationCommon</i>.</p>
<p><b>ul-toDL-COT-SharingED-Threshold</b>  Maximum energy detection threshold that the UE should use to share channel occupancy with gNB for DL transmission as specified in TS 37.213 [48].</p>
<p><b>uplinkConfig</b>  Network may configure this field only when <i>uplinkConfigCommon</i> is configured in <i>ServingCellConfigCommon</i> or <i>ServingCellConfigCommonSIB</i>. Addition or release of this field can only be done upon SCell addition or release (respectively).</p>

<b>UplinkConfig field descriptions</b>
<p><b>carrierSwitching</b> Includes parameters for configuration of carrier based SRS switching (see TS 38.214 [19], clause 6.2.1.3.</p>
<p><b>enableDefaultBeamPL-ForPUSCH0-0, enableDefaultBeamPL-ForPUCCH, enableDefaultBeamPL-ForSRS</b> When the parameter is present, UE derives the spatial relation and the corresponding pathloss reference Rs as specified in 38.213, clauses 7.1.1, 7.2.1, 7.3.1 and 9.2.2. The network only configures these parameters for FR2.</p>
<p><b>enablePL-RS-UpdateForPUSCH-SRS</b> When this parameter is present, the Rel-16 feature of MAC CE based pathloss RS updates for PUSCH/SRS is enabled. Network only configures this parameter when the UE is configured with <i>sri-PUSCH-PowerControl</i>. If this field is not configured, network configures at most 4 pathloss RS resources for PUSCH/PUCCH/SRS transmissions per BWP, not including pathloss RS resources for SRS transmissions for positioning. (See TS 38.213 [13], clause 7).</p>
<p><b>firstActiveUplinkBWP-Id</b> If configured for an SpCell, this field contains the ID of the UL BWP to be activated upon performing the RRC (re-)configuration. If the field is absent, the RRC (re-)configuration does not impose a BWP switch. If configured for an SCell, this field contains the ID of the uplink bandwidth part to be used upon MAC-activation of an SCell. The initial bandwidth part is referred to by <i>BandwidthPartId</i> = 0.</p>
<p><b>initialUplinkBWP</b> The dedicated (UE-specific) configuration for the initial uplink bandwidth-part (i.e. UL BWP#0). If any of the optional IEs are configured within this IE as part of the IE <i>uplinkConfig</i>, the UE considers the BWP#0 to be an RRC configured BWP (from UE capability viewpoint). Otherwise, the UE does not consider the BWP#0 as an RRC configured BWP (from UE capability viewpoint). Network always configures the UE with a value for this field if no other BWPs are configured. NOTE1</p>
<p><b>mpr-PowerBoost-FR2</b> Indicates whether UE is allowed to boost uplink transmission power by suspending in-band emission (IBE) requirements as specified in TS 38.101-2 [39]. Network only configures this field for FR2 serving cells.</p>
<p><b>powerBoostPi2BPSK</b> If this field is set to <i>true</i>, the UE determines the maximum output power for PUCCH/PUSCH transmissions that use pi/2 BPSK modulation according to TS 38.101-1 [15], clause 6.2.4.</p>
<p><b>pusch-ServingCellConfig</b> PUSCH related parameters that are not BWP-specific.</p>
<p><b>uplinkBWP-ToAddModList</b> The additional bandwidth parts for uplink to be added or modified. In case of TDD uplink- and downlink BWP with the same <i>bandwidthPartId</i> are considered as a BWP pair and must have the same center frequency.</p>
<p><b>uplinkBWP-ToReleaseList</b> The additional bandwidth parts for uplink to be released.</p>
<p><b>uplinkChannelBW-PerSCS-List</b> A set of UE specific channel bandwidth and location configurations for different subcarrier spacings (numerologies). Defined in relation to Point A. The UE uses the configuration provided in this field only for the purpose of channel bandwidth and location determination. If absent, UE uses the configuration indicated in <i>scs-SpecificCarrierList</i> in <i>UplinkConfigCommon</i> / <i>UplinkConfigCommonSIB</i>. Network only configures channel bandwidth that corresponds to the channel bandwidth values defined in TS 38.101-1 [15] and TS 38.101-2 [39].</p>
<p><b>uplinkTxSwitchingPeriodLocation</b> Indicates whether the location of UL Tx switching period is configured in this uplink carrier in case of inter-band UL CA, SUL, or (NG)EN-DC, as specified in TS 38.101-1 [15] and TS 38.101-3 [34]. In case of inter-band UL CA or SUL, network configures this field to TRUE for one of the uplink carriers involved in dynamic UL TX switching and configures this field in the other carrier to FALSE. In case of (NG)EN-DC, network always configures this field to TRUE for NR carrier (i.e. with (NG)EN-DC, the UL switching period always occurs on the NR carrier).</p>
<p><b>uplinkTxSwitchingCarrier</b> Indicates that the configured carrier is carrier1 or carrier2 for dynamic uplink Tx switching, as defined in TS 38.101-1 [15] and TS 38.101-3 [34]. In case of inter-band UL CA or SUL, network configures one of the two uplink carriers involved in dynamic UL TX switching as carrier1 and the other as carrier2. In case of (NG)EN-DC, network always configures the NR carrier as carrier 2.</p>

<b>DormantBWP-Config field descriptions</b>
<p><b>dormancyGroupWithinActiveTime</b> This field contains the ID of an SCell group for Dormancy within active time, to which this SCell belongs. The use of the Dormancy within active time SCell groups is specified in TS 38.213 [13].</p>
<p><b>dormancyGroupOutsideActiveTime</b> This field contains the ID of an SCell group for Dormancy outside active time, to which this SCell belongs. The use of the Dormancy outside active time SCell groups is specified in TS 38.213 [13].</p>
<p><b>dormantBWP-Id</b> This field contains the ID of the downlink bandwidth part to be used as dormant BWP. If this field is configured, its value is different from <i>defaultDownlinkBWP-Id</i>, and at least one of the <i>withinActiveTimeConfig</i> and <i>outsideActiveTimeConfig</i> should be configured.</p>
<p><b>firstOutsideActiveTimeBWP-Id</b> This field contains the ID of the downlink bandwidth part to be activated when receiving a DCI indication for SCell dormancy outside active time.</p>
<p><b>firstWithinActiveTimeBWP-Id</b> This field contains the ID of the downlink bandwidth part to be activated when receiving a DCI indication for SCell dormancy within active time.</p>
<p><b>outsideActiveTimeConfig</b> This field contains the configuration to be used for SCell dormancy outside active time, as specified in TS 38.213 [13]. The field can only be configured when the cell group the SCell belongs to is configured with <i>dcp-Config</i>.</p>
<p><b>withinActiveTimeConfig</b> This field contains the configuration to be used for SCell dormancy within active time, as specified in TS 38.213 [13].</p>

<b>GuardBand field descriptions</b>
<p><b>startCRB</b> Indicates the starting RB of the guard band.</p>
<p><b>nrofCRB</b> Indicates the length of the guard band in RBs. When set to 0, zero-size guard band is used.</p>

NOTE 1: If the dedicated part of initial UL/DL BWP configuration is absent, the initial BWP can be used but with some limitations. For example, changing to another BWP requires *RRCReconfiguration* since DCI format 1\_0 doesn't support DCI-based switching.

Conditional Presence	Explanation
<i>AsyncCA</i>	This field is mandatory present for SCells whose slot offset between the SpCell is not 0. Otherwise it is absent, Need S.
<i>MeasObject</i>	This field is mandatory present for the SpCell if the UE has a <i>measConfig</i> , and it is optionally present, Need M, for SCells.
<i>SCellOnly</i>	This field is optionally present, Need R, for SCells. It is absent otherwise.
<i>ServingCellWithoutPUCCH</i>	This field is optionally present, Need S, for SCells except PUCCH SCells. It is absent otherwise.
<i>SyncAndCellAdd</i>	This field is mandatory present for a SpCell upon PCell change and PSCell addition/change and upon <i>RRCSetup/RRCResume</i> . The field is mandatory present for an SCell upon addition. For SpCell, the field is optionally present, Need N, upon reconfiguration without <i>reconfigurationWithSync</i> , and upon reconfiguration with <i>reconfigurationWithSync</i> to the same SpCell. In all other cases the field is absent.
<i>TDD</i>	This field is optionally present, Need R, for TDD cells. It is absent otherwise.
<i>TDD_IAB</i>	For IAB-MT, this field is optionally present, Need R, for TDD cells. It is absent otherwise.

## – *ServingCellConfigCommon*

The IE *ServingCellConfigCommon* is used to configure cell specific parameters of a UE's serving cell. The IE contains parameters which a UE would typically acquire from SSB, MIB or SIBs when accessing the cell from IDLE. With this IE, the network provides this information in dedicated signalling when configuring a UE with a SCells or with an additional cell group (SCG). It also provides it for SpCells (MCG and SCG) upon reconfiguration with sync.

### *ServingCellConfigCommon* information element

```

-- ASN1START
-- TAG-SERVINGCELLCONFIGCOMMON-START

ServingCellConfigCommon ::= SEQUENCE {
    physCellId                PhysCellId                OPTIONAL, -- Cond HOAndServCellAdd,
    downlinkConfigCommon     DownlinkConfigCommon         OPTIONAL, -- Cond HOAndServCellAdd
    uplinkConfigCommon       UplinkConfigCommon            OPTIONAL, -- Need M
    supplementaryUplinkConfig UplinkConfigCommon            OPTIONAL, -- Need S
    n-TimingAdvanceOffset    ENUMERATED { n0, n25600, n39936 } OPTIONAL, -- Need S
    ssb-PositionsInBurst     CHOICE {
        shortBitmap          BIT STRING (SIZE (4)),
        mediumBitmap         BIT STRING (SIZE (8)),
        longBitmap           BIT STRING (SIZE (64))
    }
    ssb-periodicityServingCell ENUMERATED { ms5, ms10, ms20, ms40, ms80, ms160, spare2, spare1 } OPTIONAL, -- Cond AbsFreqSSB
    dmrs-TypeA-Position       ENUMERATED { pos2, pos3 },
    lte-CRS-ToMatchAround     SetupRelease { RateMatchPatternLTE-CRS }
    rateMatchPatternToAddModList SEQUENCE (SIZE (1..maxNrofRateMatchPatterns)) OF RateMatchPattern OPTIONAL, -- Need M
    rateMatchPatternToReleaseList SEQUENCE (SIZE (1..maxNrofRateMatchPatterns)) OF RateMatchPatternId OPTIONAL, -- Need N
    ssbSubcarrierSpacing      SubcarrierSpacing            OPTIONAL, -- Cond HOAndServCellWithSSB
    tdd-UL-DL-ConfigurationCommon TDD-UL-DL-ConfigCommon OPTIONAL, -- Cond TDD
    ss-PBCH-BlockPower        INTEGER (-60..50),
    ...
    [
        channelAccessMode-r16 CHOICE {
            dynamic

```

```
    semiStatic
  }
  discoveryBurstWindowLength-r16
  ssb-PositionQCL-r16
  highSpeedConfig-r16
  ]]
}
```

```
-- TAG-SERVINGCELLCONFIGCOMMON-STOP
-- ASN1STOP
```

```
SemiStaticChannelAccessConfig
  ENUMERATED {ms0dot5, ms1, ms2, ms3, ms4, ms5}
  SSB-PositionQCL-Relation-r16
  HighSpeedConfig-r16
```

```
OPTIONAL, -- Cond SharedSpectrum
OPTIONAL, -- Need R
OPTIONAL, -- Cond SharedSpectrum
OPTIONAL, -- Need R
```

<b>ServingCellConfigCommon field descriptions</b>
<p><b>channelAccessMode</b> If present, this field indicates which channel access procedures to apply for operation with shared spectrum channel access as defined in TS 37.213 [48]. If the field is configured as "semiStatic", the UE shall apply the channel access procedures for semi-static channel occupancy as described in subclause 4.3 in TS 37.213. If the field is configured as "dynamic", the UE shall apply the channel access procedures in TS 37.213, with the exception of subclause 4.3 of TS 37.213.</p>
<p><b>dmrs-TypeA-Position</b> Position of (first) DM-RS for downlink (see TS 38.211 [16], clause 7.4.1.1.1) and uplink (TS 38.211 [16], clause 6.4.1.1.3).</p>
<p><b>downlinkConfigCommon</b> The common downlink configuration of the serving cell, including the frequency information configuration and the initial downlink BWP common configuration. The parameters provided herein should match the parameters configured by MIB and SIB1 (if provided) of the serving cell, with the exception of <i>controlResourceSetZero</i> and <i>searchSpaceZero</i> which can be configured in <i>ServingCellConfigCommon</i> even if MIB indicates that they are absent.</p>
<p><b>discoveryBurstWindowLength</b> Indicates the window length of the discovery burst in ms (see TS 37.213 [48]).</p>
<p><b>longBitmap</b> Bitmap when maximum number of SS/PBCH blocks per half frame equals to 64 as defined in TS 38.213 [13], clause 4.1.</p>
<p><b>lte-CRS-ToMatchAround</b> Parameters to determine an LTE CRS pattern that the UE shall rate match around.</p>
<p><b>mediumBitmap</b> Bitmap when maximum number of SS/PBCH blocks per half frame equals to 8 as defined in TS 38.213 [13], clause 4.1.</p>
<p><b>n-TimingAdvanceOffset</b> The N_TA-Offset to be applied for all uplink transmissions on this serving cell. If the field is absent, the UE applies the value defined for the duplex mode and frequency range of this serving cell. See TS 38.133 [14], table 7.1.2-2.</p>
<p><b>rateMatchPatternToAddModList</b> Resources patterns which the UE should rate match PDSCH around. The UE rate matches around the union of all resources indicated in the rate match patterns. Rate match patterns defined here on cell level apply only to PDSCH of the same numerology (see TS 38.214 [19], clause 5.1.4.1).</p>
<p><b>semiStaticChannelAccessConfig</b> The parameters for semi-static channel access.</p>
<p><b>shortBitmap</b> Bitmap when maximum number of SS/PBCH blocks per half frame equals to 4 as defined in TS 38.213 [13], clause 4.1.</p>
<p><b>ss-PBCH-BlockPower</b> Average EPRE of the resources elements that carry secondary synchronization signals in dBm that the NW used for SSB transmission, see TS 38.213 [13], clause 7.</p>
<p><b>ssb-periodicityServingCell</b> The SSB periodicity in ms for the rate matching purpose. If the field is absent, the UE applies the value ms5. (see TS 38.213 [13], clause 4.1)</p>
<p><b>ssb-PositionQCL</b> Indicates the QCL relationship between SSB positions for this serving cell as specified in TS 38.213 [13], clause 4.1.</p>
<p><b>ssb-PositionsInBurst</b> For operation in licensed spectrum, indicates the time domain positions of the transmitted SS-blocks in a half frame with SS/PBCH blocks as defined in TS 38.213 [13], clause 4.1. The first/leftmost bit corresponds to SS/PBCH block index 0, the second bit corresponds to SS/PBCH block index 1, and so on. Value 0 in the bitmap indicates that the corresponding SS/PBCH block is not transmitted while value 1 indicates that the corresponding SS/PBCH block is transmitted. The network configures the same pattern in this field as in the corresponding field in <i>ServingCellConfigCommonSIB</i>. For operation with shared spectrum channel access, only <i>mediumBitmap</i> is used and the UE assumes that one or more SS/PBCH blocks indicated by <i>ssb-PositionsInBurst</i> may be transmitted within the discovery burst transmission window and have candidate SS/PBCH blocks indexes corresponding to SS/PBCH block indexes provided by <i>ssb-PositionsInBurst</i> (see TS 38.213 [13], clause 4.1). If the k-th bit of <i>ssb-PositionsInBurst</i> is set to 1, the UE assumes that one or more SS/PBCH blocks within the discovery burst transmission window with candidate SS/PBCH block indexes corresponding to SS/PBCH block index equal to k – 1 may be transmitted; if the k-th bit is set to 0, the UE assumes that the corresponding SS/PBCH block(s) are not transmitted. If <i>ssb-PositionQCL</i> is configured, the UE expects that the k-th bit is set to 0, where k &gt; <i>ssb-PositionQCL</i> and the number of actually transmitted SS/PBCH blocks is not larger than the number of 1's in the bitmap. The network configures the same pattern in this field as in the corresponding field in <i>ServingCellConfigCommonSIB</i>.</p>





```

}
-- TAG-SERVINGCELLCONFIGCOMMONSIB-STOP
-- ASN1STOP

```

<b>ServingCellConfigCommonSIB field descriptions</b>	
<b>channelAccessMode</b>	If present, this field indicates which channel access procedures to apply for operation with shared spectrum channel access as defined in TS 37.213 [48]. If the field is configured as "semiStatic", the UE shall apply the channel access procedures for semi-static channel occupancy as described in subclause 4.3 in TS 37.213. If the field is configured as "dynamic", the UE shall apply the channel access procedures in TS 37.213, with the exception of subclause 4.3 of TS 37.213.
<b>discoveryBurstWindowLength</b>	Indicates the window length of the discovery burst in ms (see TS 37.213 [48]).
<b>groupPresence</b>	This field is present when maximum number of SS/PBCH blocks per half frame equals to 64 as defined in TS 38.213 [13], clause 4.1. The first/leftmost bit corresponds to the SS/PBCH index 0-7, the second bit corresponds to SS/PBCH block 8-15, and so on. Value 0 in the bitmap indicates that the SSBs according to <i>inOneGroup</i> are absent. Value 1 indicates that the SS/PBCH blocks are transmitted in accordance with <i>inOneGroup</i> .
<b>inOneGroup</b>	When maximum number of SS/PBCH blocks per half frame equals to 4 as defined in TS 38.213 [13], clause 4.1, only the 4 leftmost bits are valid; the UE ignores the 4 rightmost bits. When maximum number of SS/PBCH blocks per half frame equals to 8 as defined in TS 38.213 [13], clause 4.1, all 8 bits are valid. The first/ leftmost bit corresponds to SS/PBCH block index 0, the second bit corresponds to SS/PBCH block index 1, and so on. When maximum number of SS/PBCH blocks per half frame equals to 64 as defined in TS 38.213 [13], clause 4.1, all 8 bit are valid; The first/ leftmost bit corresponds to the first SS/PBCH block index in the group (i.e., to SSB index 0, 8, and so on); the second bit corresponds to the second SS/PBCH block index in the group (i.e., to SSB index 1, 9, and so on), and so on. Value 0 in the bitmap indicates that the corresponding SS/PBCH block is not transmitted while value 1 indicates that the corresponding SS/PBCH block is transmitted.
<b>n-TimingAdvanceOffset</b>	The N_TA-Offset to be applied for random access on this serving cell. If the field is absent, the UE applies the value defined for the duplex mode and frequency range of this serving cell. See TS 38.133 [14], table 7.1.2-2.
<b>semiStaticChannelAccessConfig</b>	The parameters for semi-static channel access.
<b>ssb-PositionsInBurst</b>	Time domain positions of the transmitted SS-blocks in an SS-burst as defined in TS 38.213 [13], clause 4.1. For operation with shared spectrum channel access, only <i>mediumBitmap</i> is used. The UE assumes that a bit at position $k > N_{SSB}^{QCL}$ is 0, where $N_{SSB}^{QCL}$ is obtained from <i>MIB</i> as specified in TS 38.213 [13], clause 4.1. For operation with shared spectrum channel access, only <i>inOneGroup</i> is used and the UE interprets this field same as <i>mediumBitmap</i> in <i>ServingCellConfigCommon</i> .
<b>ss-PBCH-BlockPower</b>	Average EPRE of the resources elements that carry secondary synchronization signals in dBm that the NW used for SSB transmission, see TS 38.213 [13], clause 7.

Conditional Presence	Explanation
<i>FR2-Only</i>	This field is mandatory present for an FR2 carrier frequency. It is absent otherwise and UE releases any configured value.
<i>SharedSpectrum</i>	This field is mandatory present if this cell operates with shared spectrum channel access. Otherwise, it is absent, Need R.
<i>TDD</i>	The field is optionally present, Need R, for TDD cells; otherwise it is absent.

– **ShortI-RNTI-Value**

The IE *ShortI-RNTI-Value* is used to identify the suspended UE context of a UE in RRC\_INACTIVE using fewer bits compared to I-RNTI-Value.

**ShortI-RNTI-Value information element**

```

-- ASN1START
-- TAG-SHORTI-RNTI-VALUE-START

ShortI-RNTI-Value ::= BIT STRING (SIZE(24))

-- TAG-SHORTI-RNTI-VALUE-STOP
-- ASN1STOP

```

– **ShortMAC-I**

The IE *ShortMAC-I* is used to identify and verify the UE at RRC connection re-establishment. The 16 least significant bits of the MAC-I calculated using the AS security configuration of the source PCell, as specified in 5.3.7.4.

**ShortMAC-I information element**

```

-- ASN1START
-- TAG-SHORTMAC-I-START

ShortMAC-I ::= BIT STRING (SIZE (16))

-- TAG-SHORTMAC-I-STOP
-- ASN1STOP

```

– **SINR-Range**

The IE *SINR-Range* specifies the value range used in SINR measurements and thresholds. For measurements, integer value for SINR measurements is according to Table 10.1.16.1-1 in TS 38.133 [14]. For thresholds, the actual value is (IE value – 46) / 2 dB.

**SINR-Range information element**

```

-- ASN1START
-- TAG-SINR-RANGE-START

SINR-Range ::= INTEGER(0..127)

-- TAG-SINR-RANGE-STOP
-- ASN1STOP

```

– **SI-RequestConfig**

The IE *SI-RequestConfig* contains configuration for Msg1 based SI request.

**SI-RequestConfig** information element

```

-- ASN1START
-- TAG-SI-REQUESTCONFIG-START

SI-RequestConfig ::=
    rach-OccasionsSI          SEQUENCE {
        rach-OccasionsSI     SEQUENCE {
            rach-ConfigSI    RACH-ConfigGeneric,
            ssb-perRACH-Occasion ENUMERATED {oneEighth, oneFourth, oneHalf, one, two, four, eight, sixteen}
        }
        si-RequestPeriod      ENUMERATED {one, two, four, six, eight, ten, twelve, sixteen}
        si-RequestResources   SEQUENCE (SIZE (1..maxSI-Message)) OF SI-RequestResources
    }
    OPTIONAL, -- Need R

SI-RequestResources ::=
    ra-PreambleStartIndex    INTEGER (0..63),
    ra-AssociationPeriodIndex INTEGER (0..15)
    ra-ssb-OccasionMaskIndex INTEGER (0..15)
    OPTIONAL, -- Need R
    OPTIONAL, -- Need R

-- ASN1STOP
-- TAG-SI-REQUESTCONFIG-STOP

```

**SI-RequestConfig** field descriptions***rach-OccasionsSI***

Configuration of dedicated RACH Occasions for SI. If the field is absent, the UE uses the corresponding parameters configured in *rach-ConfigCommon* of the initial uplink BWP.

***si-RequestPeriod***

Periodicity of the *SI-Request* configuration in number of association periods.

***si-RequestResources***

If there is only one entry in the list, the configuration is used for all SI messages for which *si-BroadcastStatus* is set to *notBroadcasting*. Otherwise the 1<sup>st</sup> entry in the list corresponds to the first SI message in *schedulingInfoList* for which *si-BroadcastStatus* is set to *notBroadcasting*, 2<sup>nd</sup> entry in the list corresponds to the second SI message in *schedulingInfoList* for which *si-BroadcastStatus* is set to *notBroadcasting* and so on. Change of *si-RequestResources* should not result in system information change notification.

**SI-SchedulingInfo**

The IE *SI-SchedulingInfo* contains information needed for acquisition of SI messages.

**SI-SchedulingInfo** information element

```

-- ASN1START
-- TAG-SI-SCHEDULINGINFO-START

SI-SchedulingInfo ::=
    schedulingInfoList      SEQUENCE (SIZE (1..maxSI-Message)) OF SchedulingInfo,
    si-WindowLength         ENUMERATED {s5, s10, s20, s40, s80, s160, s320, s640, s1280},
    si-RequestConfig        SI-RequestConfig
    OPTIONAL, -- Cond MSG-1

```

```

    si-RequestConfigSUL          SI-RequestConfig          OPTIONAL, -- Cond SUL-MSG-1
    systemInformationAreaID      BIT STRING (SIZE (24))          OPTIONAL, -- Need R
    ...
}

SchedulingInfo ::=
    si-BroadcastStatus          ENUMERATED {broadcasting, notBroadcasting},
    si-Periodicity              ENUMERATED {rf8, rf16, rf32, rf64, rf128, rf256, rf512},
    sib-MappingInfo            SIB-Mapping
}

SIB-Mapping ::=
    SEQUENCE (SIZE (1..maxSIB)) OF SIB-TypeInfo

SIB-TypeInfo ::=
    type                        ENUMERATED {sibType2, sibType3, sibType4, sibType5, sibType6, sibType7, sibType8, sibType9,
                                           sibType10-v1610, sibType11-v1610, sibType12-v1610, sibType13-v1610, sibType14-v1610,
                                           spare3, spare2, spare1,... },
    valueTag                    INTEGER (0..31)                  OPTIONAL, -- Cond SIB-TYPE
    areaScope                   ENUMERATED {true}                OPTIONAL -- Need S
}

-- TAG-SI-SCHEDULINGINFO-STOP
-- ASN1STOP

```

#### SchedulingInfo field descriptions

##### **areaScope**

Indicates that a SIB is area specific. If the field is absent, the SIB is cell specific.

##### **si-BroadcastStatus**

Indicates if the SI message is being broadcasted or not. Change of *si-BroadcastStatus* should not result in system information change notifications in Short Message transmitted with P-RNTI over DCI (see clause 6.5). The value of the indication is valid until the end of the BCCH modification period when set to *broadcasting*.

##### **si-Periodicity**

Periodicity of the SI-message in radio frames. Value *rf8* corresponds to 8 radio frames, value *rf16* corresponds to 16 radio frames, and so on.

#### SI-RequestResources field descriptions

##### **ra-AssociationPeriodIndex**

Index of the association period in the *si-RequestPeriod* in which the UE can send the SI request for SI message(s) corresponding to this *SI-RequestResources*, using the preambles indicated by *ra-PreambleStartIndex* and rach occasions indicated by *ra-ssb-OccasionMaskIndex*.

##### **ra-PreambleStartIndex**

If N SSBs are associated with a RACH occasion, where  $N \geq 1$ , for the *i*-th SSB ( $i=0, \dots, N-1$ ) the preamble with preamble index = *ra-PreambleStartIndex* + *i* is used for SI request; For  $N < 1$ , the preamble with preamble index = *ra-PreambleStartIndex* is used for SI request.

<i>SI-SchedulingInfo</i> field descriptions
<p><b><i>si-RequestConfig</i></b> Configuration of Msg1 resources that the UE uses for requesting SI-messages for which <i>si-BroadcastStatus</i> is set to <i>notBroadcasting</i>.</p>
<p><b><i>si-RequestConfigSUL</i></b> Configuration of Msg1 resources that the UE uses for requesting SI-messages for which <i>si-BroadcastStatus</i> is set to <i>notBroadcasting</i>.</p>
<p><b><i>si-WindowLength</i></b> The length of the SI scheduling window. Value <i>s5</i> corresponds to 5 slots, value <i>s10</i> corresponds to 10 slots and so on. The network always configures <i>si-WindowLength</i> to be shorter than or equal to the <i>si-Periodicity</i>.</p>
<p><b><i>systemInformationAreaID</i></b> Indicates the system information area that the cell belongs to, if any. Any SIB with <i>areaScope</i> within the SI is considered to belong to this <i>systemInformationAreaID</i>. The <i>systemInformationAreaID</i> is unique within a PLMN.</p>

Conditional presence	Explanation
<i>MSG-1</i>	The field is optionally present, Need R, if <i>si-BroadcastStatus</i> is set to <i>notBroadcasting</i> for any SI-message included in <i>SchedulingInfo</i> . It is absent otherwise.
<i>SIB-TYPE</i>	The field is mandatory present if the SIB type is different from <i>SIB6</i> , <i>SIB7</i> or <i>SIB8</i> . For <i>SIB6</i> , <i>SIB7</i> and <i>SIB8</i> it is absent.
<i>SUL-MSG-1</i>	The field is optionally present, Need R, if this serving cell is configured with a supplementary uplink and if <i>si-BroadcastStatus</i> is set to <i>notBroadcasting</i> for any SI-message included in <i>SchedulingInfo</i> . It is absent otherwise.

## – *SK-Counter*

The IE *SK-Counter* is a counter used upon initial configuration of SN security for NR-DC and NE-DC, as well as upon refresh of  $S-K_{gNB}$  or  $S-K_{eNB}$  based on the current or newly derived  $K_{gNB}$  during RRC Resume or RRC Reconfiguration, as defined in TS 33.501 [11].

```
-- ASN1START
-- TAG-SKCOUNTER-START

SK-Counter ::= INTEGER (0..65535)

-- TAG-SKCOUNTER-STOP
-- ASN1STOP
```

## – *SlotFormatCombinationsPerCell*

The IE *SlotFormatCombinationsPerCell* is used to configure the *SlotFormatCombinations* applicable for one serving cell (see TS 38.213 [13], clause 11.1.1).

### ***SlotFormatCombinationsPerCell* information element**

```
-- ASN1START
-- TAG-SLOTFORMATCOMBINATIONSPERCELL-START

SlotFormatCombinationsPerCell ::= SEQUENCE {
    servingCellId          ServCellIndex,
    subcarrierSpacing      SubcarrierSpacing,
```

```

subcarrierSpacing2          SubcarrierSpacing          OPTIONAL, -- Need R
slotFormatCombinations     SEQUENCE (SIZE (1..maxNrofSlotFormatCombinationsPerSet)) OF SlotFormatCombination
                             OPTIONAL, -- Need M
positionInDCI              INTEGER(0..maxSFI-DCI-PayloadSize-1)  OPTIONAL, -- Need M
...
[[
enableConfiguredUL-r16     ENUMERATED {enabled}                OPTIONAL -- Need R
]]
}

SlotFormatCombination ::=
  SEQUENCE {
    slotFormatCombinationId SlotFormatCombinationId,
    slotFormats              SEQUENCE (SIZE (1..maxNrofSlotFormatsPerCombination)) OF INTEGER (0..255)
  }

SlotFormatCombinationId ::=
  INTEGER (0..maxNrofSlotFormatCombinationsPerSet-1)

-- TAG-SLOTFORMATCOMBINATIONSPERCELL-STOP
-- ASN1STOP

```

<i>SlotFormatCombination</i> field descriptions
<p><b><i>slotFormatCombinationId</i></b> This ID is used in the DCI payload to dynamically select this <i>SlotFormatCombination</i> (see TS 38.213 [13], clause 11.1.1).</p>
<p><b><i>slotFormats</i></b> Slot formats that occur in consecutive slots in time domain order as listed here (see TS 38.213 [13], clause 11.1.1 and TS 38.213 [13], clause 14 for IAB-MT).</p>

<b>SlotFormatCombinationsPerCell field descriptions</b>
<p><b>enableConfiguredUL</b> If configured, the UE is allowed to transmit uplink signals (SRS, PUCCH, CG-PUSCH) in the set of symbols of the slot when the UE does not detect a DCI format 2_0 providing a slot format for the set of symbols (see TS 38.213 [13], 11.1.1).</p>
<p><b>positionInDCI</b> The (starting) position (bit) of the slotFormatCombinationId (SFI-Index) for this serving cell (servingCellId) within the DCI payload (see TS 38.213 [13], clause 11.1.1).</p>
<p><b>servingCellId</b> The ID of the serving cell for which the slotFormatCombinations are applicable.</p>
<p><b>slotFormatCombinations</b> A list with <i>SlotFormatCombinations</i>. Each <i>SlotFormatCombination</i> comprises of one or more <i>SlotFormats</i> (see TS 38.211 [16], clause 4.3.2). The total number of <i>slotFormats</i> in the <i>slotFormatCombinations</i> list does not exceed 512.</p>
<p><b>subcarrierSpacing2</b> Reference subcarrier spacing for a Slot Format Combination on an FDD or SUL cell (see TS 38.213 [13], clause 11.1.1). For FDD, subcarrierSpacing (SFI-scs) is the reference SCS for DL BWP and subcarrierSpacing2 (SFI-scs2) is the reference SCS for UL BWP. For SUL, <i>subcarrierSpacing</i> (SFI-scs) is the reference SCS for non-SUL carrier and <i>subcarrierSpacing2</i> (SFI-scs2) is the reference SCS for SUL carrier. The network configures a value that is smaller than or equal to any SCS of configured BWPs of the serving cell that the command applies to. And the network configures a value that is smaller than or equal to the SCS of the serving cell which the UE monitors for SFI indications.</p>
<p><b>subcarrierSpacing</b> Reference subcarrier spacing for this Slot Format Combination. The network configures a value that is smaller than or equal to any SCS of configured BWPs of the serving cell that the command applies to. And the network configures a value that is smaller than or equal to the SCS of the serving cell which the UE monitors for SFI indications (see TS 38.213 [13], clause 11.1.1).</p>

## – SlotFormatIndicator

The IE *SlotFormatIndicator* is used to configure monitoring a Group-Common-PDCCH for Slot-Format-Indicators (SFI).

### SlotFormatIndicator information element

```

-- ASN1START
-- TAG-SLOTFORMATINDICATOR-START

SlotFormatIndicator ::= SEQUENCE {
    sfi-RNTI                RNTI-Value,
    dci-PayloadSize         INTEGER (1..maxSFI-DCI-PayloadSize),
    slotFormatCombToAddModList SEQUENCE (SIZE(1..maxNrofAggregatedCellsPerCellGroup)) OF SlotFormatCombinationsPerCell
                                                                    OPTIONAL, -- Need N
    slotFormatCombToReleaseList SEQUENCE (SIZE(1..maxNrofAggregatedCellsPerCellGroup)) OF ServCellIndex
                                                                    OPTIONAL, -- Need N
    ...,
    [[
    availableRB-SetsToAddModList-r16 SEQUENCE (SIZE(1..maxNrofAggregatedCellsPerCellGroup)) OF AvailableRB-SetsPerCell-r16
                                                                    OPTIONAL, -- Need N
    availableRB-SetsToRelease-r16 SEQUENCE (SIZE(1..maxNrofAggregatedCellsPerCellGroup)) OF ServCellIndex
                                                                    OPTIONAL, -- Need N
    switchTriggerToAddModList-r16 SEQUENCE (SIZE(1..4)) OF SearchSpaceSwitchTrigger-r16
                                                                    OPTIONAL, -- Need N
    switchTriggerToReleaseList-r16 SEQUENCE (SIZE(1..4)) OF ServCellIndex
                                                                    OPTIONAL, -- Need N
    co-DurationsPerCellToAddModList-r16 SEQUENCE (SIZE(1..maxNrofAggregatedCellsPerCellGroup)) OF CO-DurationsPerCell-r16
                                                                    OPTIONAL, -- Need N
    co-DurationsPerCellToReleaseList-r16 SEQUENCE (SIZE(1..maxNrofAggregatedCellsPerCellGroup)) OF ServCellIndex
                                                                    OPTIONAL, -- Need N
    ]]
}

CO-DurationsPerCell-r16 ::= SEQUENCE {

```



```

    servingCellId-r16           ServCellIndex,
    positionInDCI-r16           INTEGER(0..maxSFI-DCI-PayloadSize-1),
    subcarrierSpacing-r16      SubcarrierSpacing,
    co-DurationList-r16        SEQUENCE (SIZE(1..64)) OF CO-Duration-r16
}

CO-Duration-r16 ::= INTEGER (0..1120)

AvailableRB-SetsPerCell-r16 ::= SEQUENCE {
    servingCellId-r16           ServCellIndex,
    positionInDCI-r16           INTEGER(0..maxSFI-DCI-PayloadSize-1)
}

SearchSpaceSwitchTrigger-r16 ::= SEQUENCE {
    servingCellId-r16           ServCellIndex,
    positionInDCI-r16           INTEGER(0..maxSFI-DCI-PayloadSize-1)
}

-- TAG-SLOTFORMATINDICATOR-STOP
-- ASN1STOP

```

#### SlotFormatIndicator field descriptions

##### **availableRB-SetsToAddModList**

A list of *AvailableRB-SetsPerCell* objects (see TS 38.213 [13], clause 11.1.1).

##### **co-DurationsPerCellToAddModList**

A list of *CO-DurationPerCell* objects. If not configured, the UE uses slot format indicator (SFI), if available, to determine the channel occupancy duration.

##### **dci-PayloadSize**

Total length of the DCI payload scrambled with SFI-RNTI (see TS 38.213 [13], clause 11.1.1).

##### **sfi-RNTI**

RNTI used for SFI on the given cell (see TS 38.213 [13], clause 11.1.1).

##### **slotFormatCombToAddModList**

A list of *SlotFormatCombinations* for the UE's serving cells (see TS 38.213 [13], clause 11.1.1).

##### **switchTriggerToAddModList**

A list of *SearchSpaceSwitchTrigger* objects. Each *SearchSpaceSwitchTrigger* object provides position in DCI of the bit field indicating search space switching flag for a serving cell or, if *CellGroupForSwitch-r16* is configured, group of serving cells (see TS 38.213 [13], clause 10.4).

#### AvailableRB-SetsPerCell field descriptions

##### **positionInDCI**

The (starting) position of the bits within DCI payload indicating the availability of the RB sets of a serving cell (see TS 38.213 [13], clause 11.1.1).

##### **servingCellId**

The ID of the serving cell for which the configuration is applicable.

<b>CO-DurationsPerCell field descriptions</b>
<b>co-DurationList</b> A list of Channel Occupancy duration in symbols.
<b>positionInDCI</b> Position in DCI of the bit field indicating Channel Occupancy duration for UE's serving cells (see TS 38.213 [13], clause 11.1.1).
<b>servingCellId</b> The ID of the serving cell for which the configuration is applicable.
<b>subcarrierSpacing</b> Reference subcarrier spacing for the list of Channel Occupancy durations (see TS 38.213 [13], clause 11.1.1).

<b>SearchSpaceSwitchTrigger field descriptions</b>
<b>positionInDCI</b> The position of the bit within DCI payload containing a search space switching flag (see TS 38.213 [13], clause 11.1.1).
<b>servingCellId</b> The ID of the serving cell for which the configuration is applicable or the group of serving cells as indicated by <i>CellGroupsForSwitch-r16</i> containing this <i>servingCellId</i> .

## – S-NSSAI

The IE *S-NSSAI* (*Single Network Slice Selection Assistance Information*) identifies a Network Slice end to end and comprises a slice/service type and a slice differentiator, see TS 23.003 [21].

### S-NSSAI information element

```
-- ASN1START
-- TAG-S-NSSAI-START

S-NSSAI ::=
    CHOICE{
        sst          BIT STRING (SIZE (8)),
        sst-SD      BIT STRING (SIZE (32))
    }

-- TAG-S-NSSAI-STOP
-- ASN1STOP
```

<b>S-NSSAI field descriptions</b>
<b>sst</b> Indicates the S-NSSAI consisting of Slice/Service Type, see TS 23.003 [21].
<b>sst-SD</b> Indicates the S-NSSAI consisting of Slice/Service Type and Slice Differentiator, see TS 23.003 [21].

## – *SpeedStateScaleFactors*

The IE *SpeedStateScaleFactors* concerns factors, to be applied when the UE is in medium or high speed state, used for scaling a mobility control related parameter.

### **SpeedStateScaleFactors information element**

```
-- ASN1START
-- TAG-SPEEDSTATESCALEFACTORS-START

SpeedStateScaleFactors ::=          SEQUENCE {
    sf-Medium                       ENUMERATED {oDot25, oDot5, oDot75, lDot0},
    sf-High                          ENUMERATED {oDot25, oDot5, oDot75, lDot0}
}
-- TAG-SPEEDSTATESCALEFACTORS-STOP
-- ASN1STOP
```

#### **SpeedStateScaleFactors field descriptions**

##### ***sf-High***

The concerned mobility control related parameter is multiplied with this factor if the UE is in High Mobility state as defined in TS 38.304 [20]. Value *oDot25* corresponds to 0.25, value *oDot5* corresponds to 0.5, *oDot75* corresponds to 0.75 and so on.

##### ***sf-Medium***

The concerned mobility control related parameter is multiplied with this factor if the UE is in Medium Mobility state as defined in TS 38.304 [20]. Value *oDot25* corresponds to 0.25, value *oDot5* corresponds to 0.5, value *oDot75* corresponds to 0.75, and so on.

## – *SPS-Config*

The IE *SPS-Config* is used to configure downlink semi-persistent transmission. Multiple Downlink SPS configurations may be configured in one BWP of a serving cell.

### **SPS-Config information element**

```
-- ASN1START
-- TAG-SPS-CONFIG-START

SPS-Config ::=
    periodicity                ENUMERATED {ms10, ms20, ms32, ms40, ms64, ms80, ms128, ms160, ms320, ms640,
                                          spare6, spare5, spare4, spare3, spare2, spare1},
    nrofHARQ-Processes          INTEGER (1..8),
    n1PUCCH-AN                  PUCCH-ResourceId                               OPTIONAL, -- Need M
    mcs-Table                   ENUMERATED {qam64LowSE}                       OPTIONAL, -- Need S
    ...,
    [[
    sps-ConfigIndex-r16         SPS-ConfigIndex-r16                          OPTIONAL, -- Cond SPS-List
    harq-ProcID-Offset-r16     INTEGER (0..15)                               OPTIONAL, -- Need R
    periodicityExt-r16         INTEGER (1..5120)                             OPTIONAL, -- Need R
    harq-CodebookID-r16        INTEGER (1..2)                               OPTIONAL, -- Need R
    pdsch-AggregationFactor-r16 ENUMERATED {n1, n2, n4, n8 }                 OPTIONAL, -- Need S
    ]]
]]
```

```

}
-- TAG-SPS-CONFIG-STOP
-- ASN1STOP

```

<b>SPS-Config field descriptions</b>
<p><b>harq-CodebookID</b> Indicates the HARQ-ACK codebook index for the corresponding HARQ-ACK codebook for SPS PDSCH and ACK for SPS PDSCH release.</p>
<p><b>harq-ProclD-Offset</b> Indicates the offset used in deriving the HARQ process IDs, see TS 38.321 [3], clause 5.3.1.</p>
<p><b>mcs-Table</b> Indicates the MCS table the UE shall use for DL SPS (see TS 38.214 [19], clause 5.1.3.1. If present, the UE shall use the MCS table of low-SE 64QAM table indicated in Table 5.1.3.1-3 of TS 38.214 [19]. If this field is absent and field mcs-table in PDSCH-Config is set to 'qam256' and the activating DCI is of format 1_1, the UE applies the 256QAM table indicated in Table 5.1.3.1-2 of TS 38.214 [19]. Otherwise, the UE applies the non-low-SE 64QAM table indicated in Table 5.1.3.1-1 of TS 38.214 [19].</p>
<p><b>n1PUCCH-AN</b> HARQ resource for PUCCH for DL SPS. The network configures the resource either as format0 or format1. The actual <i>PUCCH-Resource</i> is configured in <i>PUCCH-Config</i> and referred to by its ID. See TS 38.213 [13], clause 9.2.3.</p>
<p><b>nrofHARQ-Processes</b> Number of configured HARQ processes for SPS DL (see TS 38.321 [3], clause 5.8.1).</p>
<p><b>pdsch-AggregationFactor</b> Number of repetitions for SPS PDSCH (see TS 38.214 [19], clause 5.1.2.1). When the field is absent, the UE applies PDSCH aggregation factor of PDSCH-Config.</p>
<p><b>periodicity</b> Periodicity for DL SPS (see TS 38.214 [19] and TS 38.321 [3], clause 5.8.1).</p>
<p><b>periodicityExt</b> This field is used to calculate the periodicity for DL SPS (see TS 38.214 [19] and see TS 38.321 [3], clause 5.8.1). If this field is present, the field <i>periodicity</i> is ignored. The following periodicities are supported depending on the configured subcarrier spacing [ms]:  15 kHz: <i>periodicityExt</i>, where <i>periodicityExt</i> has a value between 1 and 640.  30 kHz: 0.5 x <i>periodicityExt</i>, where <i>periodicityExt</i> has a value between 1 and 1280.  60 kHz with normal CP: 0.25 x <i>periodicityExt</i>, where <i>periodicityExt</i> has a value between 1 and 2560.  60 kHz with ECP: 0.25 x <i>periodicityExt</i>, where <i>periodicityExt</i> has a value between 1 and 2560.  120 kHz: 0.125 x <i>periodicityExt</i>, where <i>periodicityExt</i> has a value between 1 and 5120.</p>
<p><b>sps-ConfigIndex</b> Indicates the index of one of multiple SPS configurations.</p>

Conditional Presence	Explanation
<i>SPS-List</i>	The field is mandatory present when included in <i>sps-ConfigToAddModList-r16</i> , otherwise the field is absent.

## – SPS-ConfigIndex

The IE *SPS-ConfigIndex* is used to indicate the index of one of multiple DL SPS configurations in one BWP.

**SPS-ConfigIndex** information element

```

-- ASN1START
-- TAG-SPS-CONFIGINDEX-START

SPS-ConfigIndex-r16 ::= INTEGER (0.. maxNrofSPS-Config-r16-1)

-- TAG-SPS-CONFIGINDEX-STOP
-- ASN1STOP

```

— **SPS-PUCCH-AN**

The IE *SPS-PUCCH-AN* is used to indicate a PUCCH resource for HARQ ACK and configure the corresponding maximum payload size for the PUCCH resource.

**SPS-PUCCH-AN** information element

```

-- ASN1START
-- TAG-SPS-PUCCH-AN-START

SPS-PUCCH-AN-r16 ::= SEQUENCE {
    sps-PUCCH-AN-ResourceID-r16 PUCCH-ResourceId,
    maxPayloadSize-r16          INTEGER (4..256) OPTIONAL -- Need R
}

-- TAG-SPS-PUCCH-AN-STOP
-- ASN1STOP

```

**SPS-PUCCH-AN field descriptions****maxPayloadSize**

Indicates the maximum payload size for the corresponding PUCCH resource ID.

**sps-PUCCH-AN-ResourceID**

Indicates the PUCCH resource ID

— **SPS-PUCCH-AN-List**

The IE *SPS-PUCCH-AN-List* is used to configure the list of PUCCH resources per HARQ ACK codebook

**SPS-PUCCH-AN-List** information element

```

-- ASN1START
-- TAG-SPS-PUCCH-AN-LIST-START

SPS-PUCCH-AN-List-r16 ::= SEQUENCE (SIZE(1..4)) OF SPS-PUCCH-AN-r16

-- TAG-SPS-PUCCH-AN-LIST-STOP

```

```
-- ASN1STOP
```

## – *SRB-Identity*

The IE *SRB-Identity* is used to identify a Signalling Radio Bearer (SRB) used by a UE.

### ***SRB-Identity* information element**

```
-- ASN1START
-- TAG-SRB-IDENTITY-START
```

```
SRB-Identity ::=                INTEGER (1..3)
```

```
-- TAG-SRB-IDENTITY-STOP
-- ASN1STOP
```

## – *SRS-CarrierSwitching*

The IE *SRS-CarrierSwitching* is used to configure for SRS carrier switching when PUSCH is not configured and independent SRS power control from that of PUSCH.

### ***SRS-CarrierSwitching* information element**

```
-- ASN1START
-- TAG-SRS-CARRIERSWITCHING-START
```

```
SRS-CarrierSwitching ::=        SEQUENCE {
  srs-SwitchFromServCellIndex   INTEGER (0..31)                OPTIONAL,  -- Need M
  srs-SwitchFromCarrier         ENUMERATED {sUL, nUL},
  srs-TPC-PDCCH-Group          CHOICE {
    typeA                       SEQUENCE (SIZE (1..32)) OF SRS-TPC-PDCCH-Config,
    typeB                       SRS-TPC-PDCCH-Config
  }
  monitoringCells               SEQUENCE (SIZE (1..maxNrofServingCells)) OF ServCellIndex  OPTIONAL,  -- Need M
  ...
}
```

```
SRS-TPC-PDCCH-Config ::=       SEQUENCE {
  srs-CC-SetIndexlist           SEQUENCE (SIZE(1..4)) OF SRS-CC-SetIndex                OPTIONAL  -- Need M
}
```

```
SRS-CC-SetIndex ::=           SEQUENCE {
  cc-SetIndex                   INTEGER (0..3)                OPTIONAL,  -- Need M
  cc-IndexInOneCC-Set           INTEGER (0..7)                OPTIONAL  -- Need M
}
```

```
-- TAG-SRS-CARRIERSWITCHING-STOP
-- ASN1STOP
```

<b>SRS-CC-SetIndex field descriptions</b>
<p><b>cc-IndexInOneCC-Set</b> Indicates the CC index in one CC set for Type A (see TS 38.212 [17], TS 38.213 [13], clause 7.3.1, 11.4). The network always includes this field when the <i>srs-TPC-PDCCH-Group</i> is set to <i>typeA</i>. The network does not configure this field to 3 in this release of specification.</p>
<p><b>cc-SetIndex</b> Indicates the CC set index for Type A associated (see TS 38.212 [17], TS 38.213 [13], clause 7.3.1, 11.4). The network always includes this field when the <i>srs-TPC-PDCCH-Group</i> is set to <i>typeA</i>.</p>

<b>SRS-CarrierSwitching field descriptions</b>
<p><b>monitoringCells</b> A set of serving cells for monitoring PDCCH conveying SRS DCI format with CRC scrambled by TPC-SRS-RNTI (see TS 38.212 [17], TS 38.213 [13], clause 7.3.1, 11.3).</p>
<p><b>srs-SwitchFromServCellIndex</b> Indicates the serving cell whose UL transmission may be interrupted during SRS transmission on a PUSCH-less SCell. During SRS transmission on a PUSCH-less SCell, the UE may temporarily suspend the UL transmission on a serving cell with PUSCH in the same CG to allow the PUSCH-less SCell to transmit SRS. (see TS 38.214 [19], clause 6.2.1.3).</p>
<p><b>srs-TPC-PDCCH-Group</b> Network configures the UE with either <i>typeA-SRS-TPC-PDCCH-Group</i> or <i>typeB-SRS-TPC-PDCCH-Group</i>, if any.</p>
<p><b>typeA</b> Type A trigger configuration for SRS transmission on a PUSCH-less SCell (see TS 38.213 [13], clause 11.4). In this release, the network configures at most one entry (the first entry) of <i>typeA</i>, and the first entry corresponds to the uplink carrier in which the <i>SRS-CarrierSwitching</i> field is configured.</p>
<p><b>typeB</b> Type B trigger configuration for SRS transmission on a PUSCH-less SCell (see TS 38.213 [13], clause 11.4).</p>

<b>SRS-TPC-PDCCH-Config field descriptions</b>
<p><b>srs-CC-SetIndexlist</b> A list of pairs of [<i>cc-SetIndex</i>; <i>cc-IndexInOneCC-Set</i>] (see TS 38.212 [17], TS 38.213 [13], clause 7.3.1, 11.4). The network does not configure this field for <i>typeB</i>.</p>

## – SRS-Config

The IE *SRS-Config* is used to configure sounding reference signal transmissions. The configuration defines a list of SRS-Resources and a list of SRS-ResourceSets. Each resource set defines a set of SRS-Resources. The network triggers the transmission of the set of SRS-Resources using a configured aperiodicSRS-ResourceTrigger (L1 DCI).

### SRS-Config information element

```

-- ASN1START
-- TAG-SRS-CONFIG-START

SRS-Config ::=
    srs-ResourceSetToReleaseList    SEQUENCE (SIZE(1..maxNrofSRS-ResourceSets)) OF SRS-ResourceSetId    OPTIONAL, -- Need N
    srs-ResourceSetToAddModList     SEQUENCE (SIZE(1..maxNrofSRS-ResourceSets)) OF SRS-ResourceSet    OPTIONAL, -- Need N
    srs-ResourceToReleaseList       SEQUENCE (SIZE(1..maxNrofSRS-Resources)) OF SRS-ResourceId    OPTIONAL, -- Need N
    srs-ResourceToAddModList        SEQUENCE (SIZE(1..maxNrofSRS-Resources)) OF SRS-Resource      OPTIONAL, -- Need N

```

```

tpc-Accumulation          ENUMERATED {disabled}                                OPTIONAL, -- Need S
...
[[
srs-RequestDCI-1-2-r16    INTEGER (1..2)                                           OPTIONAL, -- Need S
srs-RequestDCI-0-2-r16    INTEGER (1..2)                                           OPTIONAL, -- Need S
srs-ResourceSetToAddModListDCI-0-2-r16 SEQUENCE (SIZE(1..maxNrofSRS-ResourceSets)) OF SRS-ResourceSet OPTIONAL, -- Need N
srs-ResourceSetToReleaseListDCI-0-2-r16 SEQUENCE (SIZE(1..maxNrofSRS-ResourceSets)) OF SRS-ResourceSetId OPTIONAL, -- Need N
srs-PosResourceSetToReleaseList-r16 SEQUENCE (SIZE(1..maxNrofSRS-PosResourceSets-r16)) OF SRS-PosResourceSetId-r16 OPTIONAL, -- Need N
srs-PosResourceSetToAddModList-r16 SEQUENCE (SIZE(1..maxNrofSRS-PosResourceSets-r16)) OF SRS-PosResourceSet-r16 OPTIONAL, -- Need N
srs-PosResourceToReleaseList-r16 SEQUENCE (SIZE(1..maxNrofSRS-PosResources-r16)) OF SRS-PosResourceId-r16 OPTIONAL, -- Need N
srs-PosResourceToAddModList-r16 SEQUENCE (SIZE(1..maxNrofSRS-PosResources-r16)) OF SRS-PosResource-r16 OPTIONAL, -- Need N
]]
}

SRS-ResourceSet ::=
  srs-ResourceSetId      SRS-ResourceSetId,
  srs-ResourceSetList    SEQUENCE (SIZE(1..maxNrofSRS-ResourcesPerSet)) OF SRS-ResourceId OPTIONAL, -- Cond Setup
  resourceType           CHOICE {
    aperiodic            SEQUENCE {
      aperiodicSRS-ResourceTrigger INTEGER (1..maxNrofSRS-TriggerStates-1),
      csi-RS              NZP-CSI-RS-ResourceId OPTIONAL, -- Cond NonCodebook
      slotOffset          INTEGER (1..32) OPTIONAL, -- Need S
      ...
      [[
      aperiodicSRS-ResourceTriggerList SEQUENCE (SIZE(1..maxNrofSRS-TriggerStates-2))
                                      OF INTEGER (1..maxNrofSRS-TriggerStates-1) OPTIONAL -- Need M
      ]]
    },
    semi-persistent      SEQUENCE {
      associatedCSI-RS    NZP-CSI-RS-ResourceId OPTIONAL, -- Cond NonCodebook
      ...
    },
    periodic              SEQUENCE {
      associatedCSI-RS    NZP-CSI-RS-ResourceId OPTIONAL, -- Cond NonCodebook
      ...
    }
  },
  usage                  ENUMERATED {beamManagement, codebook, nonCodebook, antennaSwitching},
  alpha                  Alpha OPTIONAL, -- Need S
  p0                     INTEGER (-202..24) OPTIONAL, -- Cond Setup
  pathlossReferenceRS    PathlossReferenceRS-Config OPTIONAL, -- Need M
  srs-PowerControlAdjustmentStates ENUMERATED { sameAsFci2, separateClosedLoop} OPTIONAL, -- Need S
  ...
  [[
  pathlossReferenceRSList-r16 SetupRelease { PathlossReferenceRSList-r16} OPTIONAL -- Need M
  ]]
}

PathlossReferenceRS-Config ::=
  ssb-Index              SSB-Index,
  csi-RS-Index           NZP-CSI-RS-ResourceId
}

```



```

PathlossReferenceRSList-r16 ::= SEQUENCE (SIZE (1..maxNrofSRS-PathlossReferenceRS-r16)) OF PathlossReferenceRS-r16

PathlossReferenceRS-r16 ::= SEQUENCE {
    srs-PathlossReferenceRS-Id-r16 SRS-PathlossReferenceRS-Id-r16,
    pathlossReferenceRS-r16 PathlossReferenceRS-Config
}

SRS-PathlossReferenceRS-Id-r16 ::= INTEGER (0..maxNrofSRS-PathlossReferenceRS-1-r16)

SRS-PosResourceSet-r16 ::= SEQUENCE {
    srs-PosResourceSetId-r16 SRS-PosResourceSetId-r16,
    srs-PosResourceIdList-r16 SEQUENCE (SIZE(1..maxNrofSRS-ResourcesPerSet)) OF SRS-PosResourceId-r16
                                                                    OPTIONAL, -- Cond Setup

    resourceType-r16 CHOICE {
        aperiodic-r16 SEQUENCE {
            aperiodicSRS-ResourceTriggerList-r16 SEQUENCE (SIZE(1..maxNrofSRS-TriggerStates-1))
                                                                    OF INTEGER (1..maxNrofSRS-TriggerStates-1) OPTIONAL, -- Need M
            ...
        },
        semi-persistent-r16 SEQUENCE {
            ...
        },
        periodic-r16 SEQUENCE {
            ...
        }
    },
    alpha-r16 Alpha OPTIONAL, -- Need S
    p0-r16 INTEGER (-202..24) OPTIONAL, -- Cond Setup
    pathlossReferenceRS-Pos-r16 CHOICE {
        ssb-IndexServing-r16 SSB-Index,
        ssb-Ncell-r16 SSB-InfoNcell-r16,
        dl-PRS-r16 DL-PRS-Info-r16
    }
                                                                    OPTIONAL, -- Need M
    ...
}

SRS-ResourceSetId ::= INTEGER (0..maxNrofSRS-ResourceSets-1)

SRS-PosResourceSetId-r16 ::= INTEGER (0..maxNrofSRS-PosResourceSets-1-r16)

SRS-Resource ::= SEQUENCE {
    srs-ResourceId SRS-ResourceId,
    nrofSRS-Ports ENUMERATED {port1, ports2, ports4},
    ptrs-PortIndex ENUMERATED {n0, n1 } OPTIONAL, -- Need R
    transmissionComb CHOICE {
        n2 SEQUENCE {
            combOffset-n2 INTEGER (0..1),
            cyclicShift-n2 INTEGER (0..7)
        },
        n4 SEQUENCE {
            combOffset-n4 INTEGER (0..3),
            cyclicShift-n4 INTEGER (0..11)
        }
    },
}

```

```

resourceMapping
  startPosition
  nrofSymbols
  repetitionFactor
},
freqDomainPosition
freqDomainShift
freqHopping
  c-SRS
  b-SRS
  b-hop
},
groupOrSequenceHopping
resourceType
  aperiodic
  ...
},
  semi-persistent
  periodicityAndOffset-sp
  ...
},
  periodic
  periodicityAndOffset-p
  ...
}
},
sequenceId
spatialRelationInfo
...,
[[
resourceMapping-r16
  startPosition-r16
  nrofSymbols-r16
  repetitionFactor-r16
}
]]
}

SRS-PosResource-r16 ::=
  srs-PosResourceId-r16
  transmissionComb-r16
    n2-r16
      combOffset-n2-r16
      cyclicShift-n2-r16
    },
    n4-r16
      combOffset-n4-r16
      cyclicShift-n4-r16
    },
    n8-r16
      combOffset-n8-r16
      cyclicShift-n8-r16
  },

```

```

SEQUENCE {
  INTEGER (0..5),
  ENUMERATED {n1, n2, n4},
  ENUMERATED {n1, n2, n4}
}

INTEGER (0..67),
INTEGER (0..268),
SEQUENCE {
  INTEGER (0..63),
  INTEGER (0..3),
  INTEGER (0..3)
}

ENUMERATED { neither, groupHopping, sequenceHopping },
CHOICE {
  SEQUENCE {
    SEQUENCE {
      SRS-PeriodicityAndOffset,
    }
  },
  SEQUENCE {
    SRS-PeriodicityAndOffset,
  }
}

INTEGER (0..1023),
SRS-SpatialRelationInfo
OPTIONAL, -- Need R

SEQUENCE {
  INTEGER (0..13),
  ENUMERATED {n1, n2, n4},
  ENUMERATED {n1, n2, n4}
}
OPTIONAL -- Need R

SEQUENCE {
  SRS-PosResourceId-r16,
  CHOICE {
    SEQUENCE {
      INTEGER (0..1),
      INTEGER (0..7)
    },
    SEQUENCE {
      INTEGER (0..3),
      INTEGER (0..11)
    },
    SEQUENCE {
      INTEGER (0..7),
      INTEGER (0..5)
    }
  }
}

```

```

...
},
resourceMapping-r16          SEQUENCE {
    startPosition-r16        INTEGER (0..13),
    nrofSymbols-r16         ENUMERATED {n1, n2, n4, n8, n12}
},
freqDomainShift-r16         INTEGER (0..268),
freqHopping-r16            SEQUENCE {
    c-SRS-r16               INTEGER (0..63),
    ...
},
groupOrSequenceHopping-r16  ENUMERATED { neither, groupHopping, sequenceHopping },
resourceType-r16            CHOICE {
    aperiodic-r16           SEQUENCE {
        slotOffset-r16     INTEGER (1..32)                OPTIONAL, -- Need S
        ...
    },
    semi-persistent-r16     SEQUENCE {
        periodicityAndOffset-sp-r16
        ...
    },
    periodic-r16            SEQUENCE {
        periodicityAndOffset-p-r16
        ...
    }
},
sequenceId-r16              INTEGER (0..65535),
spatialRelationInfoPos-r16  SRS-SpatialRelationInfoPos-r16    OPTIONAL, -- Need R
...
}

SRS-SpatialRelationInfo ::= SEQUENCE {
    servingCellId            ServCellIndex                OPTIONAL, -- Need S
    referenceSignal          CHOICE {
        ssb-Index           SSB-Index,
        csi-RS-Index        NZP-CSI-RS-ResourceId,
        srs                  SEQUENCE {
            resourceId       SRS-ResourceId,
            uplinkBWP        BWP-Id
        }
    }
}

SRS-SpatialRelationInfoPos-r16 ::= CHOICE {
    servingRS-r16           SEQUENCE {
        servingCellId       ServCellIndex                OPTIONAL, -- Need S
        referenceSignal-r16 CHOICE {
            ssb-IndexServing-r16 SSB-Index,
            csi-RS-IndexServing-r16 NZP-CSI-RS-ResourceId,
            srs-SpatialRelation-r16 SEQUENCE {
                resourceSelection-r16 CHOICE {
                    srs-ResourceId-r16 SRS-ResourceId,
                    srs-PosResourceId-r16 SRS-PosResourceId-r16
                }
            }
        }
    },

```



```

}
SRS-PeriodicityAndOffset-r16 ::= CHOICE {
    s11          NULL,
    s12          INTEGER(0..1),
    s14          INTEGER(0..3),
    s15          INTEGER(0..4),
    s18          INTEGER(0..7),
    s110         INTEGER(0..9),
    s116         INTEGER(0..15),
    s120         INTEGER(0..19),
    s132         INTEGER(0..31),
    s140         INTEGER(0..39),
    s164         INTEGER(0..63),
    s180         INTEGER(0..79),
    s1160        INTEGER(0..159),
    s1320        INTEGER(0..319),
    s1640        INTEGER(0..639),
    s11280       INTEGER(0..1279),
    s12560       INTEGER(0..2559),
    s15120       INTEGER(0..5119),
    s110240      INTEGER(0..10239),
    s140960      INTEGER(0..40959),
    s181920      INTEGER(0..81919),
    ...
}
-- TAG-SRS-CONFIG-STOP
-- ASN1STOP

```

#### SRS-Config field descriptions

##### ***tpc-Accumulation***

If the field is absent, UE applies TPC commands via accumulation. If disabled, UE applies the TPC command without accumulation (this applies to SRS when a separate closed loop is configured for SRS) (see TS 38.213 [13], clause 7.3).

<b>SRS-Resource field descriptions</b>
<p><b>cyclicShift-n2</b> Cyclic shift configuration (see TS 38.214 [19], clause 6.2.1).</p>
<p><b>cyclicShift-n4</b> Cyclic shift configuration (see TS 38.214 [19], clause 6.2.1).</p>
<p><b>freqHopping</b> Includes parameters capturing SRS frequency hopping (see TS 38.214 [19], clause 6.2.1). For CLI SRS-RSRP measurement, the network always configures this field such that <math>b-hop &gt; b-SRS</math>.</p>
<p><b>groupOrSequenceHopping</b> Parameter(s) for configuring group or sequence hopping (see TS 38.211 [16], clause 6.4.1.4.2). For CLI SRS-RSRP measurement, the network always configures this parameter to 'neither'.</p>
<p><b>nrofSRS-Ports</b> Number of ports. For CLI SRS-RSRP measurement, the network always configures this parameter to 'port1'.</p>
<p><b>periodicityAndOffset-p</b> Periodicity and slot offset for this SRS resource. All values are in "number of slots". Value <math>s1</math> corresponds to a periodicity of 1 slot, value <math>s2</math> corresponds to a periodicity of 2 slots, and so on. For each periodicity the corresponding offset is given in number of slots. For periodicity <math>s1</math> the offset is 0 slots (see TS 38.214 [19], clause 6.2.1). For CLI SRS-RSRP measurement, <math>s1/280</math> and <math>s1/2560</math> cannot be configured.</p>
<p><b>periodicityAndOffset-sp</b> Periodicity and slot offset for this SRS resource. All values are in "number of slots". Value <math>s1</math> corresponds to a periodicity of 1 slot, value <math>s2</math> corresponds to a periodicity of 2 slots, and so on. For each periodicity the corresponding offset is given in number of slots. For periodicity <math>s1</math> the offset is 0 slots (see TS 38.214 [19], clause 6.2.1).</p>
<p><b>ptrs-PortIndex</b> The PTRS port index for this SRS resource for non-codebook based UL MIMO. This is only applicable when the corresponding <i>PTRS-UplinkConfig</i> is set to CP-OFDM. The <i>ptrs-PortIndex</i> configured here must be smaller than the <i>maxNrofPorts</i> configured in the <i>PTRS-UplinkConfig</i> (see TS 38.214 [19], clause 6.2.3.1). This parameter is not applicable to CLI SRS-RSRP measurement.</p>
<p><b>resourceMapping</b> OFDM symbol location of the SRS resource within a slot including <i>nrofSymbols</i> (number of OFDM symbols), <i>startPosition</i> (value 0 refers to the last symbol, value 1 refers to the second last symbol, and so on) and <i>repetitionFactor</i> (see TS 38.214 [19], clause 6.2.1 and TS 38.211 [16], clause 6.4.1.4). The configured SRS resource does not exceed the slot boundary. If <i>resourceMapping-r16</i> is signalled, UE shall ignore the <i>resourceMapping</i> (without suffix). For CLI SRS-RSRP measurement, the network always configures <i>nrofSymbols</i> and <i>repetitionFactor</i> to 'n1'.</p>
<p><b>resourceType</b> Periodicity and offset for semi-persistent and periodic SRS resource (see TS 38.214 [19], clause 6.2.1). For CLI SRS-RSRP measurement, only 'periodic' is applicable for <i>resourceType</i>.</p>
<p><b>sequenceId</b> Sequence ID used to initialize pseudo random group and sequence hopping (see TS 38.214 [19], clause 6.2.1).</p>
<p><b>servingCellId</b> The serving Cell ID of the source SSB, CSI-RS, or SRS for the spatial relation of the target SRS resource. If this field is absent the SSB, the CSI-RS, or the SRS is from the same serving cell where the SRS is configured.</p>
<p><b>spatialRelationInfo</b> Configuration of the spatial relation between a reference RS and the target SRS. Reference RS can be SSB/CSI-RS/SRS (see TS 38.214 [19], clause 6.2.1). This parameter is not applicable to CLI SRS-RSRP measurement.</p>
<p><b>spatialRelationInfoPos</b> Configuration of the spatial relation between a reference RS and the target SRS. Reference RS can be SSB/CSI-RS/SRS/DL-PRS (see TS 38.214 [19], clause 6.2.1).</p>
<p><b>srs-RequestDCI-0-2</b> Indicate the number of bits for "SRS request" in DCI format 0_2. When the field is absent, then the value of 0 bit for "SRS request" in DCI format 0_2 is applied. If the parameter <i>srs-RequestDCI-0-2</i> is configured to value 1, 1 bit is used to indicate one of the first two rows of Table 7.3.1.1.2-24 in TS 38.212 [17] for triggered aperiodic SRS resource set. If the value 2 is configured, 2 bits are used to indicate one of the rows of Table 7.3.1.1.2-24 in TS 38.212 [17]. When UE is configured with <i>supplementaryUplink</i>, an extra bit (the first bit of the SRS request field) is used for the non-SUL/SUL indication.</p>

***srs-RequestDCI-1-2***

Indicate the number of bits for "SRS request" in DCI format 1\_2. When the field is absent, then the value of 0 bit for "SRS request" in DCI format 1\_2 is applied. When the UE is configured with *supplementaryUplink*, an extra bit (the first bit of the SRS request field) is used for the non-SUL/SUL indication (see TS 38.214 [19], clause 6.1.1.2).

***srs-ResourceSetToAddModListDCI-0-2***

List of SRS resource set to be added or modified for DCI format 0\_2 (see TS 38.212 [17], clause 7.3.1).

***srs-ResourceSetToReleaseListDCI-0-2***

List of SRS resource set to be released for DCI format 0\_2 (see TS 38.212 [17], clause 7.3.1).

***transmissionComb***

Comb value (2 or 4 or 8) and comb offset (0..combValue-1) (see TS 38.214 [19], clause 6.2.1).

<b>SRS-ResourceSet field descriptions</b>
<p><b>alpha</b> alpha value for SRS power control (see TS 38.213 [13], clause 7.3). When the field is absent the UE applies the value 1.</p>
<p><b>aperiodicSRS-ResourceTriggerList</b> An additional list of DCI "code points" upon which the UE shall transmit SRS according to this SRS resource set configuration (see TS 38.214 [19], clause 6.1). When the field is not included during a reconfiguration of <i>SRS-ResourceSet</i> of <i>resourceType</i> set to <i>aperiodic</i>, UE maintains this value based on the Need M; that is, this list is not considered as an extension of <i>aperiodicSRS-ResourceTrigger</i> for purpose of applying the general rule for extended list in clause 6.1.3.</p>
<p><b>aperiodicSRS-ResourceTrigger</b> The DCI "code point" upon which the UE shall transmit SRS according to this SRS resource set configuration (see TS 38.214 [19], clause 6.1.1.2).</p>
<p><b>associatedCSI-RS</b> ID of CSI-RS resource associated with this SRS resource set in non-codebook based operation (see TS 38.214 [19], clause 6.1.1.2).</p>
<p><b>csi-RS</b> ID of CSI-RS resource associated with this SRS resource set. (see TS 38.214 [19], clause 6.1.1.2).</p>
<p><b>csi-RS-IndexServingcell</b> Indicates CSI-RS index belonging to a serving cell</p>
<p><b>p0</b> P0 value for SRS power control. The value is in dBm. Only even values (step size 2) are allowed (see TS 38.213 [13], clause 7.3).</p>
<p><b>pathlossReferenceRS</b> A reference signal (e.g. a CSI-RS config or a SS block) to be used for SRS path loss estimation (see TS 38.213 [13], clause 7.3).</p>
<p><b>pathlossReferenceRS-Pos</b> A reference signal (e.g. a SS block or a DL-PRS config) to be used for SRS path loss estimation (see TS 38.213 [13], clause 7.3).</p>
<p><b>pathlossReferenceRSList</b> Multiple candidate pathloss reference RS(s) for SRS power control, where one candidate RS can be mapped to SRS Resource Set via MAC CE (clause 6.1.3.27 in TS 38.321 [3]). The network can only configure this field if <i>pathlossReferenceRS</i> is not configured in the same <i>SRS-ResourceSet</i>.</p>
<p><b>resourceSelection</b> Indicates whether the configured SRS spatial relation resource is a <i>SRS-Resource</i> or <i>SRS-PosResource</i>.</p>
<p><b>resourceType</b> Time domain behavior of SRS resource configuration, see TS 38.214 [19], clause 6.2.1. The network configures SRS resources in the same resource set with the same time domain behavior on periodic, aperiodic and semi-persistent SRS.</p>
<p><b>slotOffset</b> An offset in number of slots between the triggering DCI and the actual transmission of this <i>SRS-ResourceSet</i>. If the field is absent the UE applies no offset (value 0).</p>
<p><b>srs-PowerControlAdjustmentStates</b> Indicates whether <math>hsrs,c(i) = fc(i,1)</math> or <math>hsrs,c(i) = fc(i,2)</math> (if twoPUSCH-PC-AdjustmentStates are configured) or separate close loop is configured for SRS. This parameter is applicable only for UEs on which UE also transmits PUSCH. If absent or release, the UE applies the value sameAs-Fci1 (see TS 38.213 [13], clause 7.3).</p>
<p><b>srs-ResourceIdList</b> The IDs of the SRS-Resources used in this <i>SRS-ResourceSet</i>. If this <i>SRS-ResourceSet</i> is configured with <i>usage</i> set to <i>codebook</i>, the <i>srs-ResourceIdList</i> contains at most 2 entries. If this <i>SRS-ResourceSet</i> is configured with <i>usage</i> set to <i>nonCodebook</i>, the <i>srs-ResourceIdList</i> contains at most 4 entries.</p>
<p><b>srs-ResourceSetId</b> The ID of this resource set. It is unique in the context of the BWP in which the parent <i>SRS-Config</i> is defined.</p>
<p><b>ssb-IndexServingcell</b> Indicates SSB index belonging to a serving cell</p>
<p><b>ssb-NCell</b> This field indicates a SSB configuration from neighboring cell</p>
<p><b>usage</b> Indicates if the SRS resource set is used for beam management, codebook based or non-codebook based transmission or antenna switching. See TS 38.214 [19], clause 6.2.1. Reconfiguration between codebook based and non-codebook based transmission is not supported.</p>



<b>SSB-InfoNCell field descriptions</b>
<p><b>physicalCellId</b> This field specifies the physical cell ID of the neighbour cell for which SSB configuration is provided.</p>
<p><b>ssb-IndexNcell</b> This field specifies the index of the SSB for a neighbour cell. See TS 38.213 [13]. If this field is absent, the UE determines the <i>ssb-IndexNcell</i> of the <i>physicalCellId</i> based on its SSB measurement from the cell.</p>
<p><b>ssb-Configuration</b> This field specifies the full configuration of the SSB. If this field is absent, the UE obtains the configuration for the SSB from <i>nr-SSB-Config</i> received as part of DL-PRS assistance data in LPP, see TS 37.355 [49], by looking up the corresponding SSB configuration using the field <i>physicalCellId</i>.</p>

<b>DL-PRS-Info field descriptions</b>
<p><b>dl-PRS-ID</b> This field specifies the UE specific TRP ID (see TS 37.355 [49]) for which PRS configuration is provided.</p>
<p><b>dl-PRS-ResourceSetId</b> This field specifies the PRS-ResourceSet ID of a PRS resourceSet.</p>
<p><b>dl-PRS-ResourceId</b> This field specifies the PRS-Resource ID of a PRS resource. If this field is absent, the UE determines the <i>dl-PRS-ResourceID</i> based on its PRS measurement from the TRP and DL-PRS Resource Set.</p>

<b>SSB-Configuration field descriptions</b>
<p><b>halfFrameIndex</b> Indicates whether SSB is in the first half or the second half of the frame. Value zero indicates the first half and value 1 indicates the second half.</p>
<p><b>integerSubframeOffset</b> Indicates the subframe boundary offset of the cell in which SSB is transmitted.</p>
<p><b>sfn0-Offset</b> Indicates the time offset of the SFN0 slot 0 for the cell with respect to SFN0 slot 0 of serving cell.</p>
<p><b>sfn-Offset</b> Indicates the 4 LSBs of the SFN of the cell in which SSB is transmitted.</p>
<p><b>ssb-Freq</b> Indicates the frequency of the SSB.</p>
<p><b>ssb-PBCH-BlockPower</b> Average EPRE of the resources elements that carry secondary synchronization signals in dBm that the NW used for SSB transmission, see TS 38.213 [13], clause 7.</p>
<p><b>ssb-Periodicity</b> Indicates the periodicity of the SSB. If the field is absent, the UE applies the value ms5. (see TS 38.213 [13], clause 4.1)</p>
<p><b>ssbSubcarrierSpacing</b> Subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable.</p>

Conditional Presence	Explanation
<i>Setup</i>	This field is mandatory present upon configuration of <i>SRS-ResourceSet</i> or <i>SRS-Resource</i> and optionally present, Need M, otherwise.
<i>NonCodebook</i>	This field is optionally present, Need M, in case of non-codebook based transmission, otherwise the field is absent.
<i>Pathloss</i>	The field is mandatory present if the IE <i>SSB-InfoNcell</i> is included in <i>pathlossReferenceRS-Pos</i> ; otherwise it is optionally present, Need R

## – *SRS-RSRP-Range*

The IE *SRS-RSRP-Range* specifies the value range used in SRS-RSRP measurements and thresholds. The integer value for SRS-RSRP measurements is according to Table [FFS] in TS 38.133 [14]. For thresholds, the actual value is (IE value –140) dBm, except for the IE value 98, in which case the actual value is infinity.

### *SRS-RSRP-Range* information element

```
-- ASN1START
-- TAG-SRS-RSRP-RANGE-START

SRS-RSRP-Range-r16 ::=
    INTEGER(0..98)

-- TAG-SRS-RSRP-RANGE-STOP
-- ASN1STOP
```

## – *SRS-TPC-CommandConfig*

The IE *SRS-TPC-CommandConfig* is used to configure the UE for extracting TPC commands for SRS from a group-TPC messages on DCI

### *SRS-TPC-CommandConfig* information element

```
-- ASN1START
-- TAG-SRS-TPC-COMMANDCONFIG-START

SRS-TPC-CommandConfig ::=
    SEQUENCE {
        startingBitOfFormat2-3
            INTEGER (1..31)
            OPTIONAL, -- Need R
        fieldTypeFormat2-3
            INTEGER (0..1)
            OPTIONAL, -- Need R
        ...
        [[
            startingBitOfFormat2-3SUL
                INTEGER (1..31)
                OPTIONAL -- Need R
        ]]
    }

-- TAG-SRS-TPC-COMMANDCONFIG-STOP
-- ASN1STOP
```

<b>SRS-TPC-CommandConfig field descriptions</b>
<p><b>fieldTypeFormat2-3</b> The type of a field within the group DCI with SRS request fields (optional), which indicates how many bits in the field are for SRS request (0 or 2). Note that for Type A, there is a common SRS request field for all SCells in the set, but each SCell has its own TPC command bits. See TS 38.212 [17] clause 7.3.1 and , TS 38.213 [13], clause 11.3.</p>
<p><b>startingBitOfFormat2-3</b> The starting bit position of a block within the group DCI with SRS request fields (optional) and TPC commands. The value 1 of the field corresponds to the first/left most bit of format2-3. The value 2 of the field corresponds to the second bit format2-3, and so on (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 11.3).</p>
<p><b>startingBitOfFormat2-3SUL</b> The starting bit position of a block within the group DCI with SRS request fields (optional) and TPC commands for SUL carrier (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 11.3).</p>

## – SSB-Index

The IE *SSB-Index* identifies an SS-Block within an SS-Burst. See TS 38.213 [13], clause 4.1.

### SSB-Index information element

```
-- ASN1START
-- TAG-SSB-INDEX-START

SSB-Index ::=
    INTEGER (0..maxNrofSSBs-1)

-- TAG-SSB-INDEX-STOP
-- ASN1STOP
```

## – SSB-MTC

The IE *SSB-MTC* is used to configure measurement timing configurations, i.e., timing occasions at which the UE measures SSBs.

### SSB-MTC information element

```
-- ASN1START
-- TAG-SSB-MTC-START

SSB-MTC ::=
    SEQUENCE {
        periodicityAndOffset
            CHOICE {
                sf5          INTEGER (0..4),
                sf10         INTEGER (0..9),
                sf20         INTEGER (0..19),
                sf40         INTEGER (0..39),
                sf80         INTEGER (0..79),
                sf160        INTEGER (0..159)
            },
        duration
            ENUMERATED { sf1, sf2, sf3, sf4, sf5 }
    }

-- TAG-SSB-MTC-STOP
-- ASN1STOP
```

```

SSB-MTC2 ::=
  pci-List
  periodicity
}
SEQUENCE {
  SEQUENCE (SIZE (1..maxNrofPCIsPerSMTC)) OF PhysCellId
  ENUMERATED {sf5, sf10, sf20, sf40, sf80, spare3, spare2, spare1}
OPTIONAL, -- Need M

SSB-MTC2-LP-r16 ::=
  pci-List
  periodicity
}
SEQUENCE {
  SEQUENCE (SIZE (1..maxNrofPCIsPerSMTC)) OF PhysCellId
  ENUMERATED {sf10, sf20, sf40, sf80, sf160, spare3, spare2, spare1}
OPTIONAL, -- Need R

SSB-MTC3-r16 ::=
  periodicityAndOffset-r16
    sf5-r16
    sf10-r16
    sf20-r16
    sf40-r16
    sf80-r16
    sf160-r16
    sf320-r16
    sf640-r16
    sf1280-r16
  },
  duration-r16
  pci-List-r16
  ssb-ToMeasure-r16
}
CHOICE {
  INTEGER (0..4),
  INTEGER (0..9),
  INTEGER (0..19),
  INTEGER (0..39),
  INTEGER (0..79),
  INTEGER (0..159),
  INTEGER (0..319),
  INTEGER (0..639),
  INTEGER (0..1279)
},
ENUMERATED {sf1, sf2, sf3, sf4, sf5},
SEQUENCE (SIZE (1..maxNrofPCIsPerSMTC)) OF PhysCellId
SetupRelease { SSB-ToMeasure }
OPTIONAL, -- Need M
OPTIONAL, -- Need M

-- TAG-SSB-MTC-STOP
-- ASN1STOP

```

#### SSB-MTC field descriptions

##### **duration**

Duration of the measurement window in which to receive SS/PBCH blocks. It is given in number of subframes (see TS 38.213 [13], clause 4.1).

##### **periodicityAndOffset**

Periodicity and offset of the measurement window in which to receive SS/PBCH blocks, see 5.5.2.10. Periodicity and offset are given in number of subframes.

#### SSB-MTC2 field descriptions

##### **pci-List**

PCIs that are known to follow this SMTC.

<b>SSB-MTC3 field descriptions</b>
<p><b>duration</b> Duration of the measurement window in which to receive SS. It is given in number of subframes (see TS 38.213 [13], clause 4.1).</p>
<p><b>pci-List</b> PCIs that are known to follow this SMTC, used for IAB-node discovery.</p>
<p><b>periodicityAndOffset</b> Periodicity and offset of the measurement window in which to receive SS, see 5.5.2.10. Periodicity and offset are given in number of subframes.</p>
<p><b>ssb-ToMeasure</b> The set of SS blocks to be measured within the SMTC measurement duration. The first/leftmost bit corresponds to SS block index 0, the second bit corresponds to SS block index 1, and so on. Value 0 in the bitmap indicates that the corresponding SS block is not to be measured while value 1 indicates that the corresponding SS block is to be measured (see TS 38.215 [9]). When the field is not configured the IAB-MT measures on all SS blocks. Regardless of the value of this field, SS blocks outside of the applicable <i>smtc</i> are not to be measured. See TS 38.215 [9] clause 5.1.1.</p>

### – *SSB-PositionQCL-Relation*

The IE *SSB-PositionQCL-Relation* is used to indicate the QCL relationship between SSB positions on the frequency indicated by *ssbFrequency* (see TS 38.213 [13], clause 4.1) for operation with shared spectrum channel access. Value n1 corresponds to 1, value n2 corresponds to 2 and so on.

#### **SSB-PositionQCL-Relation information element**

```
-- ASN1START
-- TAG-SSB-POSITIONQCL-RELATION-START

SSB-PositionQCL-Relation-r16 ::= ENUMERATED {n1,n2,n4,n8}

-- TAG-SSB-POSITIONQCL-RELATION-STOP
-- ASN1STOP
```

### – *SSB-ToMeasure*

The IE *SSB-ToMeasure* is used to configure a pattern of SSBs.

#### **SSB-ToMeasure information element**

```
-- ASN1START
-- TAG-SSB-TOMEASURE-START

SSB-ToMeasure ::= CHOICE {
    shortBitmap      BIT STRING (SIZE (4)),
    mediumBitmap     BIT STRING (SIZE (8)),
    longBitmap       BIT STRING (SIZE (64))
}

-- TAG-SSB-TOMEASURE-STOP
-- ASN1STOP
```

<b>SSB-ToMeasure field descriptions</b>
<p><b>longBitmap</b> Bitmap when maximum number of SS/PBCH blocks per half frame equals to 64 as defined in TS 38.213 [13], clause 4.1.</p>
<p><b>mediumBitmap</b> Bitmap when maximum number of SS/PBCH blocks per half frame equals to 8 as defined in TS 38.213 [13], clause 4.1. For operation with shared spectrum channel access, if the k-th bit is set to 1, the UE assumes that one or more SS/PBCH blocks within the discovery burst transmission window with candidate SS/PBCH block indexes corresponding to SS/PBCH block index equal to k – 1 may be transmitted; if the kt-th bit is set to 0, the UE assumes that the corresponding SS/PBCH block(s) are not transmitted. If <i>ssb-PositionQCL</i> is configured, the UE expects that the k-th bit is set to 0, where k &gt; <i>ssb-PositionQCL</i> and the number of actually transmitted SS/PBCH blocks is not larger than the number of 1's in the bitmap.</p>
<p><b>shortBitmap</b> Bitmap when maximum number of SS/PBCH blocks per half frame equals to 4 as defined in TS 38.213 [13], clause 4.1.</p>

## – SS-RSSI-Measurement

The IE *SS-RSSI-Measurement* is used to configure RSSI measurements based on synchronization reference signals.

### **SS-RSSI-Measurement information element**

```

-- ASN1START
-- TAG-SS-RSSI-MEASUREMENT-START

SS-RSSI-Measurement ::=
    SEQUENCE {
        measurementSlots    BIT STRING (SIZE (1..80)),
        endSymbol            INTEGER(0..3)
    }

-- TAG-SS-RSSI-MEASUREMENT-STOP
-- ASN1STOP

```

<b>SS-RSSI-Measurement field descriptions</b>
<p><b>endSymbol</b> Within a slot that is configured for RSSI measurements (see <i>measurementSlots</i>) the UE measures the RSSI from symbol 0 to symbol <i>endSymbol</i>. This field identifies the entry in Table 5.1.3-1 in TS 38.215 [9], which determines the actual end symbol.</p>
<p><b>measurementSlots</b> Indicates the slots in which the UE can perform RSSI measurements. The length of the BIT STRING is equal to the number of slots in the configured SMTC window (determined by the duration and by the subcarrierSpacing). The first (left-most / most significant) bit in the bitmap corresponds to the first slot in the SMTC window, the second bit in the bitmap corresponds to the second slot in the SMTC window, and so on. The UE measures in slots for which the corresponding bit in the bitmap is set to 1.</p>

## – SubcarrierSpacing

The IE *SubcarrierSpacing* determines the subcarrier spacing. Restrictions applicable for certain frequencies, channels or signals are clarified in the fields that use this IE.

**SubcarrierSpacing** information element

```
-- ASN1START
-- TAG-SUBCARRIERSPACING-START

SubcarrierSpacing ::=          ENUMERATED {kHz15, kHz30, kHz60, kHz120, kHz240, spare3, spare2, spare1}

-- TAG-SUBCARRIERSPACING-STOP
-- ASN1STOP
```

– **TAG-Config**

The IE *TAG-Config* is used to configure parameters for a time-alignment group.

**TAG-Config** information element

```
-- ASN1START
-- TAG-TAG-CONFIG-START

TAG-Config ::=                SEQUENCE {
    tag-ToReleaseList          SEQUENCE (SIZE (1..maxNrofTAGs)) OF TAG-Id                OPTIONAL, -- Need N
    tag-ToAddModList           SEQUENCE (SIZE (1..maxNrofTAGs)) OF TAG                OPTIONAL  -- Need N
}

TAG ::=                        SEQUENCE {
    tag-Id                     TAG-Id,
    timeAlignmentTimer         TimeAlignmentTimer,
    ...
}

TAG-Id ::=                     INTEGER (0..maxNrofTAGs-1)

TimeAlignmentTimer ::=         ENUMERATED {ms500, ms750, ms1280, ms1920, ms2560, ms5120, ms10240, infinity}

-- TAG-TAG-CONFIG-STOP
-- ASN1STOP
```

**TAG field descriptions*****tag-Id***

Indicates the TAG of the SpCell or an SCell, see TS 38.321 [3]. Uniquely identifies the TAG within the scope of a Cell Group (i.e. MCG or SCG).

***timeAlignmentTimer***

Value in ms of the *timeAlignmentTimer* for TAG with ID *tag-Id*, as specified in TS 38.321 [3].

– **TCI-State**

The IE *TCI-State* associates one or two DL reference signals with a corresponding quasi-colocation (QCL) type.

**TCI-State information element**

```

-- ASN1START
-- TAG-TCI-STATE-START

TCI-State ::=
    tci-StateId
    qcl-Type1
    qcl-Type2
    ...
}

SEQUENCE {
    TCI-StateId,
    QCL-Info,
    QCL-Info
} OPTIONAL, -- Need R

QCL-Info ::=
    cell
    bwp-Id
    referenceSignal
        csi-rs
        ssb
    },
    qcl-Type
    ...
}

SEQUENCE {
    ServCellIndex
    BWP-Id
    CHOICE {
        NZP-CSI-RS-ResourceId,
        SSB-Index
    }
    ENUMERATED {typeA, typeB, typeC, typeD},
} OPTIONAL, -- Need R
OPTIONAL, -- Cond CSI-RS-Indicated

-- TAG-TCI-STATE-STOP
-- ASN1STOP

```

QCL-Info field descriptions	
<b>bwp-Id</b>	The DL BWP which the RS is located in.
<b>cell</b>	The UE's serving cell in which the <i>referenceSignal</i> is configured. If the field is absent, it applies to the serving cell in which the <i>TCI-State</i> is configured. The RS can be located on a serving cell other than the serving cell in which the <i>TCI-State</i> is configured only if the <i>qcl-Type</i> is configured as <i>typeC</i> or <i>typeD</i> . See TS 38.214 [19] clause 5.1.5.
<b>referenceSignal</b>	Reference signal with which quasi-collocation information is provided as specified in TS 38.214 [19] subclause 5.1.5.
<b>qcl-Type</b>	QCL type as specified in TS 38.214 [19] subclause 5.1.5.

Conditional Presence	Explanation
<i>CSI-RS-Indicated</i>	This field is mandatory present if <i>csi-rs</i> is included, absent otherwise

– **TCI-StateId**

The IE *TCI-StateId* is used to identify one *TCI-State* configuration.



***TCI-StateId* information element**

```

-- ASN1START
-- TAG-TCI-STATEID-START

TCI-StateId ::=
    INTEGER (0..maxNrofTCI-States-1)

-- TAG-TCI-STATEID-STOP
-- ASN1STOP

```

***TDD-UL-DL-ConfigCommon***

The IE *TDD-UL-DL-ConfigCommon* determines the cell specific Uplink/Downlink TDD configuration.

***TDD-UL-DL-ConfigCommon* information element**

```

-- ASN1START
-- TAG-TDD-UL-DL-CONFIGCOMMON-START

TDD-UL-DL-ConfigCommon ::=
    SEQUENCE {
        referenceSubcarrierSpacing    SubcarrierSpacing,
        pattern1                      TDD-UL-DL-Pattern,
        pattern2                      TDD-UL-DL-Pattern
        ...
    }
    OPTIONAL, -- Need R

TDD-UL-DL-Pattern ::=
    SEQUENCE {
        dl-UL-TransmissionPeriodicity    ENUMERATED {ms0p5, ms0p625, ms1, ms1p25, ms2, ms2p5, ms5, ms10},
        nrofDownlinkSlots                INTEGER (0..maxNrofSlots),
        nrofDownlinkSymbols              INTEGER (0..maxNrofSymbols-1),
        nrofUplinkSlots                  INTEGER (0..maxNrofSlots),
        nrofUplinkSymbols                INTEGER (0..maxNrofSymbols-1),
        ...
        [[
            dl-UL-TransmissionPeriodicity-v1530    ENUMERATED {ms3, ms4}
        ]]
    }
    OPTIONAL -- Need R

-- TAG-TDD-UL-DL-CONFIGCOMMON-STOP
-- ASN1STOP

```

***TDD-UL-DL-ConfigCommon* field descriptions*****referenceSubcarrierSpacing***

Reference SCS used to determine the time domain boundaries in the UL-DL pattern which must be common across all subcarrier specific carriers, i.e., independent of the actual subcarrier spacing used for data transmission. Only the values 15, 30 or 60 kHz (FR1), and 60 or 120 kHz (FR2) are applicable. The network configures a not larger than any SCS of configured BWPs for the serving cell. The network or *SL-PreconfigGeneral* configures a not larger than the SCS of (pre-)configured SL BWP. See TS 38.213 [13], clause 11.1.

<b>TDD-UL-DL-Pattern field descriptions</b>
<b>dl-UL-TransmissionPeriodicity</b> Periodicity of the DL-UL pattern, see TS 38.213 [13], clause 11.1. If the <i>dl-UL-TransmissionPeriodicity-v1530</i> is signalled, UE shall ignore the <i>dl-UL-TransmissionPeriodicity</i> (without suffix).
<b>nrofDownlinkSlots</b> Number of consecutive full DL slots at the beginning of each DL-UL pattern, see TS 38.213 [13], clause 11.1. In this release, the maximum value for this field is 80.
<b>nrofDownlinkSymbols</b> Number of consecutive DL symbols in the beginning of the slot following the last full DL slot (as derived from <i>nrofDownlinkSlots</i> ). The value 0 indicates that there is no partial-downlink slot. (see TS 38.213 [13], clause 11.1).
<b>nrofUplinkSlots</b> Number of consecutive full UL slots at the end of each DL-UL pattern, see TS 38.213 [13], clause 11.1. In this release, the maximum value for this field is 80.
<b>nrofUplinkSymbols</b> Number of consecutive UL symbols in the end of the slot preceding the first full UL slot (as derived from <i>nrofUplinkSlots</i> ). The value 0 indicates that there is no partial-uplink slot. (see TS 38.213 [13], clause 11.1).

### – TDD-UL-DL-ConfigDedicated

The IE *TDD-UL-DL-ConfigDedicated* determines the UE-specific Uplink/Downlink TDD configuration.

#### **TDD-UL-DL-ConfigDedicated information element**

```
-- ASN1START
-- TAG-TDD-UL-DL-CONFIGDEDICATED-START

TDD-UL-DL-ConfigDedicated ::= SEQUENCE {
    slotSpecificConfigurationsToAddModList SEQUENCE (SIZE (1..maxNrofSlots)) OF TDD-UL-DL-SlotConfig OPTIONAL, -- Need N
    slotSpecificConfigurationsToReleaseList SEQUENCE (SIZE (1..maxNrofSlots)) OF TDD-UL-DL-SlotIndex OPTIONAL, -- Need N
    ...
}

TDD-UL-DL-ConfigDedicated-IAB-MT-r16 ::= SEQUENCE {
    slotSpecificConfigurationsToAddModList-IAB-MT-r16 SEQUENCE (SIZE (1..maxNrofSlots)) OF TDD-UL-DL-SlotConfig-IAB-MT-r16 OPTIONAL, -- Need
N
    slotSpecificConfigurationsToReleaseList-IAB-MT-r16 SEQUENCE (SIZE (1..maxNrofSlots)) OF TDD-UL-DL-SlotIndex OPTIONAL, -- Need
N
    ...
}

TDD-UL-DL-SlotConfig ::= SEQUENCE {
    slotIndex TDD-UL-DL-SlotIndex,
    symbols CHOICE {
        allDownlink NULL,
        allUplink NULL,
        explicit SEQUENCE {
            nrofDownlinkSymbols INTEGER (1..maxNrofSymbols-1) OPTIONAL, -- Need S
            nrofUplinkSymbols INTEGER (1..maxNrofSymbols-1) OPTIONAL, -- Need S
        }
    }
}
-- ASN1END
```

```

TDD-UL-DL-SlotConfig-IAB-MT-r16 ::= SEQUENCE {
  slotIndex-r16          TDD-UL-DL-SlotIndex,
  symbols-IAB-MT-r16    CHOICE {
    allDownlink-r16     NULL,
    allUplink-r16       NULL,
    explicit-r16        SEQUENCE {
      nrofDownlinkSymbols-r16  INTEGER (1..maxNrofSymbols-1)  OPTIONAL, -- Need S
      nrofUplinkSymbols-r16    INTEGER (1..maxNrofSymbols-1)  OPTIONAL, -- Need S
    },
    explicit-IAB-MT-r16 SEQUENCE {
      nrofDownlinkSymbols-r16  INTEGER (1..maxNrofSymbols-1)  OPTIONAL, -- Need S
      nrofUplinkSymbols-r16    INTEGER (1..maxNrofSymbols-1)  OPTIONAL, -- Need S
    }
  }
}

TDD-UL-DL-SlotIndex ::= INTEGER (0..maxNrofSlots-1)

-- TAG-TDD-UL-DL-CONFIGDEDICATED-STOP
-- ASN1STOP

```

#### ***TDD-UL-DL-ConfigDedicated* field descriptions**

##### ***slotSpecificConfigurationsToAddModList***

The *slotSpecificConfigurationToAddModList* allows overriding UL/DL allocations provided in tdd-UL-DL-configurationCommon, see TS 38.213 [13], clause 11.1.

#### ***TDD-UL-DL-ConfigDedicated-IAB-MT* field descriptions**

##### ***slotSpecificConfigurationsToAddModList-IAB-MT***

The *slotSpecificConfigurationToAddModList-IAB-MT* allows overriding UL/DL allocations provided in tdd-UL-DL-configurationCommon with a limitation that effectively only flexible symbols can be overwritten in Rel-16.

##### ***slotSpecificConfigurationsToReleaseList-IAB-MT***

The *slotSpecificConfigurationsToReleaseList-IAB-MT* allows release of a set of slot configuration previously add with *slotSpecificConfigurationToAddModList-IAB-MT*.

<b>TDD-UL-DL-SlotConfig field descriptions</b>
<p><b><i>nrofDownlinkSymbols</i></b> Number of consecutive DL symbols in the beginning of the slot identified by <i>slotIndex</i>. If the field is absent the UE assumes that there are no leading DL symbols. (see TS 38.213 [13], clause 11.1).</p>
<p><b><i>nrofUplinkSymbols</i></b> Number of consecutive UL symbols in the end of the slot identified by <i>slotIndex</i>. If the field is absent the UE assumes that there are no trailing UL symbols. (see TS 38.213 [13], clause 11.1).</p>
<p><b><i>slotIndex</i></b> Identifies a slot within a slot configuration period given in <i>tdd-UL-DL-configurationCommon</i>, see TS 38.213 [13], clause 11.1.</p>
<p><b><i>symbols</i></b> The direction (downlink or uplink) for the symbols in this slot. Value <i>allDownlink</i> indicates that all symbols in this slot are used for downlink; value <i>allUplink</i> indicates that all symbols in this slot are used for uplink; value <i>explicit</i> indicates explicitly how many symbols in the beginning and end of this slot are allocated to downlink and uplink, respectively.</p>

<b>TDD-UL-DL-SlotConfig-IAB-MT field descriptions</b>
<p><b><i>symbols-IAB-MT</i></b> The <i>symbols-IAB-MT</i> is used to configure an IAB-MT with the SlotConfig applicable for one serving cell. Value <i>allDownlink</i> indicates that all symbols in this slot are used for downlink; value <i>allUplink</i> indicates that all symbols in this slot are used for uplink; value <i>explicit</i> indicates explicitly how many symbols in the beginning and end of this slot are allocated to downlink and uplink, respectively; value <i>explicit-IAB-MT</i> indicates explicitly how many symbols in the beginning and end of this slot are allocated to uplink and downlink, respectively.</p>

## – *TrackingAreaCode*

The IE *TrackingAreaCode* is used to identify a tracking area within the scope of a PLMN, see TS 24.501 [23].

### ***TrackingAreaCode* information element**

```
-- ASN1START
-- TAG-TRACKINGAREACODE-START

TrackingAreaCode ::= BIT STRING (SIZE (24))

-- TAG-TRACKINGAREACODE-STOP
-- ASN1STOP
```

## – *T-Reselection*

The IE *T-Reselection* concerns the cell reselection timer  $T_{reselction_{RAT}}$  for NR and E-UTRA Value in seconds. For value 0, behaviour as specified in 7.1.2 applies.

### ***T-Reselection* information element**

```
-- ASN1START
-- TAG-TRESELECTION-START
```

```
T-Reselection ::= INTEGER (0..7)
```

```
-- TAG-TRESELECTION-STOP
-- ASN1STOP
```

## – *TimeToTrigger*

The IE *TimeToTrigger* specifies the value range used for time to trigger parameter, which concerns the time during which specific criteria for the event needs to be met in order to trigger a measurement report. Value *ms0* corresponds to 0 ms and behaviour as specified in 7.1.2 applies, value *ms40* corresponds to 40 ms, and so on.

### ***TimeToTrigger* information element**

```
-- ASN1START
-- TAG-TIMETOTRIGGER-START
```

```
TimeToTrigger ::= ENUMERATED {
    ms0, ms40, ms64, ms80, ms100, ms128, ms160, ms256,
    ms320, ms480, ms512, ms640, ms1024, ms1280, ms2560,
    ms5120}
```

```
-- TAG-TIMETOTRIGGER-STOP
-- ASN1STOP
```

## – *UAC-BarringInfoSetIndex*

The IE *UAC-BarringInfoSetIndex* provides the index of the entry in *uac-BarringInfoSetList*. Value 1 corresponds to the first entry in *uac-BarringInfoSetList*, value 2 corresponds to the second entry in this list and so on. An index value referring to an entry not included in *uac-BarringInfoSetList* indicates no barring.

### ***UAC-BarringInfoSetIndex* information element**

```
-- ASN1START
-- TAG-UAC-BARRINGINFOSETINDEX-START
```

```
UAC-BarringInfoSetIndex ::= INTEGER (1..maxBarringInfoSet)
```

```
-- TAG-UAC-BARRINGINFOSETINDEX-STOP
-- ASN1STOP
```

## – *UAC-BarringInfoSetList*

The IE *UAC-BarringInfoSetList* provides a list of access control parameter sets. An access category can be configured with access parameters according to one of the sets.

### ***UAC-BarringInfoSetList* information element**

```
-- ASN1START
```

```

-- TAG-UAC-BARRINGINFOSETLIST-START
UAC-BarringInfoSetList ::=          SEQUENCE (SIZE(1..maxBarringInfoSet)) OF UAC-BarringInfoSet
UAC-BarringInfoSet ::=             SEQUENCE {
    uac-BarringFactor                ENUMERATED {p00, p05, p10, p15, p20, p25, p30, p40,
                                                p50, p60, p70, p75, p80, p85, p90, p95},
    uac-BarringTime                  ENUMERATED {s4, s8, s16, s32, s64, s128, s256, s512},
    uac-BarringForAccessIdentity     BIT STRING (SIZE(7))
}
-- TAG-UAC-BARRINGINFOSETLIST-STOP
-- ASN1STOP

```

#### **UAC-BarringInfoSetList field descriptions**

##### **uac-BarringInfoSetList**

List of access control parameter sets. Each access category can be configured with access parameters corresponding to a particular set by *uac-barringInfoSetIndex*.

Association of an access category with an index that has no corresponding entry in the *uac-BarringInfoSetList* is valid configuration and indicates no barring.

##### **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, bit 4 in the bit string corresponds to Access Identity 13, bit 5 in the bit string corresponds to Access Identity 14, and bit 6 in the bit string corresponds to Access Identity 15. Value 0 means that access attempt is allowed for the corresponding access identity.

##### **uac-BarringFactor**

Represents the probability that access attempt would be allowed during access barring check.

##### **uac-BarringTime**

The minimum time in seconds before a new access attempt is to be performed after an access attempt was barred at access barring check for the same access category.

## – UAC-BarringPerCatList

The IE *UAC-BarringPerCatList* provides access control parameters for a list of access categories.

#### **UAC-BarringPerCatList information element**

```

-- ASN1START
-- TAG-UAC-BARRINGPERCATLIST-START
UAC-BarringPerCatList ::=          SEQUENCE (SIZE (1..maxAccessCat-1)) OF UAC-BarringPerCat
UAC-BarringPerCat ::=             SEQUENCE {
    accessCategory                   INTEGER (1..maxAccessCat-1),
    uac-barringInfoSetIndex          UAC-BarringInfoSetIndex
}
-- TAG-UAC-BARRINGPERCATLIST-STOP
-- ASN1STOP

```

**UAC-BarringPerCatList field descriptions****accessCategory**

The Access Category according to TS 22.261 [25].

## – UAC-BarringPerPLMN-List

The IE *UAC-BarringPerPLMN-List* provides access category specific access control parameters, which are configured per PLMN.

**UAC-BarringPerPLMN-List information element**

```
-- ASN1START
-- TAG-UAC-BARRINGPERPLMN-LIST-START

UAC-BarringPerPLMN-List ::=          SEQUENCE (SIZE (1.. maxPLMN)) OF UAC-BarringPerPLMN

UAC-BarringPerPLMN ::=              SEQUENCE {
  plmn-IdentityIndex                INTEGER (1..maxPLMN),
  uac-ACBarringListType              CHOICE {
    uac-ImplicitACBarringList        SEQUENCE (SIZE(maxAccessCat-1)) OF UAC-BarringInfoSetIndex,
    uac-ExplicitACBarringList        UAC-BarringPerCatList
  }
}
-- TAG-UAC-BARRINGPERPLMN-LIST-STOP
-- ASN1STOP
```

OPTIONAL -- Need S

**UAC-BarringPerPLMN-List field descriptions****uac-ACBarringListType**

Access control parameters for each access category valid only for a specific PLMN or SNPN. UE behaviour upon absence of this field is specified in clause 5.3.14.2.

**plmn-IdentityIndex**

Index of the PLMN or SNPN across the *plmn-IdentityList* and *npn-IdentityInfoList* fields included in SIB1.

## – UE-TimersAndConstants

The IE *UE-TimersAndConstants* contains timers and constants used by the UE in RRC\_CONNECTED, RRC\_INACTIVE and RRC\_IDLE.

**UE-TimersAndConstants information element**

```
-- ASN1START
-- TAG-UE-TIMERSANDCONSTANTS-START

UE-TimersAndConstants ::=          SEQUENCE {
  t300                               ENUMERATED {ms100, ms200, ms300, ms400, ms600, ms1000, ms1500, ms2000},
  t301                               ENUMERATED {ms100, ms200, ms300, ms400, ms600, ms1000, ms1500, ms2000},
  t310                               ENUMERATED {ms0, ms50, ms100, ms200, ms500, ms1000, ms2000},
}
```

```

n310      ENUMERATED {n1, n2, n3, n4, n6, n8, n10, n20},
t311      ENUMERATED {ms1000, ms3000, ms5000, ms10000, ms15000, ms20000, ms30000},
n311      ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10},
t319      ENUMERATED {ms100, ms200, ms300, ms400, ms600, ms1000, ms1500, ms2000},
...
}

-- TAG-UE-TIMERSANDCONSTANTS-STOP
-- ASN1STOP

```

## – *UL-DelayValueConfig*

The IE *UL-DelayValueConfig* IE specifies the configuration of the UL PDCP Packet Delay value per DRB measurement specified in TS 38.314 [53].

### *UL-DelayValueConfig* information element

```

-- ASN1START
-- TAG-ULDELAYVALUECONFIG-START

UL-DelayValueConfig-r16 ::= SEQUENCE {
    delay-DRBlist          SEQUENCE (SIZE(1..maxDRB)) OF DRB-Identity
}

-- TAG-ULDELAYVALUECONFIG-STOP
-- ASN1STOP

```

#### *UL-DelayValueConfig* field descriptions

##### ***Delay-DRBlist***

Indicates the DRB IDs used by UE to provide results of UL PDCP Packet Delay value per DRB measurement as specified in TS 38.314 [53].

## – *UplinkCancellation*

The IE *UplinkCancellation* is used to configure the UE to monitor PDCCH for the CI-RNTI.

### *UplinkCancellation* information element

```

-- ASN1START
-- TAG-UPLINKCANCELLATION-START

UplinkCancellation-r16 ::= SEQUENCE {
    ci-RNTI-r16              RNTI-Value,
    dci-PayloadSizeForCI-r16 INTEGER (0..maxCI-DCI-PayloadSize-r16),
    ci-ConfigurationPerServingCell-r16 SEQUENCE (SIZE (1..maxNrofServingCells)) OF CI-ConfigurationPerServingCell-r16,
    ...
}

```



```

CI-ConfigurationPerServingCell-r16 ::= SEQUENCE {
  servingCellId          ServCellIndex,
  positionInDCI-r16      INTEGER (0..maxCI-DCI-PayloadSize-r16-1),
  positionInDCI-ForSUL-r16  INTEGER (0..maxCI-DCI-PayloadSize-r16-1)          OPTIONAL, -- Cond SUL-Only
  ci-PayloadSize-r16     ENUMERATED {n1, n2, n4, n5, n7, n8, n10, n14, n16, n20, n28, n32, n35, n42, n56, n112},
  timeFrequencyRegion-r16 SEQUENCE {
    timeDurationForCI-r16  ENUMERATED {n2, n4, n7, n14}          OPTIONAL, -- Cond
  }
  SymbolPeriodicity
    timeGranularityForCI-r16  ENUMERATED {n1, n2, n4, n7, n14, n28},
    frequencyRegionForCI-r16  INTEGER (0..37949),
    deltaOffset-r16           INTEGER (0..2),
    ...
  },
  uplinkCancellationPriority-v1610  ENUMERATED {enabled}          OPTIONAL -- Need S
}

-- TAG-UPLINKCANCELLATION-STOP
-- ASN1STOP

```

#### **UplinkCancellation field descriptions**

##### **ci-ConfigurationPerServingCell**

Indicates (per serving cell) the position of the *ci-PayloadSize* bit CI values inside the DCI payload (see TS 38.213 [13], clause 11.2A).

##### **ci-RNTI**

RNTI used for indication cancellation in UL (see TS 38.212 [17] clause 7.3.1 and TS 38.213 [13], clause 11.2A).

##### **dci-PayloadSizeForCI**

Total length of the DCI payload scrambled with CI-RNTI (see TS 38.213 [13], clause 11.2A).

<b>CI-ConfigurationPerServingCell field descriptions</b>	
<b>ci-PayloadSize</b>	Configures the field size for each UL cancelation indicator of this serving cell (servingCellId) (see TS 38.213 [13], clause 11.2A).
<b>deltaOffset</b>	Configures the additional offset from the end of a PDCCH reception where the UE detects the DCI format 2_4 and the first symbol of the T_ "CI" symbols, in the unit of OFDM symbols (see TS 38.213 [13], clause 11.2A).
<b>frequencyRegionForCI</b>	Configures the reference frequency region where a detected UL CI is applicable (see TS 38.213 [13], clause 11.2A). It is defined in the same way as <i>locationAndBandwidth</i> .
<b>positionInDCI</b>	Starting position (in number of bit) of the <i>ci-PayloadSize</i> bit CI value applicable for this serving cell (servingCellId) within the DCI payload (see TS 38.213 [13], clause 11.2A).
<b>positionInDCI-ForSUL</b>	Starting position (in number of bit) of the <i>ci-PayloadSize</i> bit CI value applicable for SUL of this serving cell (servingCellId) within the DCI payload (see TS 38.213 [13], clause 11.2A).
<b>timeDurationForCI</b>	Configures the duration of the reference time region in symbols where a detected UL CI is applicable of this serving cell (servingCellId) (see TS 38.213 [13], clause 11.2A). If the field is absent, i.e., the configured UL CI monitoring periodicity indicated by <i>monitoringSlotPeriodicityAndOffset</i> for DCI format 2_4 is larger than 1 slot or 1 slot with only one monitoring occasion, the UE applies the value of the configured UL CI monitoring periodicity,
<b>timeFrequencyRegion</b>	Configures the reference time and frequency region where a detected UL CI is applicable of this serving cell (servingCellId) (see TS 38.213 [13], clause 11.2A).
<b>timeGranularityForCI</b>	Configures the number of partitions within the time region of this serving cell (servingCellId) (see TS 38.213 [13], clause 11.2A).
<b>uplinkCancellationPriority</b>	Configures uplink cancellation behavior if both UL CI and intra-UE priority indicator are configured for a given UE. If the field is present, then UL CI is only applicable to the UL transmissions indicated/configured as low priority level. If the field is absent, UL CI is applicable to UL transmission irrespective of its priority level (see TS 38.213 [13], clause 11.2A).

Conditional Presence	Explanation
<i>SUL-Only</i>	The field is optionally present, Need R, if this serving cell is configured with a supplementary uplink (SUL). It is absent otherwise.
<i>SymbolPeriodicity</i>	This field is mandatory present if the configured UL CI monitoring periodicity indicated by <i>monitoringSlotPeriodicityAndOffset</i> for DCI format 2_4 is 1 slot with more than one monitoring occasion, otherwise absent.

## – UplinkConfigCommon

The IE *UplinkConfigCommon* provides common uplink parameters of a cell.

### UplinkConfigCommon information element

```
-- ASN1START
-- TAG-UPLINKCONFIGCOMMON-START

UplinkConfigCommon ::=
    frequencyInfoUL           SEQUENCE {
        FrequencyInfoUL           OPTIONAL, -- Cond InterFreqHOAndServCellAdd
        initialUplinkBWP          OPTIONAL, -- Cond ServCellAdd
        dummy                     TimeAlignmentTimer
```

```

}
-- TAG-UPLINKCONFIGCOMMON-STOP
-- ASN1STOP

```

<b><i>UplinkConfigCommon</i> field descriptions</b>	
<b><i>frequencyInfoUL</i></b>	Absolute uplink frequency configuration and subcarrier specific virtual carriers.
<b><i>initialUplinkBWP</i></b>	The initial uplink BWP configuration for a serving cell (see TS 38.213 [13], clause 12).

<b>Conditional Presence</b>	<b>Explanation</b>
<i>InterFreqHOAndServCellAdd</i>	This field is mandatory present for inter-frequency handover and upon serving cell (PSCell/SCell) addition. Otherwise, the field is optionally present, Need M.
<i>ServCellAdd</i>	This field is mandatory present upon serving cell addition (for PSCell and SCell) and upon handover from E-UTRA to NR. It is optionally present, Need M otherwise.

## – *UplinkConfigCommonSIB*

The IE *UplinkConfigCommonSIB* provides common uplink parameters of a cell.

### ***UplinkConfigCommonSIB* information element**

```

-- ASN1START
-- TAG-UPLINKCONFIGCOMMONSIB-START

UplinkConfigCommonSIB ::=
    frequencyInfoUL
    initialUplinkBWP
    timeAlignmentTimerCommon
}

SEQUENCE {
    FrequencyInfoUL-SIB,
    BWP-UplinkCommon,
    TimeAlignmentTimer
}

-- TAG-UPLINKCONFIGCOMMONSIB-STOP
-- ASN1STOP

```

<b><i>UplinkConfigCommonSIB</i> field descriptions</b>	
<b><i>frequencyInfoUL</i></b>	Absolute uplink frequency configuration and subcarrier specific virtual carriers.
<b><i>InitialUplinkBWP</i></b>	The initial uplink BWP configuration for a PCell (see TS 38.213 [13], clause 12).

– *UplinkTxDirectCurrentList*

The IE *UplinkTxDirectCurrentList* indicates the Tx Direct Current locations per serving cell for each configured UL BWP in the serving cell, based on the BWP numerology and the associated carrier bandwidth.

***UplinkTxDirectCurrentList* information element**

```
-- ASN1START
-- TAG-UPLINKTXDIRECTCURRENTLIST-START

UplinkTxDirectCurrentList ::=          SEQUENCE (SIZE (1..maxNrofServingCells)) OF UplinkTxDirectCurrentCell

UplinkTxDirectCurrentCell ::=         SEQUENCE {
    servCellIndex                      ServCellIndex,
    uplinkDirectCurrentBWP              SEQUENCE (SIZE (1..maxNrofBWPs)) OF UplinkTxDirectCurrentBWP,
    . . . ,
    [[
    uplinkDirectCurrentBWP-SUL          SEQUENCE (SIZE (1..maxNrofBWPs)) OF UplinkTxDirectCurrentBWP          OPTIONAL
    ]]
}

UplinkTxDirectCurrentBWP ::=          SEQUENCE {
    bwp-Id                              BWP-Id,
    shift7dot5kHz                       BOOLEAN,
    txDirectCurrentLocation              INTEGER (0..3301)
}

-- TAG-UPLINKTXDIRECTCURRENTLIST-STOP
-- ASN1STOP
```

***UplinkTxDirectCurrentBWP* field descriptions**

***bwp-Id***

The BWP-Id of the corresponding uplink BWP.

***shift7dot5kHz***

Indicates whether there is 7.5 kHz shift or not. 7.5 kHz shift is applied if the field is set to *true*. Otherwise 7.5 kHz shift is not applied.

***txDirectCurrentLocation***

The uplink Tx Direct Current location for the carrier. Only values in the value range of this field between 0 and 3299, which indicate the subcarrier index within the carrier corresponding to the numerology of the corresponding uplink BWP and value 3300, which indicates "Outside the carrier" and value 3301, which indicates "Undetermined position within the carrier" are used in this version of the specification.

<i>UplinkTxDirectCurrentCell</i> field descriptions
<b><i>servCellIndex</i></b> The serving cell ID of the serving cell corresponding to the <i>uplinkDirectCurrentBWP</i> .
<b><i>uplinkDirectCurrentBWP</i></b> The Tx Direct Current locations for all the uplink BWPs configured at the corresponding serving cell.
<b><i>uplinkDirectCurrentBWP-SUL</i></b> The Tx Direct Current locations for all the supplementary uplink BWPs configured at the corresponding serving cell.

## – *ZP-CSI-RS-Resource*

The IE *ZP-CSI-RS-Resource* is used to configure a Zero-Power (ZP) CSI-RS resource (see TS 38.214 [19], clause 5.1.4.2). Reconfiguration of a *ZP-CSI-RS-Resource* between periodic or semi-persistent and aperiodic is not supported.

### *ZP-CSI-RS-Resource* information element

```
-- ASN1START
-- TAG-ZP-CSI-RS-RESOURCE-START

ZP-CSI-RS-Resource ::=
    SEQUENCE {
        zp-CSI-RS-ResourceId
            ZP-CSI-RS-ResourceId,
        resourceMapping
            CSI-RS-ResourceMapping,
        periodicityAndOffset
            CSI-ResourcePeriodicityAndOffset
        ...
    }
    OPTIONAL, --Cond PeriodicOrSemiPersistent

ZP-CSI-RS-ResourceId ::=
    INTEGER (0..maxNrofZP-CSI-RS-Resources-1)

-- TAG-ZP-CSI-RS-RESOURCE-STOP
-- ASN1STOP
```

<i>ZP-CSI-RS-Resource</i> field descriptions
<b><i>periodicityAndOffset</i></b> Periodicity and slot offset for periodic/semi-persistent ZP-CSI-RS (see TS 38.214 [19], clause 5.1.4.2). Network always configures the UE with a value for this field for periodic and semi-persistent ZP-CSI-RS resource (as indicated in PDSCH-Config).
<b><i>resourceMapping</i></b> OFDM symbol and subcarrier occupancy of the ZP-CSI-RS resource within a slot.
<b><i>zp-CSI-RS-ResourceId</i></b> ZP CSI-RS resource configuration ID (see TS 38.214 [19], clause 5.1.4.2).

Conditional Presence	Explanation
<i>PeriodicOrSemiPersistent</i>	The field is optionally present, Need M, for periodic and semi-persistent ZP-CSI-RS-Resources (as indicated in PDSCH-Config). The field is absent otherwise.

## – *ZP-CSI-RS-ResourceSet*

The IE *ZP-CSI-RS-ResourceSet* refers to a set of *ZP-CSI-RS-Resources* using their *ZP-CSI-RS-ResourceIds*.

### ***ZP-CSI-RS-ResourceSet* information element**

```
-- ASN1START
-- TAG-ZP-CSI-RS-RESOURCESET-START

ZP-CSI-RS-ResourceSet ::=          SEQUENCE {
    zp-CSI-RS-ResourceSetId        ZP-CSI-RS-ResourceSetId,
    zp-CSI-RS-ResourceIdList      SEQUENCE (SIZE (1..maxNrofZP-CSI-RS-ResourcesPerSet)) OF ZP-CSI-RS-ResourceId,
    ...
}

-- TAG-ZP-CSI-RS-RESOURCESET-STOP
-- ASN1STOP
```

<b><i>ZP-CSI-RS-ResourceSet</i> field descriptions</b>
<b><i>zp-CSI-RS-ResourceIdList</i></b> The list of <i>ZP-CSI-RS-ResourceId</i> identifying the <i>ZP-CSI-RS-Resource</i> elements belonging to this set.

## – *ZP-CSI-RS-ResourceSetId*

The IE *ZP-CSI-RS-ResourceSetId* identifies a *ZP-CSI-RS-ResourceSet*.

### ***ZP-CSI-RS-ResourceSetId* information element**

```
-- ASN1START
-- TAG-ZP-CSI-RS-RESOURCESETID-START

ZP-CSI-RS-ResourceSetId ::=          INTEGER (0..maxNrofZP-CSI-RS-ResourceSets-1)

-- TAG-ZP-CSI-RS-RESOURCESETID-STOP
-- ASN1STOP
```

## 6.3.3 UE capability information elements

### – *AccessStratumRelease*

The IE *AccessStratumRelease* indicates the release supported by the UE.

**AccessStratumRelease** information element

```

-- ASN1START
-- TAG-ACCESSSTRATUMRELEASE-START

AccessStratumRelease ::= ENUMERATED {
    rel15, rel16, spare6, spare5, spare4, spare3, spare2, spare1, ... }

-- TAG-ACCESSSTRATUMRELEASE-STOP
-- ASN1STOP

```

– **BandCombinationList**

The IE *BandCombinationList* contains a list of NR CA, NR non-CA and/or MR-DC band combinations (also including DL only or UL only band).

**BandCombinationList** information element

```

-- ASN1START
-- TAG-BANDCOMBINATIONLIST-START

BandCombinationList ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombination

BandCombinationList-v1540 ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombination-v1540

BandCombinationList-v1550 ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombination-v1550

BandCombinationList-v1560 ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombination-v1560

BandCombinationList-v1570 ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombination-v1570

BandCombinationList-v1580 ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombination-v1580

BandCombinationList-v1590 ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombination-v1590

BandCombinationList-v1610 ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombination-v1610

BandCombinationList-UplinkTxSwitch-r16 ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombination-UplinkTxSwitch-r16

BandCombination ::= SEQUENCE {
    bandList SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BandParameters,
    featureSetCombination FeatureSetCombinationId,
    ca-ParametersEUTRA CA-ParametersEUTRA OPTIONAL,
    ca-ParametersNR CA-ParametersNR OPTIONAL,
    mrdc-Parameters MRDC-Parameters OPTIONAL,
    supportedBandwidthCombinationSet BIT STRING (SIZE (1..32)) OPTIONAL,
    powerClass-v1530 ENUMERATED {pc2} OPTIONAL
}

BandCombination-v1540 ::= SEQUENCE {
    bandList-v1540 SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BandParameters-v1540,
    ca-ParametersNR-v1540 CA-ParametersNR-v1540 OPTIONAL
}

```

```

}

BandCombination-v1550 ::= SEQUENCE {
    ca-ParametersNR-v1550 CA-ParametersNR-v1550
}

BandCombination-v1610 ::= SEQUENCE {
    bandList-v1610 SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BandParameters-v1610 OPTIONAL,
    ca-ParametersNR-v1610 CA-ParametersNR-v1610 OPTIONAL,
    ca-ParametersNRDC-v1610 CA-ParametersNRDC-v1610 OPTIONAL,
    powerClass-v1610 ENUMERATED {pc1dot5} OPTIONAL,
    powerClassNRPart-r16 ENUMERATED {pc1, pc2, pc3, pc5} OPTIONAL,
    featureSetCombinationDAPS-r16 FeatureSetCombinationId OPTIONAL,
    mrdc-Parameters-v1620 MRDC-Parameters-v1620 OPTIONAL
}

BandCombination-v1560 ::= SEQUENCE {
    ne-DC-BC ENUMERATED {supported} OPTIONAL,
    ca-ParametersNRDC CA-ParametersNRDC OPTIONAL,
    ca-ParametersEUTRA-v1560 CA-ParametersEUTRA-v1560 OPTIONAL,
    ca-ParametersNR-v1560 CA-ParametersNR-v1560 OPTIONAL
}

BandCombination-v1570 ::= SEQUENCE {
    ca-ParametersEUTRA-v1570 CA-ParametersEUTRA-v1570
}

BandCombination-v1580 ::= SEQUENCE {
    mrdc-Parameters-v1580 MRDC-Parameters-v1580
}

BandCombination-v1590 ::= SEQUENCE {
    supportedBandwidthCombinationSetIntraENDC BIT STRING (SIZE (1..32)) OPTIONAL,
    mrdc-Parameters-v1590 MRDC-Parameters-v1590
}

BandCombination-UplinkTxSwitch-r16 ::= SEQUENCE {
    bandCombination-r16 BandCombination,
    bandCombination-v1540 BandCombination-v1540 OPTIONAL,
    bandCombination-v1560 BandCombination-v1560 OPTIONAL,
    bandCombination-v1570 BandCombination-v1570 OPTIONAL,
    bandCombination-v1580 BandCombination-v1580 OPTIONAL,
    bandCombination-v1590 BandCombination-v1590 OPTIONAL,
    bandCombination-v1610 BandCombination-v1610 OPTIONAL,
    supportedBandPairListNR-r16 SEQUENCE (SIZE (1..maxULTxSwitchingBandPairs)) OF ULTxSwitchingBandPair-r16,
    uplinkTxSwitching-OptionSupport-r16 ENUMERATED {switchedUL, dualUL, both} OPTIONAL,
    uplinkTxSwitching-PowerBoosting-r16 ENUMERATED {supported} OPTIONAL,
    ...
}

ULTxSwitchingBandPair-r16 ::= SEQUENCE {
    bandIndexUL1-r16 INTEGER(1..maxSimultaneousBands),
    bandIndexUL2-r16 INTEGER(1..maxSimultaneousBands),
    uplinkTxSwitchingPeriod-r16 ENUMERATED {n35us, n140us, n210us},

```



```

    uplinkTxSwitching-DL-Interruption-r16 BIT STRING (SIZE(1..maxSimultaneousBands)) OPTIONAL
  }

BandParameters ::=
  eutra CHOICE {
    bandEUTRA SEQUENCE {
      ca-BandwidthClassDL-EUTRA FreqBandIndicatorEUTRA,
      ca-BandwidthClassUL-EUTRA CA-BandwidthClassEUTRA OPTIONAL,
      ca-BandwidthClassUL-EUTRA CA-BandwidthClassEUTRA OPTIONAL
    },
    nr SEQUENCE {
      bandNR FreqBandIndicatorNR,
      ca-BandwidthClassDL-NR CA-BandwidthClassNR OPTIONAL,
      ca-BandwidthClassUL-NR CA-BandwidthClassNR OPTIONAL
    }
  }

BandParameters-v1540 ::=
  srs-CarrierSwitch SEQUENCE {
    nr CHOICE {
      srs-SwitchingTimesListNR SEQUENCE (SIZE (1..maxSimultaneousBands)) OF SRS-SwitchingTimeNR
    },
    eutra SEQUENCE {
      srs-SwitchingTimesListEUTRA SEQUENCE (SIZE (1..maxSimultaneousBands)) OF SRS-SwitchingTimeEUTRA
    }
  } OPTIONAL,
  srs-TxSwitch SEQUENCE {
    supportedSRS-TxPortSwitch ENUMERATED {t1r2, t1r4, t2r4, t1r4-t2r4, t1r1, t2r2, t4r4, notSupported},
    txSwitchImpactToRx INTEGER (1..32) OPTIONAL,
    txSwitchWithAnotherBand INTEGER (1..32) OPTIONAL
  } OPTIONAL
}

BandParameters-v1610 ::=
  srs-TxSwitch-v1610 SEQUENCE {
    supportedSRS-TxPortSwitch-v1610 ENUMERATED {t1r1-t1r2, t1r1-t1r2-t1r4, t1r1-t1r2-t2r2-t2r4, t1r1-t1r2-t2r2-t1r4-t2r4,
      t1r1-t2r2, t1r1-t2r2-t4r4}
  } OPTIONAL
}

-- TAG-BANDCOMBINATIONLIST-STOP
-- ASN1STOP

```

<b>BandCombination field descriptions</b>
<p><b>BandCombinationList-v1540, BandCombinationList-v1550, BandCombinationList-v1560, BandCombinationList-v1570, BandCombinationList-v1580, BandCombinationList-v1590, BandCombinationList-r16</b></p> <p>The UE shall include the same number of entries, and listed in the same order, as in <i>BandCombinationList</i> (without suffix). If the field is included in <i>supportedBandCombinationListNEDC-Only-v1610</i>, the UE shall include the same number of entries, and listed in the same order, as in <i>BandCombinationList of supportedBandCombinationListNEDC-Only</i> (without suffix) field.</p> <p>If the field is included in <i>supportedBandCombinationListNEDC-Only-v15a0</i>, the UE shall include the same number of entries, and listed in the same order, as in <i>BandCombinationList</i> (without suffix) of <i>supportedBandCombinationListNEDC-Only</i> (without suffix) field.</p>
<p><b>ca-ParametersNRDC</b></p> <p>If the field is included for a band combination in the NR capability container, the field indicates support of NR-DC. Otherwise, the field is absent.</p>
<p><b>featureSetCombinationDAPS</b></p> <p>If this field is present for a band combination, it reports the feature set combination supported for the band combination when any DAPS bearer is configured.</p>
<p><b>ne-DC-BC</b></p> <p>If the field is included for a band combination in the MR-DC capability container, the field indicates support of NE-DC. Otherwise, the field is absent.</p>
<p><b>srs-SwitchingTimesListNR</b></p> <p>Indicates, for a particular pair of NR bands, the RF retuning time when switching between a NR carrier corresponding to this band entry and another (PUSCH-less) NR carrier corresponding to the band entry in the order indicated below:</p> <ul style="list-style-type: none"> <li>- For the first NR band, the UE shall include the same number of entries for NR bands as in <i>bandList</i>, i.e. first entry corresponds to first NR band in <i>bandList</i> and so on,</li> <li>- For the second NR band, the UE shall include one entry less, i.e. first entry corresponds to the second NR band in <i>bandList</i> and so on</li> <li>- And so on</li> </ul>
<p><b>srs-SwitchingTimesListEUTRA</b></p> <p>Indicates, for a particular pair of E-UTRA bands, the RF retuning time when switching between an E-UTRA carrier corresponding to this band entry and another (PUSCH-less) E-UTRA carrier corresponding to the band entry in the order indicated below:</p> <ul style="list-style-type: none"> <li>- For the first E-UTRA band, the UE shall include the same number of entries for E-UTRA bands as in <i>bandList</i>, i.e. first entry corresponds to first E-UTRA band in <i>bandList</i> and so on,</li> <li>- For the second E-UTRA band, the UE shall include one entry less, i.e. first entry corresponds to the second E-UTRA band in <i>bandList</i> and so on</li> <li>- And so on</li> </ul>
<p><b>srs-TxSwitch</b></p> <p>Indicates supported SRS antenna switch capability for the associated band. If the UE indicates support of <i>SRS-SwitchingTimeNR</i>, the UE is allowed to set this field for a band with associated <i>FeatureSetUplinkId</i> set to 0 for SRS carrier switching.</p>

## – *BandCombinationListSidelink*

The IE *BandCombinationListSidelink* contains a list of V2X sidelink and NR sidelink band combinations.

### BandCombinationListSidelink information element

```
-- ASN1START
-- TAG-BANDCOMBINATIONLISTSIDELINK-START
```

```
BandParametersSidelink-r16 ::= SEQUENCE {
    freqBandSidelink-r16          FreqBandIndicatorNR
}
```

```
BandCombinationListSidelinkEUTRA-NR-r16 ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombinationParametersSidelinkEUTRA-NR-r16
```

```

BandCombinationParametersSidelinkEUTRA-NR-r16 ::= SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BandParametersSidelinkEUTRA-NR-r16

BandParametersSidelinkEUTRA-NR-r16 ::= CHOICE {
    eutra          SEQUENCE {
        bandParametersSidelinkEUTRA1-r16  OCTET STRING          OPTIONAL,
        bandParametersSidelinkEUTRA2-r16  OCTET STRING          OPTIONAL
    },
    nr             SEQUENCE {
        bandParametersSidelinkNR-r16      BandParametersSidelink-r16
    }
}

-- TAG-BANDCOMBINATIONLISTSIDELINK-STOP
-- ASN1STOP

```

<b><i>BandCombinationSidelink</i> field descriptions</b>
<b><i>bandParametersSidelinkEUTRA1, bandParametersSidelinkEUTRA2</i></b> This field includes the <i>V2X-BandParameters-r14</i> and <i>V2X-BandParameters-v1530</i> IE as specified in 36.331 [10]. It is used for reporting the per-band capability for V2X sidelink communication.

### – *CA-BandwidthClassEUTRA*

The IE *CA-BandwidthClassEUTRA* indicates the E-UTRA CA bandwidth class as defined in TS 36.101 [22], table 5.6A-1.

#### ***CA-BandwidthClassEUTRA* information element**

```

-- ASN1START
-- TAG-CA-BANDWIDTHCLASSEUTRA-START

CA-BandwidthClassEUTRA ::= ENUMERATED {a, b, c, d, e, f, ...}

-- TAG-CA-BANDWIDTHCLASSEUTRA-STOP
-- ASN1STOP

```

### – *CA-BandwidthClassNR*

The IE *CA-BandwidthClassNR* indicates the NR CA bandwidth class as defined in TS 38.101-1 [15], table 5.3A.5-1 and TS 38.101-2 [39], table 5.3A.4-1.

#### ***CA-BandwidthClassNR* information element**

```

-- ASN1START
-- TAG-CA-BANDWIDTHCLASSNR-START

CA-BandwidthClassNR ::= ENUMERATED {a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, ...}

-- TAG-CA-BANDWIDTHCLASSNR-STOP

```

```
-- ASN1STOP
```

## – CA-ParametersEUTRA

The IE *CA-ParametersEUTRA* contains the E-UTRA part of band combination parameters for a given MR-DC band combination.

NOTE: If additional E-UTRA band combination parameters are defined in TS 36.331 [10], which are supported for MR-DC, they will be defined here as well.

### CA-ParametersEUTRA information element

```
-- ASN1START
-- TAG-CA-PARAMETERSEUTRA-START

CA-ParametersEUTRA ::=
    multipleTimingAdvance          SEQUENCE {
        multipleTimingAdvance      ENUMERATED {supported}          OPTIONAL,
        simultaneousRx-Tx          ENUMERATED {supported}          OPTIONAL,
        supportedNAICS-2CRS-AP     BIT STRING (SIZE (1..8))        OPTIONAL,
        additionalRx-Tx-PerformanceReq  ENUMERATED {supported}    OPTIONAL,
        ue-CA-PowerClass-N         ENUMERATED {class2}             OPTIONAL,
        supportedBandwidthCombinationSetEUTRA-v1530 BIT STRING (SIZE (1..32)) OPTIONAL,
        ...
    }

CA-ParametersEUTRA-v1560 ::=
    fd-MIMO-TotalWeightedLayers    SEQUENCE {
        fd-MIMO-TotalWeightedLayers INTEGER (2..128)          OPTIONAL
    }

CA-ParametersEUTRA-v1570 ::=
    dl-1024QAM-TotalWeightedLayers SEQUENCE {
        dl-1024QAM-TotalWeightedLayers INTEGER (0..10)          OPTIONAL
    }

-- TAG-CA-PARAMETERSEUTRA-STOP
-- ASN1STOP
```

## – CA-ParametersNR

The IE *CA-ParametersNR* contains carrier aggregation related capabilities that are defined per band combination.

### CA-ParametersNR information element

```
-- ASN1START
-- TAG-CA-PARAMETERSNR-START

CA-ParametersNR ::=
    dummy                SEQUENCE {
        dummy            ENUMERATED {supported}          OPTIONAL,
        parallelTxSRS-PUCCH-PUSCH ENUMERATED {supported}  OPTIONAL,
        parallelTxPRACH-SRS-PUCCH-PUSCH ENUMERATED {supported}  OPTIONAL,
    }
```

```

simultaneousRxTxInterBandCA          ENUMERATED {supported}      OPTIONAL,
simultaneousRxTxSUL                   ENUMERATED {supported}      OPTIONAL,
diffNumerologyAcrossPUCCH-Group       ENUMERATED {supported}      OPTIONAL,
diffNumerologyWithinPUCCH-GroupSmallerSCS  ENUMERATED {supported}      OPTIONAL,
supportedNumberTAG                     ENUMERATED {n2, n3, n4}     OPTIONAL,
...
}

CA-ParametersNR-v1540 ::=
SEQUENCE {
simultaneousSRS-AssocCSI-RS-AllCC      INTEGER (5..32)             OPTIONAL,
csi-RS-IM-ReceptionForFeedbackPerBandComb SEQUENCE {
maxNumberSimultaneousNZP-CSI-RS-ActBWP-AllCC INTEGER (1..64)             OPTIONAL,
totalNumberPortsSimultaneousNZP-CSI-RS-ActBWP-AllCC INTEGER (2..256)           OPTIONAL,
}
simultaneousCSI-ReportsAllCC           INTEGER (5..32)             OPTIONAL,
dualPA-Architecture                     ENUMERATED {supported}     OPTIONAL,
}

CA-ParametersNR-v1550 ::=
SEQUENCE {
dummy                                   ENUMERATED {supported}     OPTIONAL,
}

CA-ParametersNR-v1560 ::=
SEQUENCE {
diffNumerologyWithinPUCCH-GroupLargerSCS  ENUMERATED {supported}     OPTIONAL,
}

CA-ParametersNR-v1610 ::=
SEQUENCE {
-- R1 9-3: Parallel MsgA and SRS/PUCCH/PUSCH transmissions across CCs in inter-band CA
parallelTxMsgA-SRS-PUCCH-PUSCH-r16       ENUMERATED {supported}     OPTIONAL,
-- R1 9-4: MsgA operation in a band combination including SUL
msgA-SUL-r16                              ENUMERATED {supported}     OPTIONAL,
-- R1 10-9c: Joint search space group switching across multiple cells
jointSearchSpaceGroupSwitchingAcrossCells-r16  ENUMERATED {supported}     OPTIONAL,
-- R1 14-5: Half-duplex UE behaviour in TDD CA for same SCS
half-DuplexTDD-CA-SameSCS-r16            ENUMERATED {supported}     OPTIONAL,
-- R1 18-4: SCell dormancy within active time
scellDormancyWithinActiveTime-r16        ENUMERATED {supported}     OPTIONAL,
-- R1 18-4a: SCell dormancy outside active time
scellDormancyOutsideActiveTime-r16       ENUMERATED {supported}     OPTIONAL,
-- R1 18-6: Cross-carrier A-CSI RS triggering with different SCS
crossCarrierA-CSI-trigDiffSCS-r16       ENUMERATED {higherA-CSI-SCS,lowerA-CSI-SCS,both}  OPTIONAL,
-- R1 18-6a: Default QCL assumption for cross-carrier A-CSI-RS triggering
defaultQCL-CrossCarrierA-CSI-Trig-r16   ENUMERATED {diffOnly, both}  OPTIONAL,
-- R1 18-7: CA with non-aligned frame boundaries for inter-band CA
interCA-NonAlignedFrame-r16             ENUMERATED {supported}     OPTIONAL,
simul-SRS-Trans-BC-r16                  ENUMERATED {n2}            OPTIONAL,
interFreqDAPS-r16                        SEQUENCE {
interFreqAsyncDAPS-r16                  ENUMERATED {supported}     OPTIONAL,
interFreqDiffSCS-DAPS-r16              ENUMERATED {supported}     OPTIONAL,
interFreqMultiUL-TransmissionDAPS-r16  ENUMERATED {supported}     OPTIONAL,
interFreqSemiStaticPowerSharingDAPS-Model-r16  ENUMERATED {supported}     OPTIONAL,
interFreqSemiStaticPowerSharingDAPS-Mode2-r16  ENUMERATED {supported}     OPTIONAL,
interFreqDynamicPowerSharingDAPS-r16    ENUMERATED {short, long}   OPTIONAL,
interFreqUL-TransCancellationDAPS-r16   ENUMERATED {supported}     OPTIONAL,
}
}

```

```

}
codebookParametersPerBC-r16                               CodebookParameters-v1610     OPTIONAL,
-- R1 16-2a-10 Value of R for BD/CCE                       OPTIONAL,
blindDetectFactor-r16                                     INTEGER (1..2)                OPTIONAL,
-- R1 11-2a: Capability on the number of CCs for monitoring a maximum number of BDs and non-overlapped CCEs per span when configured
-- with DL CA with Rel-16 PDCCH monitoring capability on all the serving cells
pdcch-MonitoringCA-r16                                     SEQUENCE {
  maxNumberOfMonitoringCC-r16                             INTEGER (2..16),
  supportedSpanArrangement-r16                           ENUMERATED {alignedOnly, alignedAndNonAligned}
}
-- R1 11-2c: Number of carriers for CCE/BD scaling with DL CA with mix of Rel. 16 and Rel. 15 PDCCH monitoring capabilities on
-- different carriers
pdcch-BlindDetectionCA-Mixed-r16                          SEQUENCE {
  pdcch-BlindDetectionCA1-r16                             INTEGER (1..15),
  pdcch-BlindDetectionCA2-r16                             INTEGER (1..15),
  supportedSpanArrangement-r16                           ENUMERATED {alignedOnly, alignedAndNonAligned}
}
-- R1 11-2d: Capability on the number of CCs for monitoring a maximum number of BDs and non-overlapped CCEs per span for MCG and for
-- SCG when configured for NR-DC operation with Rel-16 PDCCH monitoring capability on all the serving cells
pdcch-BlindDetectionMCG-UE-r16                            INTEGER (1..14)               OPTIONAL,
pdcch-BlindDetectionSCG-UE-r16                            INTEGER (1..14)               OPTIONAL,
-- R1 11-2e: Number of carriers for CCE/BD scaling for MCG and for SCG when configured for NR-DC operation with mix of Rel. 16 and
-- Rel. 15 PDCCH monitoring capabilities on different carriers
pdcch-BlindDetectionMCG-UE-Mixed-r16                      SEQUENCE {
  pdcch-BlindDetectionMCG-UE1-r16                        INTEGER (0..15),
  pdcch-BlindDetectionMCG-UE2-r16                        INTEGER (0..15)
}
pdcch-BlindDetectionSCG-UE-Mixed-r16                      SEQUENCE {
  pdcch-BlindDetectionSCG-UE1-r16                        INTEGER (0..15),
  pdcch-BlindDetectionSCG-UE2-r16                        INTEGER (0..15)
}
-- R1 18-5 cross-carrier scheduling with different SCS in DL CA
crossCarrierSchedulingDL-DiffSCS-r16                      ENUMERATED {low-to-high, high-to-low, both} OPTIONAL,
-- R1 18-5a Default QCL assumption for cross-carrier scheduling
crossCarrierSchedulingDefaultQCL-r16                      ENUMERATED {diff-only, both} OPTIONAL,
-- R1 18-5b cross-carrier scheduling with different SCS in UL CA
crossCarrierSchedulingUL-DiffSCS-r16                      ENUMERATED {low-to-high, high-to-low, both} OPTIONAL,
-- R1 13.19a Simultaneous positioning SRS and MIMO SRS transmission for a given BC
simul-SRS-MIMO-Trans-BC-r16                               ENUMERATED {n2}               OPTIONAL,
-- R1 16-3a, 16-3a-1, 16-3b, 16-3b-1: New Individual Codebook
codebookParametersAdditionPerBC-r16                      CodebookParametersAdditionPerBC-r16     OPTIONAL,
-- R1 16-8: Mixed codebook
codebookComboParametersAdditionPerBC-r16                 CodebookComboParametersAdditionPerBC-r16  OPTIONAL
}

-- TAG-CA-PARAMETERSNR-STOP
-- ASN1STOP

```

**CA-ParametersNR field description****codebookParametersPerBC**

For a given supported band combination, this field indicates the alternative list of *SupportedCSI-RS-Resource* supported for each codebook type, amongst the supported CSI-RS resources included in *codebookParametersPerBand* in *MIMO-ParametersPerBand*.

– **CA-ParametersNRDC**

The IE *CA-ParametersNRDC* contains dual connectivity related capabilities that are defined per band combination.

**CA-ParametersNRDC information element**

```
-- ASN1START
-- TAG-CA-PARAMETERS-NRDC-START

CA-ParametersNRDC ::=
    ca-ParametersNR-ForDC                SEQUENCE {
        ca-ParametersNR-ForDC            CA-ParametersNR                OPTIONAL,
        ca-ParametersNR-ForDC-v1540     CA-ParametersNR-v1540        OPTIONAL,
        ca-ParametersNR-ForDC-v1550     CA-ParametersNR-v1550        OPTIONAL,
        ca-ParametersNR-ForDC-v1560     CA-ParametersNR-v1560        OPTIONAL,
        featureSetCombinationDC          FeatureSetCombinationId      OPTIONAL
    }

CA-ParametersNRDC-v1610 ::= SEQUENCE {
    -- R1 18-1: Semi-static power sharing model between MCG and SCG cells of same FR for NR dual connectivity
    intraFR-NR-DC-PwrSharingModel-r16   ENUMERATED {supported}        OPTIONAL,
    -- R1 18-1a: Semi-static power sharing mode 2 between MCG and SCG cells of same FR for NR dual connectivity
    intraFR-NR-DC-PwrSharingMode2-r16   ENUMERATED {supported}        OPTIONAL,
    -- R1 18-1b: Dynamic power sharing between MCG and SCG cells of same FR for NR dual connectivity
    intraFR-NR-DC-DynamicPwrSharing-r16  ENUMERATED {short, long}      OPTIONAL,
    asyncNRDC-r16                       ENUMERATED {supported}        OPTIONAL
}

-- TAG-CA-PARAMETERS-NRDC-STOP
-- ASN1STOP
```

**CA-ParametersNRDC field descriptions****ca-ParametersNR-forDC (with and without suffix)**

If this field is present for a band combination, it reports the UE capabilities when NR-DC is configured with the band combination. If no version of this field (i.e., with and without suffix) is present for a band combination, the *ca-ParametersNR* field versions (with and without suffix) in *BandCombination* are applicable to the UE configured with NR-DC for the band combination.

**featureSetCombinationDC**

If this field is present for a band combination, it reports the feature set combination supported for the band combination when NR-DC is configured. If this field is absent for a band combination, the *featureSetCombination* in *BandCombination* (without suffix) is applicable to the UE configured with NR-DC for the band combination.

## – CarrierAggregationVariant

The IE *CarrierAggregationVariant* informs the network about supported "placement" of the SpCell in an NR cell group.

### CarrierAggregationVariant information element

```
-- ASN1START
-- TAG-CARRIERAGGREGATIONVARIANT-START

CarrierAggregationVariant ::=
    SEQUENCE {
        fr1fdd-FR1TDD-CA-SpCellOnFR1FDD    ENUMERATED {supported}           OPTIONAL,
        fr1fdd-FR1TDD-CA-SpCellOnFR1TDD    ENUMERATED {supported}           OPTIONAL,
        fr1fdd-FR2TDD-CA-SpCellOnFR1FDD    ENUMERATED {supported}           OPTIONAL,
        fr1fdd-FR2TDD-CA-SpCellOnFR2TDD    ENUMERATED {supported}           OPTIONAL,
        fr1tdd-FR2TDD-CA-SpCellOnFR1TDD    ENUMERATED {supported}           OPTIONAL,
        fr1tdd-FR2TDD-CA-SpCellOnFR2TDD    ENUMERATED {supported}           OPTIONAL,
        fr1fdd-FR1TDD-FR2TDD-CA-SpCellOnFR1FDD    ENUMERATED {supported}           OPTIONAL,
        fr1fdd-FR1TDD-FR2TDD-CA-SpCellOnFR1TDD    ENUMERATED {supported}           OPTIONAL,
        fr1fdd-FR1TDD-FR2TDD-CA-SpCellOnFR2TDD    ENUMERATED {supported}           OPTIONAL
    }

-- TAG-CARRIERAGGREGATIONVARIANT-STOP
-- ASN1STOP
```

## – CodebookParameters

The IE *CodebookParameters* is used to convey codebook related parameters.

### CodebookParameters information element

```
-- ASN1START
-- TAG-CODEBOOKPARAMETERS-START

CodebookParameters ::=
    SEQUENCE {
        type1
            SEQUENCE {
                singlePanel
                    SEQUENCE {
                        supportedCSI-RS-ResourceList    SEQUENCE (SIZE (1.. maxNrofCSI-RS-Resources)) OF SupportedCSI-RS-Resource,
                        modes                            ENUMERATED {mode1, mode1andMode2},
                        maxNumberCSI-RS-PerResourceSet    INTEGER (1..8)
                    },
                multiPanel
                    SEQUENCE {
                        supportedCSI-RS-ResourceList    SEQUENCE (SIZE (1.. maxNrofCSI-RS-Resources)) OF SupportedCSI-RS-Resource,
                        modes                            ENUMERATED {mode1, mode2, both},
                        nrofPanels                        ENUMERATED {n2, n4},
                        maxNumberCSI-RS-PerResourceSet    INTEGER (1..8)
                    }
            }
        OPTIONAL
        type2
            SEQUENCE {
                supportedCSI-RS-ResourceList    SEQUENCE (SIZE (1.. maxNrofCSI-RS-Resources)) OF SupportedCSI-RS-Resource,
                parameterLx                      INTEGER (2..4),
            }
    }

```



```

    amplitudeScalingType          ENUMERATED {wideband, widebandAndSubband},
    amplitudeSubsetRestriction    ENUMERATED {supported}                OPTIONAL
  }
  type2-PortSelection            SEQUENCE {
    supportedCSI-RS-ResourceList SEQUENCE (SIZE (1.. maxNrofCSI-RS-Resources)) OF SupportedCSI-RS-Resource,
    parameterLx                  INTEGER (2..4),
    amplitudeScalingType          ENUMERATED {wideband, widebandAndSubband}
  }
}
OPTIONAL,
}
}
CodebookParameters-v1610 ::= SEQUENCE {
  supportedCSI-RS-ResourceListAlt-r16 SEQUENCE {
    type1-SinglePanel-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-Resources)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
OPTIONAL,
    type1-MultiPanel-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-Resources)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
OPTIONAL,
    type2-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-Resources)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
OPTIONAL,
    type2-PortSelection-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-Resources)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
OPTIONAL
  }
OPTIONAL
}
CodebookParametersAddition-r16 ::= SEQUENCE {
  etype2-r16 SEQUENCE {
    -- R1 16-3a Regular eType 2 R=1
    etype2R1-r16 SEQUENCE {
      supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF
                                                                                               INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
    },
    -- R1 16-3a-1 Regular eType 2 R=2
    etype2R2-r16 SEQUENCE {
      supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF
                                                                                               INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
    }
    OPTIONAL,
    -- R1 16-3a-2: Support of parameter combinations 7-8
    paramComb7-8-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 16-3a-3: Support of rank 3,4
    rank3-4-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 16-3a-4: CBR with soft amplitude restriction
    softAmpRestriction-r16 ENUMERATED {supported} OPTIONAL
  }
  etype2-PS-r16 SEQUENCE {
    -- R1 16-3b Regular eType 2 R=1 PortSelection
    etype2R1-PortSelection-r16 SEQUENCE {
      supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF
                                                                                               INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
    },
    -- R1 16-3b-1 Regular eType 2 R=2 PortSelection
    etype2R2-PortSelection-r16 SEQUENCE {
      supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF
                                                                                               INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
    }
  }
  OPTIONAL,
}

```

```

    -- R1 16-3b-2: Support of rank 3,4
    rank3-4-r16          ENUMERATED {supported}    OPTIONAL
  }
}
OPTIONAL

```

```

CodebookComboParametersAddition-r16 ::= SEQUENCE {
  -- R1 16-8 Mixed codebook types
  type1SP-Type2-null-r16          SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
  }
  type1SP-Type2PS-null-r16        SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
  }
  type1SP-eType2R1-null-r16      SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
  }
  type1SP-eType2R2-null-r16      SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
  }
  type1SP-eType2R1PS-null-r16    SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
  }
  type1SP-eType2R2PS-null-r16    SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
  }
  type1SP-Type2-Type2PS-r16      SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
  }
  type1MP-Type2-null-r16         SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
  }
  type1MP-Type2PS-null-r16      SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
  }
  type1MP-eType2R1-null-r16     SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
  }
  type1MP-eType2R2-null-r16     SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
  }
  type1MP-eType2R1PS-null-r16   SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
  }
  type1MP-eType2R2PS-null-r16   SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
  }
  type1MP-Type2-Type2PS-r16     SEQUENCE {
    supportedCSI-RS-ResourceListAdd-r16 SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
  }
}

```

```

CodebookParametersAdditionPerBC-r16 ::= SEQUENCE {
  -- R1 16-3a Regular eType 2 R=1
  etype2R1-r16          SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
}

```

```

                                OPTIONAL,
-- R1 16-3a-1 Regular eType 2 R=2
etype2R2-r16                     SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
                                OPTIONAL,
-- R1 16-3b Regular eType 2 R=1 PortSelection
etype2R1-PortSelection-r16       SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
                                OPTIONAL,
-- R1 16-3b-1 Regular eType 2 R=2 PortSelection
etype2R2-PortSelection-r16       SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
                                OPTIONAL
}

CodebookComboParametersAdditionPerBC-r16 ::= SEQUENCE {
-- R1 16-8 Mixed codebook types
type1SP-Type2-null-r16           SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
                                OPTIONAL,
type1SP-Type2PS-null-r16         SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
                                OPTIONAL,
type1SP-eType2R1-null-r16        SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
                                OPTIONAL,
type1SP-eType2R2-null-r16        SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
                                OPTIONAL,
type1SP-eType2R1PS-null-r16      SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
                                OPTIONAL,
type1SP-eType2R2PS-null-r16      SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
                                OPTIONAL,
type1SP-Type2-Type2PS-r16        SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
                                OPTIONAL,
type1MP-Type2-null-r16           SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
                                OPTIONAL,
type1MP-Type2PS-null-r16         SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
                                OPTIONAL,
type1MP-eType2R1-null-r16        SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
                                OPTIONAL,
type1MP-eType2R2-null-r16        SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
                                OPTIONAL,
type1MP-eType2R1PS-null-r16      SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
                                OPTIONAL,
type1MP-eType2R2PS-null-r16      SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
                                OPTIONAL,
type1MP-Type2-Type2PS-r16        SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesExt-r16)) OF INTEGER (0..maxNrofCSI-RS-ResourcesAlt-1-r16)
                                OPTIONAL
}

CodebookVariantsList-r16 ::= SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesAlt-r16)) OF SupportedCSI-RS-Resource

SupportedCSI-RS-Resource ::= SEQUENCE {
    maxNumberTxPortsPerResource    ENUMERATED {p2, p4, p8, p12, p16, p24, p32},
    maxNumberResourcesPerBand      INTEGER (1..64),
    totalNumberTxPortsPerBand      INTEGER (2..256)
}

-- TAG-CODEBOOKPARAMETERS-STOP
-- ASN1STOP

```

**CodebookParameters field descriptions****supportedCSI-RS-ResourceListAlt**

This field indicates the alternative list of *SupportedCSI-RS-Resource* supported for each codebook type. The supported CSI-RS resource is indicated by an integer value which pinpoints *SupportedCSI-RS-Resource* defined in *CodebookVariantsList*. The value 0 corresponds to the first entry of *CodebookVariantsList*. The value 1 corresponds to the second entry of *CodebookVariantsList*, and so on. For each codebook type, the field shall be included in both *codebookParametersPerBC* and *codebookParametersPerBand*.

– **FeatureSetCombination**

The IE *FeatureSetCombination* is a two-dimensional matrix of *FeatureSet* entries.

Each *FeatureSetsPerBand* contains a list of feature sets applicable to the carrier(s) of one band entry of the associated band combination. Across the associated bands, the UE shall support the combination of *FeatureSets* at the same position in the *FeatureSetsPerBand*. All *FeatureSetsPerBand* in one *FeatureSetCombination* must have the same number of entries.

The number of *FeatureSetsPerBand* in the *FeatureSetCombination* must be equal to the number of band entries in an associated band combination. The first *FeatureSetPerBand* applies to the first band entry of the band combination, and so on.

Each *FeatureSet* contains either a pair of NR or E-UTRA feature set IDs for UL and DL.

In case of NR, the actual feature sets for UL and DL are defined in the *FeatureSets* IE and referred to from here by their ID, i.e., their position in the *featureSetsUplink* / *featureSetsDownlink* list in the *FeatureSet* IE.

In case of E-UTRA, the feature sets referred to from this list are defined in TS 36.331 [10] and conveyed as part of the *UE-EUTRA-Capability* container.

The *FeatureSetUplink* and *FeatureSetDownlink* referred to from the *FeatureSet* comprise, among other information, a set of *FeatureSetUplinkPerCC-Id:s* and *FeatureSetDownlinkPerCC-Id:s*. The number of these per-CC IDs determines the number of carriers that the UE is able to aggregate contiguously in frequency domain in the corresponding band. The number of carriers supported by the UE is also restricted by the bandwidth class indicated in the associated *BandCombination*, if present.

In feature set combinations the UE shall exclude entries for fallback combinations with same capabilities, since the network may anyway assume that the UE supports those.

NOTE 1: The UE may advertise fallback band-combinations in which it supports additional functionality explicitly in two ways: Either by setting *FeatureSet* IDs to zero (inter-band and intra-band non-contiguous fallback) and by reducing the number of *FeatureSet-PerCC* IDs in a *FeatureSet* (intra-band contiguous fallback). Or by separate *BandCombination* entries with associated *FeatureSetCombinations*.

NOTE 2: The UE may advertise a *FeatureSetCombination* containing only fallback band combinations. That means, in a *FeatureSetCombination*, each group of *FeatureSets* across the bands may contain at least one pair of *FeatureSetUplinkId* and *FeatureSetDownlinkId* which is set to 0/0.

NOTE 3: The Network configures serving cell(s) and BWP(s) configuration to comply with capabilities derived from the combination of *FeatureSets* at the same position in the *FeatureSetsPerBand*, regardless of activated/deactivated serving cell(s) and BWP(s).

**FeatureSetCombination information element**

-- ASN1START

```

-- TAG-FEATURESETCOMBINATION-START
FeatureSetCombination ::=          SEQUENCE (SIZE (1..maxSimultaneousBands)) OF FeatureSetsPerBand
FeatureSetsPerBand ::=            SEQUENCE (SIZE (1..maxFeatureSetsPerBand)) OF FeatureSet
FeatureSet ::=                     CHOICE {
    eutra                           SEQUENCE {
        downlinkSetEUTRA             FeatureSetEUTRA-DownlinkId,
        uplinkSetEUTRA              FeatureSetEUTRA-UplinkId
    },
    nr                               SEQUENCE {
        downlinkSetNR                FeatureSetDownlinkId,
        uplinkSetNR                  FeatureSetUplinkId
    }
}
-- TAG-FEATURESETCOMBINATION-STOP
-- ASN1STOP

```

### – *FeatureSetCombinationId*

The IE *FeatureSetCombinationId* identifies a *FeatureSetCombination*. The *FeatureSetCombinationId* of a *FeatureSetCombination* is the position of the *FeatureSetCombination* in the *featureSetCombinations* list (in *UE-NR-Capability* or *UE-MRDC-Capability*). The *FeatureSetCombinationId* = 0 refers to the first entry in the *featureSetCombinations* list (in *UE-NR-Capability* or *UE-MRDC-Capability*).

NOTE: The *FeatureSetCombinationId* = 1024 is not used due to the maximum entry number of *featureSetCombinations*.

#### ***FeatureSetCombinationId* information element**

```

-- ASN1START
-- TAG-FEATURESETCOMBINATIONID-START
FeatureSetCombinationId ::=        INTEGER (0.. maxFeatureSetCombinations)
-- TAG-FEATURESETCOMBINATIONID-STOP
-- ASN1STOP

```

### – *FeatureSetDownlink*

The IE *FeatureSetDownlink* indicates a set of features that the UE supports on the carriers corresponding to one band entry in a band combination.

#### ***FeatureSetDownlink* information element**

```

-- ASN1START
-- TAG-FEATURESETDOWNLINK-START

```

```

FeatureSetDownlink ::=
  featureSetListPerDownlinkCC
    SEQUENCE {
      SEQUENCE (SIZE (1..maxNrofServingCells)) OF FeatureSetDownlinkPerCC-Id,

      intraBandFreqSeparationDL FreqSeparationClass OPTIONAL,
      scalingFactor ENUMERATED {f0p4, f0p75, f0p8} OPTIONAL,
      crossCarrierScheduling-OtherSCS ENUMERATED {supported} OPTIONAL,
      scellWithoutSSB ENUMERATED {supported} OPTIONAL,
      csi-RS-MeasSCellWithoutSSB ENUMERATED {supported} OPTIONAL,
      dummy1 ENUMERATED {supported} OPTIONAL,
      type1-3-CSS ENUMERATED {supported} OPTIONAL,
      pdcch-MonitoringAnyOccasions ENUMERATED {withoutDCI-Gap, withDCI-Gap} OPTIONAL,
      dummy2 ENUMERATED {supported} OPTIONAL,
      ue-SpecificUL-DL-Assignment ENUMERATED {supported} OPTIONAL,
      searchSpaceSharingCA-DL ENUMERATED {supported} OPTIONAL,
      timeDurationForQCL SEQUENCE {
        scs-60kHz ENUMERATED {s7, s14, s28} OPTIONAL,
        scs-120kHz ENUMERATED {s14, s28} OPTIONAL
      } OPTIONAL,
      pdsch-ProcessingType1-DifferentTB-PerSlot SEQUENCE {
        scs-15kHz ENUMERATED {upto2, upto4, upto7} OPTIONAL,
        scs-30kHz ENUMERATED {upto2, upto4, upto7} OPTIONAL,
        scs-60kHz ENUMERATED {upto2, upto4, upto7} OPTIONAL,
        scs-120kHz ENUMERATED {upto2, upto4, upto7} OPTIONAL
      } OPTIONAL,
      dummy3 DummyA OPTIONAL,
      dummy4 SEQUENCE (SIZE (1.. maxNrofCodebooks)) OF DummyB OPTIONAL,
      dummy5 SEQUENCE (SIZE (1.. maxNrofCodebooks)) OF DummyC OPTIONAL,
      dummy6 SEQUENCE (SIZE (1.. maxNrofCodebooks)) OF DummyD OPTIONAL,
      dummy7 SEQUENCE (SIZE (1.. maxNrofCodebooks)) OF DummyE OPTIONAL
    }

FeatureSetDownlink-v1540 ::= SEQUENCE {
  oneFL-DMRS-TwoAdditionalDMRS-DL ENUMERATED {supported} OPTIONAL,
  additionalDMRS-DL-Alt ENUMERATED {supported} OPTIONAL,
  twoFL-DMRS-TwoAdditionalDMRS-DL ENUMERATED {supported} OPTIONAL,
  oneFL-DMRS-ThreeAdditionalDMRS-DL ENUMERATED {supported} OPTIONAL,
  pdcch-MonitoringAnyOccasionsWithSpanGap SEQUENCE {
    scs-15kHz ENUMERATED {set1, set2, set3} OPTIONAL,
    scs-30kHz ENUMERATED {set1, set2, set3} OPTIONAL,
    scs-60kHz ENUMERATED {set1, set2, set3} OPTIONAL,
    scs-120kHz ENUMERATED {set1, set2, set3} OPTIONAL
  } OPTIONAL,
  pdsch-SeparationWithGap ENUMERATED {supported} OPTIONAL,
  pdsch-ProcessingType2 SEQUENCE {
    scs-15kHz ProcessingParameters OPTIONAL,
    scs-30kHz ProcessingParameters OPTIONAL,
    scs-60kHz ProcessingParameters OPTIONAL
  } OPTIONAL,
  pdsch-ProcessingType2-Limited SEQUENCE {
    differentTB-PerSlot-SCS-30kHz ENUMERATED {upto1, upto2, upto4, upto7}
  } OPTIONAL,
  dl-MCS-TableAlt-DynamicIndication ENUMERATED {supported} OPTIONAL
}

```

```

FeatureSetDownlink-v15a0 ::= SEQUENCE {
    supportedSRS-Resources          SRS-Resources          OPTIONAL
}

FeatureSetDownlink-v1610 ::= SEQUENCE {
    -- R1 22-4e/4f/4g/4h: CBG based reception for DL with unicast PDSCH(s) per slot per CC with UE processing time Capability 1
    cbgPDSCH-ProcessingType1-NumberOfTB-PerSlot SEQUENCE {
        scs-15kHz          ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
        scs-30kHz          ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
        scs-60kHz          ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
        scs-120kHz         ENUMERATED {one, upto2, upto4, upto7} OPTIONAL
    } OPTIONAL,

    -- R1 22-3e/3f/3g/3h: CBG based reception for DL with unicast PDSCH(s) per slot per CC with UE processing time Capability 2
    cbgPDSCH-ProcessingType2-NumberOfTB-PerSlot SEQUENCE {
        scs-15kHz          ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
        scs-30kHz          ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
        scs-60kHz          ENUMERATED {one, upto2, upto4, upto7} OPTIONAL,
        scs-120kHz         ENUMERATED {one, upto2, upto4, upto7} OPTIONAL
    } OPTIONAL,
    intraFreqDAPS-r16 SEQUENCE {
        intraFreqDiffSCS-DAPS-r16          ENUMERATED {supported}          OPTIONAL,
        intraFreqAsyncDAPS-r16             ENUMERATED {supported}          OPTIONAL
    } OPTIONAL,
    intraBandFreqSeparationDL-v1620        FreqSeparationClassDL-v1620      OPTIONAL,
    intraBandFreqSeparationDL-Only-r16     FreqSeparationClassDL-Only-r16  OPTIONAL,

    -- R1 11-2: Rel-16 PDCCH monitoring capability
    pdcch-Monitoring-r16 SEQUENCE {
        pdsch-ProcessingType1-r16 SEQUENCE {
            scs-15kHz-r16          PDCCH-MonitoringOccasions-r16 OPTIONAL,
            scs-30kHz-r16          PDCCH-MonitoringOccasions-r16 OPTIONAL
        } OPTIONAL,
        pdsch-ProcessingType2-r16 SEQUENCE {
            scs-15kHz-r16          PDCCH-MonitoringOccasions-r16 OPTIONAL,
            scs-30kHz-r16          PDCCH-MonitoringOccasions-r16 OPTIONAL
        } OPTIONAL
    } OPTIONAL,

    -- R1 11-2b: Mix of Rel. 16 PDCCH monitoring capability and Rel. 15 PDCCH monitoring capability on different carriers
    pdcch-MonitoringMixed-r16 ENUMERATED {supported}          OPTIONAL,

    -- R1 18-5c: Processing up to X unicast DCI scheduling for DL per scheduled CC
    crossCarrierSchedulingProcessing-DiffSCS-r16 SEQUENCE {
        scs-15kHz-120kHz-r16      ENUMERATED {n1,n2,n4}          OPTIONAL,
        scs-15kHz-60kHz-r16       ENUMERATED {n1,n2,n4}          OPTIONAL,
        scs-30kHz-120kHz-r16      ENUMERATED {n1,n2,n4}          OPTIONAL,
        scs-15kHz-30kHz-r16       ENUMERATED {n2}              OPTIONAL,
        scs-30kHz-60kHz-r16       ENUMERATED {n2}              OPTIONAL,
        scs-60kHz-120kHz-r16      ENUMERATED {n2}              OPTIONAL
    } OPTIONAL,

    -- R1 16-2b-1: Support of single-DCI based SDM scheme
    singleDCI-SDM-scheme-r16      ENUMERATED {supported}          OPTIONAL
}

```

```

}

PDCCH-MonitoringOccasions-r16 ::= SEQUENCE {
    period7span3-r16          ENUMERATED {supported}          OPTIONAL,
    period4span3-r16          ENUMERATED {supported}          OPTIONAL,
    period2span2-r16          ENUMERATED {supported}          OPTIONAL
}

DummyA ::= SEQUENCE {
    maxNumberNZP-CSI-RS-PerCC      INTEGER (1..32),
    maxNumberPortsAcrossNZP-CSI-RS-PerCC  ENUMERATED {p2, p4, p8, p12, p16, p24, p32, p40, p48, p56, p64, p72, p80,
    p88, p96, p104, p112, p120, p128, p136, p144, p152, p160, p168,
    p176, p184, p192, p200, p208, p216, p224, p232, p240, p248, p256},
    maxNumberCS-IM-PerCC          ENUMERATED {n1, n2, n4, n8, n16, n32},
    maxNumberSimultaneousCSI-RS-ActBWP-AllCC  ENUMERATED {n5, n6, n7, n8, n9, n10, n12, n14, n16, n18, n20, n22, n24, n26,
    n28, n30, n32, n34, n36, n38, n40, n42, n44, n46, n48, n50, n52,
    n54, n56, n58, n60, n62, n64},
    totalNumberPortsSimultaneousCSI-RS-ActBWP-AllCC  ENUMERATED {p8, p12, p16, p24, p32, p40, p48, p56, p64, p72, p80,
    p88, p96, p104, p112, p120, p128, p136, p144, p152, p160, p168,
    p176, p184, p192, p200, p208, p216, p224, p232, p240, p248, p256}
}

DummyB ::= SEQUENCE {
    maxNumberTxPortsPerResource    ENUMERATED {p2, p4, p8, p12, p16, p24, p32},
    maxNumberResources             INTEGER (1..64),
    totalNumberTxPorts             INTEGER (2..256),
    supportedCodebookMode          ENUMERATED {mode1, mode1AndMode2},
    maxNumberCSI-RS-PerResourceSet  INTEGER (1..8)
}

DummyC ::= SEQUENCE {
    maxNumberTxPortsPerResource    ENUMERATED {p8, p16, p32},
    maxNumberResources             INTEGER (1..64),
    totalNumberTxPorts             INTEGER (2..256),
    supportedCodebookMode          ENUMERATED {mode1, mode2, both},
    supportedNumberPanels          ENUMERATED {n2, n4},
    maxNumberCSI-RS-PerResourceSet  INTEGER (1..8)
}

DummyD ::= SEQUENCE {
    maxNumberTxPortsPerResource    ENUMERATED {p4, p8, p12, p16, p24, p32},
    maxNumberResources             INTEGER (1..64),
    totalNumberTxPorts             INTEGER (2..256),
    parameterLx                   INTEGER (2..4),
    amplitudeScalingType           ENUMERATED {wideband, widebandAndSubband},
    amplitudeSubsetRestriction     ENUMERATED {supported}          OPTIONAL,
    maxNumberCSI-RS-PerResourceSet  INTEGER (1..8)
}

DummyE ::= SEQUENCE {
    maxNumberTxPortsPerResource    ENUMERATED {p4, p8, p12, p16, p24, p32},
    maxNumberResources             INTEGER (1..64),
    totalNumberTxPorts             INTEGER (2..256),
    parameterLx                   INTEGER (2..4),
}

```



```

    amplitudeScalingType          ENUMERATED {wideband, widebandAndSubband},
    maxNumberCSI-RS-PerResourceSet  INTEGER (1..8)
}

-- TAG-FEATURESETDOWNLINK-STOP
-- ASN1STOP

```

#### **FeatureSetDownlink field descriptions**

##### **crossCarrierScheduling-OtherSCS**

The UE shall set this field to the same value as *crossCarrierScheduling-OtherSCS* in the associated *FeatureSetUplink* (if present).

##### **featureSetListPerDownlinkCC**

Indicates which features the UE supports on the individual DL carriers of the feature set (and hence of a band entry that refer to the feature set). The UE shall hence include at least as many *FeatureSetDownlinkPerCC-Id* in this list as the number of carriers it supports according to the *ca-BandwidthClassDL*, except if indicating additional functionality by reducing the number of *FeatureSetDownlinkPerCC-Id* in the feature set (see NOTE 1 in *FeatureSetCombination* IE description). The order of the elements in this list is not relevant, i.e., the network may configure any of the carriers in accordance with any of the *FeatureSetDownlinkPerCC-Id* in this list.

##### **supportedSRS-Resources**

Indicates supported SRS resources for SRS carrier switching to the band associated with this *FeatureSetDownlink*. The UE is only allowed to set this field for a band with associated *FeatureSetUplinkId* set to 0.

#### – *FeatureSetDownlinkId*

The IE *FeatureSetDownlinkId* identifies a downlink feature set. The *FeatureSetDownlinkId* of a *FeatureSetDownlink* is the index position of the *FeatureSetDownlink* in the *featureSetsDownlink* list in the *FeatureSets* IE. The first element in that list is referred to by *FeatureSetDownlinkId* = 1. The *FeatureSetDownlinkId*=0 is not used by an actual *FeatureSetDownlink* but means that the UE does not support a carrier in this band of a band combination.

#### **FeatureSetDownlinkId information element**

```

-- ASN1START
-- TAG-FEATURESETDOWNLINKID-START

FeatureSetDownlinkId ::=          INTEGER (0..maxDownlinkFeatureSets)

-- TAG-FEATURESETDOWNLINKID-STOP
-- ASN1STOP

```

#### – *FeatureSetDownlinkPerCC*

The IE *FeatureSetDownlinkPerCC* indicates a set of features that the UE supports on the corresponding carrier of one band entry of a band combination.

#### **FeatureSetDownlinkPerCC information element**

```

-- ASN1START
-- TAG-FEATURESETDOWNLINKPERCC-START

```

```

FeatureSetDownlinkPerCC ::= SEQUENCE {
    supportedSubcarrierSpacingDL SubcarrierSpacing,
    supportedBandwidthDL SupportedBandwidth,
    channelBW-90mhz ENUMERATED {supported} OPTIONAL,
    maxNumberMIMO-LayersPDSCH MIMO-LayersDL OPTIONAL,
    supportedModulationOrderDL ModulationOrder OPTIONAL
}

FeatureSetDownlinkPerCC-v1620 ::= SEQUENCE {
    -- R1 16-2a: Multi-DCI based multi-TRP
    multiDCI-MultiTRP-r16 MultiDCI-MultiTRP-r16 OPTIONAL,
    -- R1 16-2b-3: Support of single-DCI based FDMSchemeB
    supportFDM-SchemeB-r16 ENUMERATED {supported} OPTIONAL
}

MultiDCI-MultiTRP-r16 ::= SEQUENCE {
    maxNumberCORESET-r16 ENUMERATED {n2, n3, n4, n5},
    maxNumberCORESETPerPoolIndex-r16 INTEGER (1..3),
    maxNumberUnicastPDSCH-PerPool-r16 ENUMERATED {n1, n2, n3, n4, n7}
}

-- TAG-FEATURESETDOWNLINKPERCC-STOP
-- ASN1STOP

```

### – *FeatureSetDownlinkPerCC-Id*

The IE *FeatureSetDownlinkPerCC-Id* identifies a set of features applicable to one carrier of a feature set. The *FeatureSetDownlinkPerCC-Id* of a *FeatureSetDownlinkPerCC* is the index position of the *FeatureSetDownlinkPerCC* in the *featureSetsDownlinkPerCC*. The first element in the list is referred to by *FeatureSetDownlinkPerCC-Id = 1*, and so on.

#### ***FeatureSetDownlinkPerCC-Id* information element**

```

-- ASN1START
-- TAG-FEATURESETDOWNLINKPERCC-ID-START

FeatureSetDownlinkPerCC-Id ::= INTEGER (1..maxPerCC-FeatureSets)

-- TAG-FEATURESETDOWNLINKPERCC-ID-STOP
-- ASN1STOP

```

### – *FeatureSetEUTRA-DownlinkId*

The IE *FeatureSetEUTRA-DownlinkId* identifies a downlink feature set in E-UTRA list (see TS 36.331 [10]). The first element in that list is referred to by *FeatureSetEUTRA-DownlinkId = 1*. The *FeatureSetEUTRA-DownlinkId=0* is used when the UE does not support a carrier in this band of a band combination.

**FeatureSetEUTRA-DownlinkId information element**

```

-- ASN1START
-- TAG-FEATURESETEUTRADOWNLINKID-START

FeatureSetEUTRA-DownlinkId ::=      INTEGER (0..maxEUTRA-DL-FeatureSets)

-- TAG-FEATURESETEUTRADOWNLINKID-STOP
-- ASN1STOP

```

– **FeatureSetEUTRA-UplinkId**

The IE *FeatureSetEUTRA-UplinkId* identifies an uplink feature set in E-UTRA list (see TS 36.331 [10]). The first element in that list is referred to by *FeatureSetEUTRA-UplinkId* = 1. The *FeatureSetEUTRA-UplinkId* = 0 is used when the UE does not support a carrier in this band of a band combination.

**FeatureSetEUTRA-UplinkId information element**

```

-- ASN1START
-- TAG-FEATURESETEUTRAUPLINKID-START

FeatureSetEUTRA-UplinkId ::=      INTEGER (0..maxEUTRA-UL-FeatureSets)

-- TAG-FEATURESETEUTRAUPLINKID-STOP
-- ASN1STOP

```

– **FeatureSets**

The IE *FeatureSets* is used to provide pools of downlink and uplink features sets. A *FeatureSetCombination* refers to the IDs of the feature set(s) that the UE supports in that *FeatureSetCombination*. The *BandCombination* entries in the *BandCombinationList* then indicate the ID of the *FeatureSetCombination* that the UE supports for that band combination.

The entries in the lists in this IE are identified by their index position. For example, the *FeatureSetUplinkPerCC-Id* = 4 identifies the 4<sup>th</sup> element in the *featureSetsUplinkPerCC* list.

NOTE: When feature sets (per CC) IEs require extension in future versions of the specification, new versions of the *FeatureSetDownlink*, *FeatureSetUplink*, *FeatureSets*, *FeatureSetDownlinkPerCC* and/or *FeatureSetUplinkPerCC* will be created and instantiated in corresponding new lists in the *FeatureSets* IE. For example, if new capability bits are to be added to the *FeatureSetDownlink*, they will instead be defined in a new *FeatureSetDownlink-rxy* which will be instantiated in a new *featureSetDownlinkList-rxy* list. If a UE indicates in a *FeatureSetCombination* that it supports the *FeatureSetDownlink* with ID #5, it implies that it supports both the features in *FeatureSetDownlink* #5 and *FeatureSetDownlink-rxy* #5 (if present). The number of entries in the new list(s) shall be the same as in the original list(s).

**FeatureSets information element**

```

-- ASN1START

```

```

-- TAG-FEATURESETS-START
FeatureSets ::= SEQUENCE {
    featureSetsDownlink          SEQUENCE (SIZE (1..maxDownlinkFeatureSets)) OF FeatureSetDownlink          OPTIONAL,
    featureSetsDownlinkPerCC     SEQUENCE (SIZE (1..maxPerCC-FeatureSets)) OF FeatureSetDownlinkPerCC     OPTIONAL,
    featureSetsUplink            SEQUENCE (SIZE (1..maxUplinkFeatureSets)) OF FeatureSetUplink            OPTIONAL,
    featureSetsUplinkPerCC       SEQUENCE (SIZE (1..maxPerCC-FeatureSets)) OF FeatureSetUplinkPerCC       OPTIONAL,
    ...,
    [[
    featureSetsDownlink-v1540     SEQUENCE (SIZE (1..maxDownlinkFeatureSets)) OF FeatureSetDownlink-v1540     OPTIONAL,
    featureSetsUplink-v1540       SEQUENCE (SIZE (1..maxUplinkFeatureSets)) OF FeatureSetUplink-v1540       OPTIONAL,
    featureSetsUplinkPerCC-v1540  SEQUENCE (SIZE (1..maxPerCC-FeatureSets)) OF FeatureSetUplinkPerCC-v1540  OPTIONAL
    ]],
    [[
    featureSetsDownlink-v15a0     SEQUENCE (SIZE (1..maxDownlinkFeatureSets)) OF FeatureSetDownlink-v15a0     OPTIONAL
    ]],
    [[
    featureSetsDownlink-v1610     SEQUENCE (SIZE (1..maxDownlinkFeatureSets)) OF FeatureSetDownlink-v1610     OPTIONAL,
    featureSetsUplink-v1610       SEQUENCE (SIZE (1..maxUplinkFeatureSets)) OF FeatureSetUplink-v1610       OPTIONAL,
    featureSetDownlinkPerCC-v1620 SEQUENCE (SIZE (1..maxPerCC-FeatureSets)) OF FeatureSetDownlinkPerCC-v1620  OPTIONAL
    ]]
}
-- TAG-FEATURESETS-STOP
-- ASN1STOP

```

## – FeatureSetUplink

The IE *FeatureSetUplink* is used to indicate the features that the UE supports on the carriers corresponding to one band entry in a band combination.

### FeatureSetUplink information element

```

-- ASN1START
-- TAG-FEATURESETUPLINK-START
FeatureSetUplink ::= SEQUENCE {
    featureSetListPerUplinkCC     SEQUENCE (SIZE (1..maxNrofServingCells)) OF FeatureSetUplinkPerCC-Id,
    scalingFactor                 ENUMERATED {f0p4, f0p75, f0p8}                                OPTIONAL,
    crossCarrierScheduling-OtherSCS ENUMERATED {supported}                                OPTIONAL,
    intraBandFreqSeparationUL     FreqSeparationClass                                    OPTIONAL,
    searchSpaceSharingCA-UL       ENUMERATED {supported}                                OPTIONAL,
    dummy1                        DummyI                                                OPTIONAL,
    supportedSRS-Resources        SRS-Resources                                        OPTIONAL,
    twoPUCCH-Group                ENUMERATED {supported}                                OPTIONAL,
    dynamicSwitchSUL              ENUMERATED {supported}                                OPTIONAL,
    simultaneousTxSUL-NonSUL      ENUMERATED {supported}                                OPTIONAL,
    pusch-ProcessingType1-DifferentTB-PerSlot SEQUENCE {
        scs-15kHz                 ENUMERATED {upto2, upto4, upto7}                                OPTIONAL,
        scs-30kHz                 ENUMERATED {upto2, upto4, upto7}                                OPTIONAL,
        scs-60kHz                 ENUMERATED {upto2, upto4, upto7}                                OPTIONAL,
        scs-120kHz                ENUMERATED {upto2, upto4, upto7}                                OPTIONAL
    }
}
-- ASN1STOP

```

```

    }
    dummy2                DummyF                OPTIONAL,
    }                    OPTIONAL

FeatureSetUplink-v1540 ::= SEQUENCE {
    zeroSlotOffsetAperiodicSRS    ENUMERATED {supported}    OPTIONAL,
    pa-PhaseDiscontinuityImpacts  ENUMERATED {supported}    OPTIONAL,
    pusch-SeparationWithGap        ENUMERATED {supported}    OPTIONAL,
    pusch-ProcessingType2          SEQUENCE {
        scs-15kHz                  ProcessingParameters    OPTIONAL,
        scs-30kHz                  ProcessingParameters    OPTIONAL,
        scs-60kHz                  ProcessingParameters    OPTIONAL
    }    OPTIONAL,
    ul-MCS-TableAlt-DynamicIndication  ENUMERATED {supported}    OPTIONAL
}

FeatureSetUplink-v1610 ::= SEQUENCE {
    -- R1 11-5: PUSCH repetition Type B
    pusch-RepetitionTypeB-r16      SEQUENCE {
        maxNumberPUSCH-Tx-r16      ENUMERATED {n2, n3, n4, n7, n8, n12},
        hoppingScheme-r16          ENUMERATED {interSlotHopping, interRepetitionHopping, both}
    }    OPTIONAL,
    -- R1 11-7: UL cancelation scheme for self-carrier
    ul-CancellationSelfCarrier-r16  ENUMERATED {supported}    OPTIONAL,
    -- R1 11-7a: UL cancelation scheme for cross-carrier
    ul-CancellationCrossCarrier-r16  ENUMERATED {supported}    OPTIONAL,
    -- R1 16-5c: The maximum number of SRS resources in one SRS resource set with usage set to 'codebook' for Mode 2
    ul-FullPwrMode2-MaxSRS-ResInSet  ENUMERATED {n1, n2, n4}    OPTIONAL

    -- R1 22-4a/4b/4c/4d: CBG based transmission for UL with unicast PUSCH(s) per slot per CC with UE processing time Capability 1
    cbgPUSCH-ProcessingType1-DifferentTB-PerSlot SEQUENCE {
        scs-15kHz    ENUMERATED {one-pusch, upto2, upto4, upto7}    OPTIONAL,
        scs-30kHz    ENUMERATED {one-pusch, upto2, upto4, upto7}    OPTIONAL,
        scs-60kHz    ENUMERATED {one-pusch, upto2, upto4, upto7}    OPTIONAL,
        scs-120kHz   ENUMERATED {one-pusch, upto2, upto4, upto7}    OPTIONAL
    }    OPTIONAL,

    -- R1 22-3a/3b/3c/3d: CBG based transmission for UL with unicast PUSCH(s) per slot per CC with UE processing time Capability 2
    cbgPUSCH-ProcessingType2-DifferentTB-PerSlot SEQUENCE {
        scs-15kHz    ENUMERATED {one-pusch, upto2, upto4, upto7}    OPTIONAL,
        scs-30kHz    ENUMERATED {one-pusch, upto2, upto4, upto7}    OPTIONAL,
        scs-60kHz    ENUMERATED {one-pusch, upto2, upto4, upto7}    OPTIONAL,
        scs-120kHz   ENUMERATED {one-pusch, upto2, upto4, upto7}    OPTIONAL
    }    OPTIONAL,
    supportedSRS-PosResources-r16      SRS-AllPosResources-r16    OPTIONAL,
    intraFreqDAPS-UL-r16              SEQUENCE {
        intraFreqMultiUL-TransmissionDAPS-r16    ENUMERATED {supported}    OPTIONAL,
        intraFreqTwoTAGs-DAPS-r16                ENUMERATED {supported}    OPTIONAL,
        intraFreqSemiStaticPowerSharingDAPS-Model-r16  ENUMERATED {supported}    OPTIONAL,
        intraFreqSemiStaticPowerSharingDAPS-Mode2-r16  ENUMERATED {supported}    OPTIONAL,
        intraFreqDynamicPowerSharingDAPS-r16          ENUMERATED {short, long}    OPTIONAL
    }    OPTIONAL,
    intraBandFreqSeparationUL-v1620    FreqSeparationClassUL-v1620    OPTIONAL,

```

```

-- R1 11-3: More than one PUCCH for HARQ-ACK transmission within a slot
multiPUCCH-r16          SEQUENCE {
    sub-SlotConfig-NCP-r16      ENUMERATED {set1, set2}          OPTIONAL,
    sub-SlotConfig-ECP-r16      ENUMERATED {set1, set2}          OPTIONAL,
}
-- R1 11-3c: 2 PUCCH of format 0 or 2 for a single 7*2-symbol subslot based HARQ-ACK codebook
twoPUCCH-Type1-r16      ENUMERATED {supported}                OPTIONAL,
-- R1 11-3d: 2 PUCCH of format 0 or 2 for a single 2*7-symbol subslot based HARQ-ACK codebook
twoPUCCH-Type2-r16      ENUMERATED {supported}                OPTIONAL,
-- R1 11-3e: 1 PUCCH format 0 or 2 and 1 PUCCH format 1, 3 or 4 in the same subslot for a single 2*7-symbol HARQ-ACK codebooks
twoPUCCH-Type3-r16      ENUMERATED {supported}                OPTIONAL,
-- R1 11-3f: 2 PUCCH transmissions in the same subslot for a single 2*7-symbol HARQ-ACK codebooks which are not covered by 11-3d and
-- 11-3e
twoPUCCH-Type4-r16      ENUMERATED {supported}                OPTIONAL,
-- R1 11-3g: SR/HARQ-ACK multiplexing at most once per subslot using a PUCCH (or HARQ-ACK piggybacked on a PUSCH) when SR/HARQ-ACK
-- are supposed to be sent with different starting symbols in a subslot
mux-SR-HARQ-ACK-r16     ENUMERATED {supported}                OPTIONAL,
-- R1 11-4: Two HARQ-ACK codebooks with up to one sub-slot based HARQ-ACK codebook (i.e. slot-based + slot-based, or slot-based +
-- sub-slot based) simultaneously constructed for supporting HARQ-ACK codebooks with different priorities at a UE
twoHARQ-ACK-Codebook-type1-r16  ENUMERATED {supported}          OPTIONAL,
-- R1 11-4a: Two sub-slot based HARQ-ACK codebooks simultaneously constructed for supporting HARQ-ACK codebooks with different
-- priorities at a UE
twoHARQ-ACK-Codebook-type2-r16  ENUMERATED {supported}          OPTIONAL,
-- R1 11-4c: 2 PUCCH of format 0 or 2 for two HARQ-ACK codebooks with one 7*2-symbol sub-slot based HARQ-ACK codebook
twoPUCCH-Type5-r16      ENUMERATED {supported}                OPTIONAL,
-- R1 11-4d: 2 PUCCH of format 0 or 2 in consecutive symbols for two HARQ-ACK codebooks with one 2*7-symbol sub-slot based HARQ-ACK
-- codebook
twoPUCCH-Type6-r16      ENUMERATED {supported}                OPTIONAL,
-- R1 11-4e: 2 PUCCH of format 0 or 2 for two subslot based HARQ-ACK codebooks
twoPUCCH-Type7-r16      ENUMERATED {supported}                OPTIONAL,
-- R1 11-4f: 1 PUCCH format 0 or 2 and 1 PUCCH format 1, 3 or 4 in the same subslot for HARQ-ACK codebooks with one 2*7-symbol
-- subslot based HARQ-ACK codebook
twoPUCCH-Type8-r16      ENUMERATED {supported}                OPTIONAL,
-- R1 11-4g: 1 PUCCH format 0 or 2 and 1 PUCCH format 1, 3 or 4 in the same subslot for two subslot based HARQ-ACK codebooks
twoPUCCH-Type9-r16      ENUMERATED {supported}                OPTIONAL,
-- R1 11-4h: 2 PUCCH transmissions in the same subslot for two HARQ-ACK codebooks with one 2*7-symbol subslot which are not covered
-- by 11-4c and 11-4e
twoPUCCH-Type10-r16     ENUMERATED {supported}                OPTIONAL,
-- R1 11-4i: 2 PUCCH transmissions in the same subslot for two subslot based HARQ-ACK codebooks which are not covered by 11-4d and
-- 11-4f
twoPUCCH-Type11-r16     ENUMERATED {supported}                OPTIONAL,
-- R1 12-1: UL intra-UE multiplexing/prioritization of overlapping channel/signals with two priority levels in physical layer
ul-IntraUE-Mux-r16      SEQUENCE {
    puschedPreparationLowPriority-r16  ENUMERATED {sym0, sym1, sym2},
    puschedPreparationHighPriority-r16  ENUMERATED {sym0, sym1, sym2}
}
-- R1 16-5a: Supported UL full power transmission mode of fullpower
ul-FullPwrMode-r16      ENUMERATED {supported}                OPTIONAL,
-- R1 18-5d: Processing up to X unicast DCI scheduling for UL per scheduled CC
crossCarrierSchedulingProcessing-DiffSCS-r16  SEQUENCE {
    scs-15kHz-120kHz-r16      ENUMERATED {n1,n2,n4}          OPTIONAL,
    scs-15kHz-60kHz-r16       ENUMERATED {n1,n2,n4}          OPTIONAL,
    scs-30kHz-120kHz-r16      ENUMERATED {n1,n2,n4}          OPTIONAL,
    scs-15kHz-30kHz-r16       ENUMERATED {n2}                OPTIONAL,
}

```

```

    scs-30kHz-60kHz-r16          ENUMERATED {n2}          OPTIONAL,
    scs-60kHz-120kHz-r16        ENUMERATED {n2}          OPTIONAL,
  }
-- R1 16-5b: Supported UL full power transmission mode of fullpowerMode1
ul-FullPwrMode1-r16            ENUMERATED {supported}    OPTIONAL,
-- R1 16-5c-2: Ports configuration for Mode 2
ul-FullPwrMode2-SRSConfig-diffNumSRSPorts-r16  ENUMERATED {p1-2, p1-4, p1-2-4} OPTIONAL,
-- R1 16-5c-3: TPMI group for Mode 2
ul-FullPwrMode2-TPMIGroup-r16  SEQUENCE {
  twoPorts-r16                 BIT STRING(SIZE(2))      OPTIONAL,
  fourPortsNonCoherent-r16     ENUMERATED{g0, g1, g2, g3}    OPTIONAL,
  fourPortsPartialCoherent-r16 ENUMERATED{g0, g1, g2, g3, g4, g5, g6} OPTIONAL
}
}

SRS-AllPosResources-r16 ::= SEQUENCE {
  srs-PosResources-r16        SRS-PosResources-r16,
  srs-PosResourceAP-r16       SRS-PosResourceAP-r16    OPTIONAL,
  srs-PosResourceSP-r16       SRS-PosResourceSP-r16    OPTIONAL
}

SRS-PosResources-r16 ::= SEQUENCE {
  maxNumberSRS-PosResourceSetPerBWP-r16  ENUMERATED {n1, n2, n4, n8, n12, n16},
  maxNumberSRS-PosResourcesPerBWP-r16    ENUMERATED {n1, n2, n4, n8, n16, n32, n64},
  maxNumberSRS-ResourcesPerBWP-PerSlot-r16  ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10, n12, n14},
  maxNumberPeriodicSRS-PosResourcesPerBWP-r16  ENUMERATED {n1, n2, n4, n8, n16, n32, n64},
  maxNumberPeriodicSRS-PosResourcesPerBWP-PerSlot-r16  ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10, n12, n14}
}

SRS-PosResourceAP-r16 ::= SEQUENCE {
  maxNumberAP-SRS-PosResourcesPerBWP-r16  ENUMERATED {n1, n2, n4, n8, n16, n32, n64},
  maxNumberAP-SRS-PosResourcesPerBWP-PerSlot-r16  ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10, n12, n14}
}

SRS-PosResourceSP-r16 ::= SEQUENCE {
  maxNumberSP-SRS-PosResourcesPerBWP-r16  ENUMERATED {n1, n2, n4, n8, n16, n32, n64},
  maxNumberSP-SRS-PosResourcesPerBWP-PerSlot-r16  ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10, n12, n14}
}

SRS-Resources ::= SEQUENCE {
  maxNumberAperiodicSRS-PerBWP          ENUMERATED {n1, n2, n4, n8, n16},
  maxNumberAperiodicSRS-PerBWP-PerSlot  INTEGER (1..6),
  maxNumberPeriodicSRS-PerBWP          ENUMERATED {n1, n2, n4, n8, n16},
  maxNumberPeriodicSRS-PerBWP-PerSlot  INTEGER (1..6),
  maxNumberSemiPersistentSRS-PerBWP    ENUMERATED {n1, n2, n4, n8, n16},
  maxNumberSemiPersistentSRS-PerBWP-PerSlot  INTEGER (1..6),
  maxNumberSRS-Ports-PerResource       ENUMERATED {n1, n2, n4}
}

DummyF ::= SEQUENCE {
  maxNumberPeriodicCSI-ReportPerBWP    INTEGER (1..4),
  maxNumberAperiodicCSI-ReportPerBWP   INTEGER (1..4),
  maxNumberSemiPersistentCSI-ReportPerBWP  INTEGER (0..4),
  simultaneousCSI-ReportsAllCC         INTEGER (5..32)
}

```

```

}
-- TAG-FEATURESETUPLINK-STOP
-- ASN1STOP

```

#### **FeatureSetUplink field descriptions**

##### **crossCarrierScheduling-OtherSCS**

The UE shall set this field to the same value as *crossCarrierScheduling-OtherSCS* in the associated *FeatureSetDownlink* (if present).

##### **featureSetListPerUplinkCC**

Indicates which features the UE supports on the individual UL carriers of the feature set (and hence of a band entry that refers to the feature set). The UE shall hence include at least as many *FeatureSetUplinkPerCC-Id* in this list as the number of carriers it supports according to the *ca-BandwidthClassUL*, except if indicating additional functionality by reducing the number of *FeatureSetUplinkPerCC-Id* in the feature set (see NOTE 1 in *FeatureSetCombination* IE description). The order of the elements in this list is not relevant, i.e., the network may configure any of the carriers in accordance with any of the *FeatureSetUplinkPerCC-Id* in this list.

## – *FeatureSetUplinkId*

The IE *FeatureSetUplinkId* identifies an uplink feature set. The *FeatureSetUplinkId* of a *FeatureSetUplink* is the index position of the *FeatureSetUplink* in the *featureSetsUplink* list in the *FeatureSets* IE. The first element in the list is referred to by *FeatureSetUplinkId* = 1, and so on. The *FeatureSetUplinkId* = 0 is not used by an actual *FeatureSetUplink* but means that the UE does not support a carrier in this band of a band combination.

#### **FeatureSetUplinkId information element**

```

-- ASN1START
-- TAG-FEATURESETUPLINKID-START

FeatureSetUplinkId ::=
    INTEGER (0..maxUplinkFeatureSets)

-- TAG-FEATURESETUPLINKID-STOP
-- ASN1STOP

```

## – *FeatureSetUplinkPerCC*

The IE *FeatureSetUplinkPerCC* indicates a set of features that the UE supports on the corresponding carrier of one band entry of a band combination.

#### **FeatureSetUplinkPerCC information element**

```

-- ASN1START
-- TAG-FEATURESETUPLINKPERCC-START

FeatureSetUplinkPerCC ::=
    supportedSubcarrierSpacingUL
    supportedBandwidthUL
    channelBW-90mhz
    mimo-CB-PUSCH
    maxNumberMIMO-LayersCB-PUSCH
    SEQUENCE {
        SubcarrierSpacing,
        SupportedBandwidth,
        ENUMERATED {supported}
        SEQUENCE {
            MIMO-LayersUL
        }
    }
    OPTIONAL,
    OPTIONAL,

```



```

        maxNumberSRS-ResourcePerSet          INTEGER (1..2)
    }
    maxNumberMIMO-LayersNonCB-PUSCH          MIMO-LayersUL
    supportedModulationOrderUL               ModulationOrder
}
FeatureSetUplinkPerCC-v1540 ::= SEQUENCE {
    mimo-NonCB-PUSCH                      SEQUENCE {
        maxNumberSRS-ResourcePerSet      INTEGER (1..4),
        maxNumberSimultaneousSRS-ResourceTx  INTEGER (1..4)
    } OPTIONAL
}
-- TAG-FEATURESETUPLINKPERCC-STOP
-- ASN1STOP

```

### – *FeatureSetUplinkPerCC-Id*

The IE *FeatureSetUplinkPerCC-Id* identifies a set of features applicable to one carrier of a feature set. The *FeatureSetUplinkPerCC-Id* of a *FeatureSetUplinkPerCC* is the index position of the *FeatureSetUplinkPerCC* in the *featureSetsUplinkPerCC*. The first element in the list is referred to by *FeatureSetUplinkPerCC-Id* = 1, and so on.

#### ***FeatureSetUplinkPerCC-Id* information element**

```

-- ASN1START
-- TAG-FEATURESETUPLINKPERCC-ID-START
FeatureSetUplinkPerCC-Id ::= INTEGER (1..maxPerCC-FeatureSets)
-- TAG-FEATURESETUPLINKPERCC-ID-STOP
-- ASN1STOP

```

### – *FreqBandIndicatorEUTRA*

```

-- ASN1START
-- TAG-FREQBANDINDICATOREUTRA-START
FreqBandIndicatorEUTRA ::= INTEGER (1..maxBandsEUTRA)
-- TAG-FREQBANDINDICATOREUTRA-STOP
-- ASN1STOP

```

### – *FreqBandList*

The IE *FreqBandList* is used by the network to request NR CA, NR non-CA and/or MR-DC band combinations for specific NR and/or E-UTRA frequency bands and/or up to a specific number of carriers and/or up to specific aggregated bandwidth. This is also used to request feature sets (for NR) and feature set combinations (for NR and MR-DC).

***FreqBandList* information element**

```

-- ASN1START
-- TAG-FREQBANDLIST-START

FreqBandList ::=                               SEQUENCE (SIZE (1..maxBandsMRDC)) OF FreqBandInformation

FreqBandInformation ::=                       CHOICE {
    bandInformationEUTRA                       FreqBandInformationEUTRA,
    bandInformationNR                           FreqBandInformationNR
}

FreqBandInformationEUTRA ::=                  SEQUENCE {
    bandEUTRA                                   FreqBandIndicatorEUTRA,
    ca-BandwidthClassDL-EUTRA                  CA-BandwidthClassEUTRA                               OPTIONAL,    -- Need N
    ca-BandwidthClassUL-EUTRA                  CA-BandwidthClassEUTRA                               OPTIONAL,    -- Need N
}

FreqBandInformationNR ::=                     SEQUENCE {
    bandNR                                       FreqBandIndicatorNR,
    maxBandwidthRequestedDL                     AggregatedBandwidth                               OPTIONAL,    -- Need N
    maxBandwidthRequestedUL                     AggregatedBandwidth                               OPTIONAL,    -- Need N
    maxCarriersRequestedDL                       INTEGER (1..maxNrofServingCells)                   OPTIONAL,    -- Need N
    maxCarriersRequestedUL                       INTEGER (1..maxNrofServingCells)                   OPTIONAL,    -- Need N
}

AggregatedBandwidth ::=                       ENUMERATED {mhz50, mhz100, mhz150, mhz200, mhz250, mhz300, mhz350,
    mhz400, mhz450, mhz500, mhz550, mhz600, mhz650, mhz700, mhz750, mhz800}

-- TAG-FREQBANDLIST-STOP
-- ASN1STOP

```

***FreqSeparationClass***

The IE *FreqSeparationClass* is used for an intra-band non-contiguous CA band combination to indicate frequency separation between lower edge of lowest CC and upper edge of highest CC in a frequency band.

***FreqSeparationClass* information element**

```

-- ASN1START
-- TAG-FREQSEPARATIONCLASS-START

FreqSeparationClass ::= ENUMERATED { mhz800, mhz1200, mhz1400, ... }

FreqSeparationClassDL-v1620 ::= ENUMERATED {mhz1000, mhz1600, mhz1800, mhz2000, mhz2200, mhz2400}

FreqSeparationClassUL-v1620 ::= ENUMERATED {mhz1000}

-- TAG-FREQSEPARATIONCLASS-STOP
-- ASN1STOP

```

### – *FreqSeparationClassDL-Only*

The IE *FreqSeparationClassDL-Only* is used to indicate the frequency separation between lower edge of lowest CC and upper edge of highest CC of DL only frequency spectrum in a frequency band.

#### ***FreqSeparationClassDL-Only* information element**

```
-- ASN1START
-- TAG-FREQSEPARATIONCLASSDL-Only-START

FreqSeparationClassDL-Only-r16 ::= ENUMERATED {mhz200, mhz400, mhz600, mhz800, mhz1000, mhz1200}

-- TAG-FREQSEPARATIONCLASSDL-Only-STOP
-- ASN1STOP
```

### – *HighSpeedParameters*

The IE *HighSpeedParameters* is used to convey capabilities related to high speed scenarios.

#### ***HighSpeedParameters* information element**

```
-- ASN1START
-- TAG-HIGHSPEEDPARAMETERS-START

HighSpeedParameters-r16 ::= SEQUENCE {
    measurementEnhancement-r16      ENUMERATED {supported}    OPTIONAL,
    demodulationEnhancement-r16     ENUMERATED {supported}    OPTIONAL
}

-- TAG-HIGHSPEEDPARAMETERS-STOP
-- ASN1STOP
```

### – *IMS-Parameters*

The IE *IMS-Parameters* is used to convey capabilities related to IMS.

#### ***IMS-Parameters* information element**

```
-- ASN1START
-- TAG-IMS-PARAMETERS-START

IMS-Parameters ::= SEQUENCE {
    ims-ParametersCommon            IMS-ParametersCommon    OPTIONAL,

```

```

ims-ParametersFRX-Diff      IMS-ParametersFRX-Diff      OPTIONAL,
...
}

IMS-ParametersCommon ::= SEQUENCE {
  voiceOverEUTRA-5GC        ENUMERATED {supported}      OPTIONAL,
  ...,
  [[
  voiceOverSCG-BearerEUTRA-5GC  ENUMERATED {supported}  OPTIONAL
  ]],
  [[
  voiceFallbackIndicationEPS-r16  ENUMERATED {supported}  OPTIONAL
  ]]
}

IMS-ParametersFRX-Diff ::= SEQUENCE {
  voiceOverNR                ENUMERATED {supported}      OPTIONAL,
  ...
}

-- TAG-IMS-PARAMETERS-STOP
-- ASN1STOP

```

## – InterRAT-Parameters

The IE *InterRAT-Parameters* is used convey UE capabilities related to the other RATs.

### *InterRAT-Parameters* information element

```

-- ASN1START
-- TAG-INTERRAT-PARAMETERS-START

InterRAT-Parameters ::= SEQUENCE {
  eutra                EUTRA-Parameters      OPTIONAL,
  ...,
  [[
  utra-FDD-r16        UTRA-FDD-Parameters-r16  OPTIONAL
  ]]
}

EUTRA-Parameters ::= SEQUENCE {
  supportedBandListEUTRA SEQUENCE (SIZE (1..maxBandsEUTRA)) OF FreqBandIndicatorEUTRA,
  eutra-ParametersCommon EUTRA-ParametersCommon      OPTIONAL,
  eutra-ParametersXDD-Diff EUTRA-ParametersXDD-Diff    OPTIONAL,
  ...
}

EUTRA-ParametersCommon ::= SEQUENCE {
  mfb-EUTRA            ENUMERATED {supported}      OPTIONAL,
  modifiedMPR-BehaviorEUTRA BIT STRING (SIZE (32))  OPTIONAL,

```

```

multiNS-Pmax-EUTRA          ENUMERATED {supported}          OPTIONAL,
rs-SINR-MeasEUTRA          ENUMERATED {supported}          OPTIONAL,
...
[[
ne-DC                      ENUMERATED {supported}          OPTIONAL
]],
[[
nr-HO-ToEN-DC-r16         ENUMERATED {supported}          OPTIONAL
]]
}

EUTRA-ParametersXDD-Diff ::= SEQUENCE {
  rsrqMeasWidebandEUTRA   ENUMERATED {supported}          OPTIONAL,
  ...
}

UTRA-FDD-Parameters-r16 ::= SEQUENCE {
  supportedBandListUTRA-FDD-r16 SEQUENCE (SIZE (1..maxBandsUTRA-FDD-r16)) OF SupportedBandUTRA-FDD-r16,
  ...
}

SupportedBandUTRA-FDD-r16 ::= ENUMERATED {
  bandI, bandII, bandIII, bandIV, bandV, bandVI,
  bandVII, bandVIII, bandIX, bandX, bandXI,
  bandXII, bandXIII, bandXIV, bandXV, bandXVI,
  bandXVII, bandXVIII, bandXIX, bandXX,
  bandXXI, bandXXII, bandXXIII, bandXXIV,
  bandXXV, bandXXVI, bandXXVII, bandXXVIII,
  bandXXIX, bandXXX, bandXXXI, bandXXXII}

-- TAG-INTERRAT-PARAMETERS-STOP
-- ASN1STOP

```

## – MAC-Parameters

The IE *MAC-Parameters* is used to convey capabilities related to MAC.

### MAC-Parameters information element

```

-- ASN1START
-- TAG-MAC-PARAMETERS-START

MAC-Parameters ::= SEQUENCE {
  mac-ParametersCommon    MAC-ParametersCommon    OPTIONAL,
  mac-ParametersXDD-Diff  MAC-ParametersXDD-Diff    OPTIONAL
}

MAC-Parameters-v1610 ::= SEQUENCE {
  mac-ParametersFRX-Diff-r16  MAC-ParametersFRX-Diff-r16  OPTIONAL
}

```

```

MAC-ParametersCommon ::= SEQUENCE {
  lcp-Restriction          ENUMERATED {supported}      OPTIONAL,
  dummy                   ENUMERATED {supported}      OPTIONAL,
  lch-ToSCellRestriction  ENUMERATED {supported}      OPTIONAL,
  ...,
  [[
  recommendedBitRate      ENUMERATED {supported}      OPTIONAL,
  recommendedBitRateQuery ENUMERATED {supported}      OPTIONAL
  ]],
  [[
  recommendedBitRateMultiplier-r16  ENUMERATED {supported}      OPTIONAL,
  preEmptiveBSR-r16                 ENUMERATED {supported}      OPTIONAL,
  autonomousTransmission-r16        ENUMERATED {supported}      OPTIONAL,
  lch-PriorityBasedPrioritization-r16 ENUMERATED {supported}      OPTIONAL,
  lch-ToConfiguredGrantMapping-r16   ENUMERATED {supported}      OPTIONAL,
  lch-ToGrantPriorityRestriction-r16   ENUMERATED {supported}      OPTIONAL,
  singlePHR-P-r16                 ENUMERATED {supported}      OPTIONAL,
  ul-LBT-FailureDetectionRecovery-r16 ENUMERATED {supported}      OPTIONAL,
  -- R4 8-1: MPE
  tdd-MPE-P-MPR-Reporting-r16        ENUMERATED {supported}      OPTIONAL,
  lcid-ExtensionIAB-r16              ENUMERATED {supported}      OPTIONAL
  ]]
}

MAC-ParametersFRX-Diff-r16 ::= SEQUENCE {
  directMCG-SCellActivation-r16      ENUMERATED {supported}      OPTIONAL,
  directMCG-SCellActivationResume-r16 ENUMERATED {supported}      OPTIONAL,
  directSCG-SCellActivation-r16      ENUMERATED {supported}      OPTIONAL,
  directSCG-SCellActivationResume-r16 ENUMERATED {supported}      OPTIONAL,
  -- R1 19-1: DRX Adaptation
  drx-Adaptation-r16 SEQUENCE {
    non-SharedSpectrumChAccess-r16  MinTimeGap-r16      OPTIONAL,
    sharedSpectrumChAccess-r16      MinTimeGap-r16      OPTIONAL
  }
  ...
}

MAC-ParametersXDD-Diff ::= SEQUENCE {
  skipUplinkTxDynamic      ENUMERATED {supported}      OPTIONAL,
  logicalChannelSR-DelayTimer ENUMERATED {supported}      OPTIONAL,
  longDRX-Cycle            ENUMERATED {supported}      OPTIONAL,
  shortDRX-Cycle          ENUMERATED {supported}      OPTIONAL,
  multipleSR-Configurations ENUMERATED {supported}      OPTIONAL,
  multipleConfiguredGrants  ENUMERATED {supported}      OPTIONAL,
  ...,
  [[
  secondaryDRX-Group-r16    ENUMERATED {supported}      OPTIONAL
  ]]
}

MinTimeGap-r16 ::= SEQUENCE {
  scs-15kHz-r16  ENUMERATED {s11, s13}      OPTIONAL,
  scs-30kHz-r16  ENUMERATED {s11, s16}      OPTIONAL,
  scs-60kHz-r16  ENUMERATED {s11, s112}     OPTIONAL,

```

```

    scs-120kHz-r16          ENUMERATED {s12, s124}    OPTIONAL
}
-- TAG-MAC-PARAMETERS-STOP
-- ASN1STOP

```

## – *MeasAndMobParameters*

The IE *MeasAndMobParameters* is used to convey UE capabilities related to measurements for radio resource management (RRM), radio link monitoring (RLM) and mobility (e.g. handover).

### *MeasAndMobParameters* information element

```

-- ASN1START
-- TAG-MEASANDMOBPARAMETERS-START

MeasAndMobParameters ::=
    MeasAndMobParametersCommon
    MeasAndMobParametersXDD-Diff
    MeasAndMobParametersFRX-Diff
}

MeasAndMobParametersCommon ::=
    supportedGapPattern          BIT STRING (SIZE (22))          OPTIONAL,
    ssb-RLM                      ENUMERATED {supported}          OPTIONAL,
    ssb-AndCSI-RS-RLM            ENUMERATED {supported}          OPTIONAL,
    . . . ,
    [[
    eventB-MeasAndReport          ENUMERATED {supported}          OPTIONAL,
    handoverFDD-TDD              ENUMERATED {supported}          OPTIONAL,
    eutra-CGI-Reporting           ENUMERATED {supported}          OPTIONAL,
    nr-CGI-Reporting              ENUMERATED {supported}          OPTIONAL
    ]],
    [[
    independentGapConfig          ENUMERATED {supported}          OPTIONAL,
    periodicEUTRA-MeasAndReport   ENUMERATED {supported}          OPTIONAL,
    handoverFRL-FR2               ENUMERATED {supported}          OPTIONAL,
    maxNumberCSI-RS-RRM-RS-SINR   ENUMERATED {n4, n8, n16, n32, n64, n96}  OPTIONAL
    ]],
    [[
    nr-CGI-Reporting-ENDC         ENUMERATED {supported}          OPTIONAL
    ]],
    [[
    eutra-CGI-Reporting-NEDC      ENUMERATED {supported}          OPTIONAL,
    eutra-CGI-Reporting-NRDC      ENUMERATED {supported}          OPTIONAL,
    nr-CGI-Reporting-NEDC         ENUMERATED {supported}          OPTIONAL,
    nr-CGI-Reporting-NRDC         ENUMERATED {supported}          OPTIONAL
    ]],
    [[
    reportAddNeighMeasForPeriodic-r16  ENUMERATED {supported}          OPTIONAL,
    condHandoverParametersCommon-r16  SEQUENCE {

```

condHandoverFDD-TDD-r16	ENUMERATED {supported}	OPTIONAL,
condHandoverFR1-FR2-r16	ENUMERATED {supported}	OPTIONAL,
}		OPTIONAL,
nr-NeedForGap-Reporting-r16	ENUMERATED {supported}	OPTIONAL,
supportedGapPattern-NRonly-r16	BIT STRING (SIZE (10))	OPTIONAL,
supportedGapPattern-NRonly-NEDC-r16	ENUMERATED {supported}	OPTIONAL,
maxNumberCLI-RSSI-r16	ENUMERATED {n8, n16, n32, n64}	OPTIONAL,
maxNumberCLI-SRS-RSRP-r16	ENUMERATED {n4, n8, n16, n32}	OPTIONAL,
maxNumberPerSlotCLI-SRS-RSRP-r16	ENUMERATED {n2, n4, n8}	OPTIONAL,
mfbI-IAB-r16	ENUMERATED {supported}	OPTIONAL,
multipleNS-And-Pmax-IAB-r16	ENUMERATED {supported}	OPTIONAL,
nr-CGI-Reporting-NPN-r16	ENUMERATED {supported}	OPTIONAL,
idleInactiveEUTRA-MeasReport-r16	ENUMERATED {supported}	OPTIONAL,
idleInactive-ValidityArea-r16	ENUMERATED {supported}	OPTIONAL,
eutra-AutonomousGaps-r16	ENUMERATED {supported}	OPTIONAL,
eutra-AutonomousGaps-NEDC-r16	ENUMERATED {supported}	OPTIONAL,
eutra-AutonomousGaps-NRDC-r16	ENUMERATED {supported}	OPTIONAL,
pCellT312-r16	ENUMERATED {supported}	OPTIONAL,
supportedGapPattern-r16	BIT STRING (SIZE (2))	OPTIONAL
}}		
}		
MeasAndMobParametersXDD-Diff ::=	SEQUENCE {	
intraAndInterF-MeasAndReport	ENUMERATED {supported}	OPTIONAL,
eventA-MeasAndReport	ENUMERATED {supported}	OPTIONAL,
...		
[[		
handoverInterF	ENUMERATED {supported}	OPTIONAL,
handoverLTE-EPC	ENUMERATED {supported}	OPTIONAL,
handoverLTE-5GC	ENUMERATED {supported}	OPTIONAL
]],		
[[		
sftd-MeasNR-Neigh	ENUMERATED {supported}	OPTIONAL,
sftd-MeasNR-Neigh-DRX	ENUMERATED {supported}	OPTIONAL
]],		
[[		
handoverUTRA-FDD-r16	ENUMERATED {supported}	OPTIONAL
]]		
}		
MeasAndMobParametersFRX-Diff ::=	SEQUENCE {	
ss-SINR-Meas	ENUMERATED {supported}	OPTIONAL,
csi-RSRP-AndRSRQ-MeasWithSSB	ENUMERATED {supported}	OPTIONAL,
csi-RSRP-AndRSRQ-MeasWithoutSSB	ENUMERATED {supported}	OPTIONAL,
csi-SINR-Meas	ENUMERATED {supported}	OPTIONAL,
csi-RS-RLM	ENUMERATED {supported}	OPTIONAL,
...		
[[		
handoverInterF	ENUMERATED {supported}	OPTIONAL,
handoverLTE-EPC	ENUMERATED {supported}	OPTIONAL,
handoverLTE-5GC	ENUMERATED {supported}	OPTIONAL
]],		
[[		
maxNumberResource-CI-RS-RLM	ENUMERATED {n2, n4, n6, n8}	OPTIONAL



```

]],
[[
simultaneousRxDataSSB-DiffNumerology      ENUMERATED {supported}          OPTIONAL
]],
[[
nr-AutonomousGaps-r16                      ENUMERATED {supported}          OPTIONAL,
nr-AutonomousGaps-ENDC-r16                 ENUMERATED {supported}          OPTIONAL,
nr-AutonomousGaps-NEDC-r16                 ENUMERATED {supported}          OPTIONAL,
nr-AutonomousGaps-NRDC-r16                 ENUMERATED {supported}          OPTIONAL,
handoverUTRA-FDD-r16                       ENUMERATED {supported}          OPTIONAL,
cli-RSSI-Meas-r16                          ENUMERATED {supported}          OPTIONAL,
cli-SRS-RSRP-Meas-r16                     ENUMERATED {supported}          OPTIONAL,
interFrequencyMeas-Nogap-r16                ENUMERATED {supported}          OPTIONAL,
simultaneousRxDataSSB-DiffNumerology-Inter-r16  ENUMERATED {supported}          OPTIONAL,
idleInactiveNR-MeasReport-r16              ENUMERATED {supported}          OPTIONAL,
-- R4 6-2: Support of beam level Early Measurement Reporting
idleInactiveNR-MeasBeamReport-r16          ENUMERATED {supported}          OPTIONAL
]]
}

-- TAG-MEASANDMOBPARAMETERS-STOP
-- ASN1STOP

```

## – *MeasAndMobParametersMRDC*

The IE *MeasAndMobParametersMRDC* is used to convey capability parameters related to RRM measurements and RRC mobility.

### *MeasAndMobParametersMRDC* information element

```

-- ASN1START
-- TAG-MEASANDMOBPARAMETERSMRDC-START

MeasAndMobParametersMRDC ::= SEQUENCE {
    measAndMobParametersMRDC-Common          MeasAndMobParametersMRDC-Common          OPTIONAL,
    measAndMobParametersMRDC-XDD-Diff        MeasAndMobParametersMRDC-XDD-Diff        OPTIONAL,
    measAndMobParametersMRDC-FRX-Diff        MeasAndMobParametersMRDC-FRX-Diff        OPTIONAL
}

MeasAndMobParametersMRDC-v1560 ::= SEQUENCE {
    measAndMobParametersMRDC-XDD-Diff-v1560  MeasAndMobParametersMRDC-XDD-Diff-v1560  OPTIONAL
}

MeasAndMobParametersMRDC-v1610 ::= SEQUENCE {
    measAndMobParametersMRDC-Common-v1610     MeasAndMobParametersMRDC-Common-v1610     OPTIONAL,
    interNR-MeasEUTRA-IAB-r16                 ENUMERATED {supported}                     OPTIONAL
}

MeasAndMobParametersMRDC-Common ::= SEQUENCE {
    independentGapConfig                       ENUMERATED {supported}                     OPTIONAL
}

```

```

MeasAndMobParametersMRDC-Common-v1610 ::= SEQUENCE {
  condPSCellChangeParametersCommon-r16 SEQUENCE {
    condPSCellChangeFDD-TDD-r16 ENUMERATED {supported} OPTIONAL,
    condPSCellChangeFR1-FR2-r16 ENUMERATED {supported} OPTIONAL,
  } OPTIONAL,
  pscellT312-r16 ENUMERATED {supported} OPTIONAL
}

MeasAndMobParametersMRDC-XDD-Diff ::= SEQUENCE {
  sftd-MeasPSCell ENUMERATED {supported} OPTIONAL,
  sftd-MeasNR-Cell ENUMERATED {supported} OPTIONAL
}

MeasAndMobParametersMRDC-XDD-Diff-v1560 ::= SEQUENCE {
  sftd-MeasPSCell-NEDC ENUMERATED {supported} OPTIONAL
}

MeasAndMobParametersMRDC-FRX-Diff ::= SEQUENCE {
  simultaneousRxDataSSB-DiffNumerology ENUMERATED {supported} OPTIONAL
}

-- TAG-MEASANDMOBPARAMETERSMRDC-STOP
-- ASN1STOP

```

## – MIMO-Layers

The IE *MIMO-Layers* is used to convey the number of supported MIMO layers.

### **MIMO-Layers information element**

```

-- ASN1START
-- TAG-MIMO-LAYERS-START

MIMO-LayersDL ::= ENUMERATED {twoLayers, fourLayers, eightLayers}

MIMO-LayersUL ::= ENUMERATED {oneLayer, twoLayers, fourLayers}

-- TAG-MIMO-LAYERS-STOP
-- ASN1STOP

```

## – MIMO-ParametersPerBand

The IE *MIMO-ParametersPerBand* is used to convey MIMO related parameters specific for a certain band (not per feature set or band combination).

### **MIMO-ParametersPerBand information element**

```

-- ASN1START
-- TAG-MIMO-PARAMETERSPERBAND-START

```

```

MIMO-ParametersPerBand ::= SEQUENCE {
  tci-StatePDSCH SEQUENCE {
    maxNumberConfiguredTCIstatesPerCC ENUMERATED {n4, n8, n16, n32, n64, n128} OPTIONAL,
    maxNumberActiveTCI-PerBWP ENUMERATED {n1, n2, n4, n8} OPTIONAL
  }
  additionalActiveTCI-StatePDCCH ENUMERATED {supported} OPTIONAL,
  pusch-TransCoherence ENUMERATED {nonCoherent, partialCoherent, fullCoherent} OPTIONAL,
  beamCorrespondenceWithoutUL-BeamSweeping ENUMERATED {supported} OPTIONAL,
  periodicBeamReport ENUMERATED {supported} OPTIONAL,
  aperiodicBeamReport ENUMERATED {supported} OPTIONAL,
  sp-BeamReportPUCCH ENUMERATED {supported} OPTIONAL,
  sp-BeamReportPUSCH ENUMERATED {supported} OPTIONAL,
  dummy1 DummyG OPTIONAL,
  maxNumberRxBeam INTEGER (2..8) OPTIONAL,
  maxNumberRxTxBeamSwitchDL SEQUENCE {
    scs-15kHz ENUMERATED {n4, n7, n14} OPTIONAL,
    scs-30kHz ENUMERATED {n4, n7, n14} OPTIONAL,
    scs-60kHz ENUMERATED {n4, n7, n14} OPTIONAL,
    scs-120kHz ENUMERATED {n4, n7, n14} OPTIONAL,
    scs-240kHz ENUMERATED {n4, n7, n14} OPTIONAL
  } OPTIONAL,
  maxNumberNonGroupBeamReporting ENUMERATED {n1, n2, n4} OPTIONAL,
  groupBeamReporting ENUMERATED {supported} OPTIONAL,
  uplinkBeamManagement SEQUENCE {
    maxNumberSRS-ResourcePerSet-BM ENUMERATED {n2, n4, n8, n16},
    maxNumberSRS-ResourceSet INTEGER (1..8)
  } OPTIONAL,
  maxNumberCSI-RS-BFD INTEGER (1..64) OPTIONAL,
  maxNumberSSB-BFD INTEGER (1..64) OPTIONAL,
  maxNumberCSI-RS-SSB-CBD INTEGER (1..256) OPTIONAL,
  dummy2 ENUMERATED {supported} OPTIONAL,
  twoPortsPTRS-UL ENUMERATED {supported} OPTIONAL,
  dummy5 SRS-Resources OPTIONAL,
  dummy3 INTEGER (1..4) OPTIONAL,
  beamReportTiming SEQUENCE {
    scs-15kHz ENUMERATED {sym2, sym4, sym8} OPTIONAL,
    scs-30kHz ENUMERATED {sym4, sym8, sym14, sym28} OPTIONAL,
    scs-60kHz ENUMERATED {sym8, sym14, sym28} OPTIONAL,
    scs-120kHz ENUMERATED {sym14, sym28, sym56} OPTIONAL
  } OPTIONAL,
  ptrs-DensityRecommendationSetDL SEQUENCE {
    scs-15kHz PTRS-DensityRecommendationDL OPTIONAL,
    scs-30kHz PTRS-DensityRecommendationDL OPTIONAL,
    scs-60kHz PTRS-DensityRecommendationDL OPTIONAL,
    scs-120kHz PTRS-DensityRecommendationDL OPTIONAL
  } OPTIONAL,
  ptrs-DensityRecommendationSetUL SEQUENCE {
    scs-15kHz PTRS-DensityRecommendationUL OPTIONAL,
    scs-30kHz PTRS-DensityRecommendationUL OPTIONAL,
    scs-60kHz PTRS-DensityRecommendationUL OPTIONAL,
    scs-120kHz PTRS-DensityRecommendationUL OPTIONAL
  } OPTIONAL,
  dummy4 DummyH OPTIONAL,

```

```

aperiodicTRS          ENUMERATED {supported}          OPTIONAL,
...
[[
dummy6                ENUMERATED {true}              OPTIONAL,
beamManagementSSB-CSI-RS BeamManagementSSB-CSI-RS    OPTIONAL,
beamSwitchTiming      SEQUENCE {
  scs-60kHz            ENUMERATED {sym14, sym28, sym48, sym224, sym336}  OPTIONAL,
  scs-120kHz           ENUMERATED {sym14, sym28, sym48, sym224, sym336}  OPTIONAL
}
codebookParameters    CodebookParameters            OPTIONAL,
csi-RS-IM-ReceptionForFeedback CSI-RS-IM-ReceptionForFeedback  OPTIONAL,
csi-RS-ProcFrameworkForSRS CSI-RS-ProcFrameworkForSRS      OPTIONAL,
csi-ReportFramework  CSI-ReportFramework           OPTIONAL,
csi-RS-ForTracking    CSI-RS-ForTracking              OPTIONAL,
srs-AssocCSI-RS      SEQUENCE (SIZE (1.. maxNrofCSI-RS-Resources)) OF SupportedCSI-RS-Resource OPTIONAL,
spatialRelations      SpatialRelations              OPTIONAL,
]],
[[
-- R1 16-2b-0: Support of default QCL assumption with two TCI states
defaultQCL-TwoTCI-r16  ENUMERATED {supported}          OPTIONAL,
codebookParametersPerBand-r16 CodebookParameters-v1610    OPTIONAL,
-- R1 16-1b-3: Support of PUCCH resource groups per BWP for simultaneous spatial relation update
simul-SpatialRelationUpdatePUCCHResGroup-r16  ENUMERATED {supported}          OPTIONAL,

-- R1 16-1f: Maximum number of SCells configured for SCell beam failure recovery simultaneously
maxNumberSCellBFR-r16  ENUMERATED {n1,n2,n4,n8}      OPTIONAL,

-- R1 16-2c: Supports simultaneous reception with different Type-D for FR2 only
simultaneousReceptionDiffTypeD-r16            ENUMERATED {supported}          OPTIONAL,
-- R1 16-1a-1: SSB/CSI-RS for L1-SINR measurement
ssb-csirs-SINR-measurement-r16 SEQUENCE {
  maxNumberSSB-CSIRS-OneTx-CMR-r16  ENUMERATED {n8, n16, n32, n64},
  maxNumberCSI-IM-NZP-IMR-res-r16   ENUMERATED {n8, n16, n32, n64},
  maxNumberCSIRS-2Tx-res-r16        ENUMERATED {n0, n4, n8, n16, n32, n64},
  maxNumberSSB-CSIRS-res-r16        ENUMERATED {n8, n16, n32, n64, n128},
  maxNumberCSI-IM-NZP-IMR-res-mem-r16 ENUMERATED {n8, n16, n32, n64, n128},
  supportedCSI-RS-Density-CMR-r16   ENUMERATED {one, three, oneAndThree},
  maxNumberAperiodicCSI-RS-Res-r16  ENUMERATED {n2, n4, n8, n16, n32, n64},
  supportedSNIR-meas-r16            ENUMERATED {ssbWithCSI-IM, ssbWithNZP-IMR, csirsWithNZP-IMR, csi-RSWithoutIMR} OPTIONAL
}
-- R1 16-1a-2: Non-group based L1-SINR reporting
nonGroupSINR-reporting-r16            ENUMERATED {n1, n2, n4}          OPTIONAL,
-- R1 16-1a-3: Non-group based L1-SINR reporting
groupSINR-reporting-r16               ENUMERATED {supported}          OPTIONAL,

multiDCI-multiTRP-Parameters-r16 SEQUENCE {
  -- R1 16-2a-0: Overlapping PDSCHs in time and fully overlapping in frequency and time
  overlapPDSCHsFullyFreqTime-r16     INTEGER (1..2)          OPTIONAL,
  -- R1 16-2a-1: Overlapping PDSCHs in time and partially overlapping in frequency and time
  overlapPDSCHsInTimePartiallyFreq-r16 ENUMERATED {supported}          OPTIONAL,
  -- R1 16-2a-2: Out of order operation for DL
  outOfOrderOperationDL-r16          SEQUENCE {
    supportPDCCH-ToPDSCH-r16         ENUMERATED {supported}          OPTIONAL,
    supportPDSCH-ToHARQ-ACK-r16      ENUMERATED {supported}          OPTIONAL
  }
}

```

```

}
-- R1 16-2a-3: Out of order operation for UL
outOfOrderOperationUL-r16          ENUMERATED {supported}
-- R1 16-2a-5: Separate CRS rate matching
separateCRS-RateMatching-r16      ENUMERATED {supported}
-- R1 16-2a-6: Default QCL enhancement for multi-DCI based multi-TRP
defaultQCL-PerCORESETPoolIndex-r16  ENUMERATED {supported}
-- R1 16-2a-7: Maximum number of activated TCI states
maxNumberActivatedTCI-States-r16   SEQUENCE {
  maxNumberPerCORESET-Pool-r16     ENUMERATED {n1, n2, n4, n8},
  maxTotalNumberAcrossCORESET-Pool-r16  ENUMERATED {n2, n4, n8, n16}
}
}
singleDCI-SDM-scheme-Parameters-r16 SEQUENCE {
  -- R1 16-2b-1b: Single-DCI based SDM scheme - Support of new DMRS port entry
  supportNewDMRS-Port-r16          ENUMERATED {n0, n2, n3}
  -- R1 16-2b-1a: Support of s-port DL PTRS
  supportTwoPortDL-PTRS-r16       ENUMERATED {supported}
}
-- R1 16-2b-2: Support of single-DCI based FDMSchemeA
supportFDM-SchemeA-r16            ENUMERATED {supported}
-- R1 16-2b-3a: Single-DCI based FDMSchemeB CW soft combining
supportCodeWordSoftCombining-r16  ENUMERATED {supported}
-- R1 16-2b-4: Single-DCI based TDMSchemeA
supportTDM-SchemeA-r16            ENUMERATED {kb3, kb5, kb10, kb20, noRestriction}
-- R1 16-2b-5: Single-DCI based inter-slot TDM
supportInter-slotTDM-r16          SEQUENCE {
  supportRepNumPDSCH-TDRA-r16     ENUMERATED {n2, n3, n4, n5, n6, n7, n8, n16},
  maxTBS-Size-r16                 ENUMERATED {kb3, kb5, kb10, kb20, noRestriction},
  maxNumberTCI-states-r16         INTEGER (1..2)
}
-- R1 16-4: Low PAPR DMRS for PDSCH
lowPAPR-DMRS-PDSCH-r16            ENUMERATED {supported}
-- R1 16-6a: Low PAPR DMRS for PUSCH without transform precoding
lowPAPR-DMRS-PUSCHwithoutPrecoding-r16  ENUMERATED {supported}
-- R1 16-6b: Low PAPR DMRS for PUCCH
lowPAPR-DMRS-PUCCH-r16            ENUMERATED {supported}
-- R1 16-6c: Low PAPR DMRS for PUSCH with transform precoding & pi/2 BPSK
lowPAPR-DMRS-PUSCHwithPrecoding-r16  ENUMERATED {supported}
-- R1 16-7: Extension of the maximum number of configured aperiodic CSI report settings
csi-ReportFrameworkExt-r16        CSI-ReportFrameworkExt-r16
-- R1 16-3a, 16-3a-1, 16-3b, 16-3b-1, 16-8: Individual new codebook types
codebookParametersAddition-r16    CodebookParametersAddition-r16
-- R1 16-8: Mixed codebook types
codebookComboParametersAddition-r16  CodebookComboParametersAddition-r16
-- R4 8-2: SSB based beam correspondence
beamCorrespondenceSSB-based-r16    ENUMERATED {supported}
-- R4 8-3: CSI-RS based beam correspondence
beamCorrespondenceCSI-RS-based-r16  ENUMERATED {supported}
beamSwitchTiming-r16              SEQUENCE {
  scs-60kHz-r16                   ENUMERATED {sym224, sym336}
  scs-120kHz-r16                   ENUMERATED {sym224, sym336}
}
]]

```

OPTIONAL,

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```

}

DummyG ::=
    SEQUENCE {
        maxNumberSSB-CSI-RS-ResourceOneTx    ENUMERATED {n8, n16, n32, n64},
        maxNumberSSB-CSI-RS-ResourceTwoTx    ENUMERATED {n0, n4, n8, n16, n32, n64},
        supportedCSI-RS-Density              ENUMERATED {one, three, oneAndThree}
    }

BeamManagementSSB-CSI-RS ::=
    SEQUENCE {
        maxNumberSSB-CSI-RS-ResourceOneTx    ENUMERATED {n0, n8, n16, n32, n64},
        maxNumberCSI-RS-Resource             ENUMERATED {n0, n4, n8, n16, n32, n64},
        maxNumberCSI-RS-ResourceTwoTx        ENUMERATED {n0, n4, n8, n16, n32, n64},
        supportedCSI-RS-Density              ENUMERATED {one, three, oneAndThree}
        maxNumberAperiodicCSI-RS-Resource    ENUMERATED {n0, n1, n4, n8, n16, n32, n64}
    }
    OPTIONAL,

DummyH ::=
    SEQUENCE {
        burstLength                          INTEGER (1..2),
        maxSimultaneousResourceSetsPerCC     INTEGER (1..8),
        maxConfiguredResourceSetsPerCC      INTEGER (1..64),
        maxConfiguredResourceSetsAllCC      INTEGER (1..128)
    }

CSI-RS-ForTracking ::=
    SEQUENCE {
        maxBurstLength                      INTEGER (1..2),
        maxSimultaneousResourceSetsPerCC     INTEGER (1..8),
        maxConfiguredResourceSetsPerCC      INTEGER (1..64),
        maxConfiguredResourceSetsAllCC      INTEGER (1..256)
    }

CSI-RS-IM-ReceptionForFeedback ::=
    SEQUENCE {
        maxConfigNumberNZP-CSI-RS-PerCC      INTEGER (1..64),
        maxConfigNumberPortsAcrossNZP-CSI-RS-PerCC  INTEGER (2..256),
        maxConfigNumberCSI-IM-PerCC          ENUMERATED {n1, n2, n4, n8, n16, n32},
        maxNumberSimultaneousNZP-CSI-RS-PerCC  INTEGER (1..64),
        totalNumberPortsSimultaneousNZP-CSI-RS-PerCC  INTEGER (2..256)
    }

CSI-RS-ProcFrameworkForSRS ::=
    SEQUENCE {
        maxNumberPeriodicSRS-AssocCSI-RS-PerBWP  INTEGER (1..4),
        maxNumberAperiodicSRS-AssocCSI-RS-PerBWP  INTEGER (1..4),
        maxNumberSP-SRS-AssocCSI-RS-PerBWP        INTEGER (0..4),
        simultaneousSRS-AssocCSI-RS-PerCC        INTEGER (1..8)
    }

CSI-ReportFramework ::=
    SEQUENCE {
        maxNumberPeriodicCSI-PerBWP-ForCSI-Report  INTEGER (1..4),
        maxNumberAperiodicCSI-PerBWP-ForCSI-Report  INTEGER (1..4),
        maxNumberSemiPersistentCSI-PerBWP-ForCSI-Report  INTEGER (0..4),
        maxNumberPeriodicCSI-PerBWP-ForBeamReport  INTEGER (1..4),
        maxNumberAperiodicCSI-PerBWP-ForBeamReport  INTEGER (1..4),
        maxNumberAperiodicCSI-triggeringStatePerCC  ENUMERATED {n3, n7, n15, n31, n63, n128},
    }

```

```

    maxNumberSemiPersistentCSI-PerBWP-ForBeamReport INTEGER (0..4),
    simultaneousCSI-ReportsPerCC                    INTEGER (1..8)
}

CSI-ReportFrameworkExt-r16 ::=                      SEQUENCE {
    maxNumberAperiodicCSI-PerBWP-ForCSI-ReportExt-r16 INTEGER (5..8)
}

PTRS-DensityRecommendationDL ::= SEQUENCE {
    frequencyDensity1    INTEGER (1..276),
    frequencyDensity2    INTEGER (1..276),
    timeDensity1         INTEGER (0..29),
    timeDensity2         INTEGER (0..29),
    timeDensity3         INTEGER (0..29)
}

PTRS-DensityRecommendationUL ::= SEQUENCE {
    frequencyDensity1    INTEGER (1..276),
    frequencyDensity2    INTEGER (1..276),
    timeDensity1         INTEGER (0..29),
    timeDensity2         INTEGER (0..29),
    timeDensity3         INTEGER (0..29),
    sampleDensity1       INTEGER (1..276),
    sampleDensity2       INTEGER (1..276),
    sampleDensity3       INTEGER (1..276),
    sampleDensity4       INTEGER (1..276),
    sampleDensity5       INTEGER (1..276)
}

SpatialRelations ::= SEQUENCE {
    maxNumberConfiguredSpatialRelations    ENUMERATED {n4, n8, n16, n32, n64, n96},
    maxNumberActiveSpatialRelations        ENUMERATED {n1, n2, n4, n8, n14},
    additionalActiveSpatialRelationPUCCH   ENUMERATED {supported} OPTIONAL,
    maxNumberDL-RS-QCL-TypeD               ENUMERATED {n1, n2, n4, n8, n14}
}

DummyI ::= SEQUENCE {
    supportedSRS-TxPortSwitch    ENUMERATED {t1r2, t1r4, t2r4, t1r4-t2r4, tr-equal},
    txSwitchImpactToRx           ENUMERATED {true} OPTIONAL
}

-- TAG-MIMO-PARAMETERSPERBAND-STOP
-- ASN1STOP

```

### **MIMO-ParametersPerBand field description**

#### **codebookParametersPerBand**

For a given frequency band, this field indicates the alternative list of *SupportedCSI-RS-Resource* supported for each codebook type. The supported CSI-RS resources indicated by this field are referred by *codebookParametersperBC* in *CA-ParametersNR* to indicate the supported CSI-RS resource per band combination.

#### **csi-RS-IM-ReceptionForFeedback/ csi-RS-ProcFrameworkForSRS/ csi-ReportFramework**

CSI related capabilities which the UE supports on each of the carriers operated on this band. If the network configures the UE with serving cells on both FR1 and FR2 bands these values may be further limited by the corresponding fields in *fr1-fr2-Add-UE-NR-Capabilities*.

## – *ModulationOrder*

The IE *ModulationOrder* is used to convey the maximum supported modulation order.

### ***ModulationOrder* information element**

```
-- ASN1START
-- TAG-MODULATIONORDER-START

ModulationOrder ::= ENUMERATED {bpsk-halfpi, bpsk, qpsk, qam16, qam64, qam256}

-- TAG-MODULATIONORDER-STOP
-- ASN1STOP
```

## – *MRDC-Parameters*

The IE *MRDC-Parameters* contains the band combination parameters specific to MR-DC for a given MR-DC band combination.

### ***MRDC-Parameters* information element**

```
-- ASN1START
-- TAG-MRDC-PARAMETERS-START

MRDC-Parameters ::= SEQUENCE {
    singleUL-Transmission          ENUMERATED {supported}          OPTIONAL,
    dynamicPowerSharingENDC        ENUMERATED {supported}          OPTIONAL,
    tdm-Pattern                    ENUMERATED {supported}          OPTIONAL,
    ul-SharingEUTRA-NR             ENUMERATED {tdm, fdm, both}      OPTIONAL,
    ul-SwitchingTimeEUTRA-NR       ENUMERATED {type1, type2}      OPTIONAL,
    simultaneousRxTxInterBandENDC  ENUMERATED {supported}          OPTIONAL,
    asyncIntraBandENDC             ENUMERATED {supported}          OPTIONAL,
    . . . ,
    [
        dualPA-Architecture          ENUMERATED {supported}          OPTIONAL,
        intraBandENDC-Support        ENUMERATED {non-contiguous, both} OPTIONAL,
        ul-TimingAlignmentEUTRA-NR  ENUMERATED {required}          OPTIONAL
    ]
}

MRDC-Parameters-v1580 ::= SEQUENCE {
    dynamicPowerSharingNEDC        ENUMERATED {supported}          OPTIONAL
}

MRDC-Parameters-v1590 ::= SEQUENCE {
    interBandContiguousMRDC        ENUMERATED {supported}          OPTIONAL
}

MRDC-Parameters-v1620 ::= SEQUENCE {
    maxUplinkDutyCycle-interBandENDC-TDD-PC2-r16 SEQUENCE {
        eutra-TDD-Config0-r16       ENUMERATED {n20, n40, n50, n60, n70, n80, n90, n100} OPTIONAL,
```



```

    eutra-TDD-Config1-r16      ENUMERATED {n20, n40, n50, n60, n70, n80, n90, n100}  OPTIONAL,
    eutra-TDD-Config2-r16      ENUMERATED {n20, n40, n50, n60, n70, n80, n90, n100}  OPTIONAL,
    eutra-TDD-Config3-r16      ENUMERATED {n20, n40, n50, n60, n70, n80, n90, n100}  OPTIONAL,
    eutra-TDD-Config4-r16      ENUMERATED {n20, n40, n50, n60, n70, n80, n90, n100}  OPTIONAL,
    eutra-TDD-Config5-r16      ENUMERATED {n20, n40, n50, n60, n70, n80, n90, n100}  OPTIONAL,
    eutra-TDD-Config6-r16      ENUMERATED {n20, n40, n50, n60, n70, n80, n90, n100}  OPTIONAL,
  }
  -- R1 18-2 Single UL TX operation for TDD PCell in EN-DC
  tdm-restrictionTDD-encd-r16  ENUMERATED {supported}                                OPTIONAL,
  -- R1 18-2a Single UL TX operation for FDD PCell in EN-DC
  tdm-restrictionFDD-encd-r16  ENUMERATED {supported}                                OPTIONAL,
  -- R1 18-2b Support of HARQ-offset for SUO casel in EN-DC with LTE TDD PCell for type 1 UE
  singleUL-HARQ-offsetTDD-PCell-r16  ENUMERATED {supported}                        OPTIONAL,
  -- R1 18-3 Dual Tx transmission for EN-DC with FDD PCell(TDM pattern for dual Tx UE)
  tdm-restrictionDualTX-FDD-encd-r16  ENUMERATED {supported}                        OPTIONAL
}

-- TAG-MRDC-PARAMETERS-STOP
-- ASN1STOP

```

## – NRDC-Parameters

The IE *NRDC-Parameters* contains parameters specific to NR-DC, i.e., which are not applicable to NR SA.

### NRDC-Parameters information element

```

-- ASN1START
-- TAG-NRDC-PARAMETERS-START

NRDC-Parameters ::=
  SEQUENCE {
    measAndMobParametersNRDC      MeasAndMobParametersMRDC          OPTIONAL,
    generalParametersNRDC         GeneralParametersMRDC-XDD-Diff    OPTIONAL,
    fdd-Add-UE-NRDC-Capabilities  UE-MRDC-CapabilityAddXDD-Mode  OPTIONAL,
    tdd-Add-UE-NRDC-Capabilities  UE-MRDC-CapabilityAddXDD-Mode  OPTIONAL,
    fr1-Add-UE-NRDC-Capabilities  UE-MRDC-CapabilityAddFRX-Mode  OPTIONAL,
    fr2-Add-UE-NRDC-Capabilities  UE-MRDC-CapabilityAddFRX-Mode  OPTIONAL,
    lateNonCriticalExtension      OCTET STRING                    OPTIONAL,
    dummy                          SEQUENCE {}                        OPTIONAL
  }

NRDC-Parameters-v1570 ::=
  SEQUENCE {
    sfn-SyncNRDC                  ENUMERATED {supported}          OPTIONAL
  }

NRDC-Parameters-v1610 ::=
  SEQUENCE {
    measAndMobParametersNRDC-v1610  MeasAndMobParametersMRDC-v1610  OPTIONAL
  }

-- TAG-NRDC-PARAMETERS-STOP
-- ASN1STOP

```

## – OLPC-SRS-Pos

The IE *OLPC-SRS-Pos* is used to convey OLPC SRS positioning related parameters specific for a certain band.

### **OLPC-SRS-Pos information element**

```
-- ASN1START
-- TAG-OLPC-SRS-POS-START

OLPC-SRS-Pos-r16 ::= SEQUENCE {
    olpc-SRS-PosBasedOnPRS-Serving-r16      ENUMERATED {supported}           OPTIONAL,
    olpc-SRS-PosBasedOnSSB-Neigh-r16       ENUMERATED {supported}           OPTIONAL,
    olpc-SRS-PosBasedOnPRS-Neigh-r16       ENUMERATED {supported}           OPTIONAL,
    maxNumberPathLossEstimatePerServing-r16 ENUMERATED {n1, n4, n8, n16}    OPTIONAL
}

--TAG-OLPC-SRS-POS-STOP
-- ASN1STOP
```

## – PDCP-Parameters

The IE *PDCP-Parameters* is used to convey capabilities related to PDCP.

### **PDCP-Parameters information element**

```
-- ASN1START
-- TAG-PDCP-PARAMETERS-START

PDCP-Parameters ::= SEQUENCE {
    supportedROHC-Profiles SEQUENCE {
        profile0x0000    BOOLEAN,
        profile0x0001    BOOLEAN,
        profile0x0002    BOOLEAN,
        profile0x0003    BOOLEAN,
        profile0x0004    BOOLEAN,
        profile0x0006    BOOLEAN,
        profile0x0101    BOOLEAN,
        profile0x0102    BOOLEAN,
        profile0x0103    BOOLEAN,
        profile0x0104    BOOLEAN
    },
    maxNumberROHC-ContextSessions    ENUMERATED {cs2, cs4, cs8, cs12, cs16, cs24, cs32, cs48, cs64,
        cs128, cs256, cs512, cs1024, cs16384, spare2, spare1},
    uplinkOnlyROHC-Profiles          ENUMERATED {supported}           OPTIONAL,
    continueROHC-Context              ENUMERATED {supported}           OPTIONAL,
    outOfOrderDelivery                ENUMERATED {supported}           OPTIONAL,
    shortSN                           ENUMERATED {supported}           OPTIONAL
}
```

```

pdcp-DuplicationSRB          ENUMERATED {supported}    OPTIONAL,
pdcp-DuplicationMCG-OrSCG-DRB  ENUMERATED {supported}    OPTIONAL,
...
[[
drb-IAB-r16                  ENUMERATED {supported}    OPTIONAL,
non-DRB-IAB-r16              ENUMERATED {supported}    OPTIONAL,
extendedDiscardTimer-r16     ENUMERATED {supported}    OPTIONAL,
continueEHC-Context-r16     ENUMERATED {supported}    OPTIONAL,
ehc-r16                      ENUMERATED {supported}    OPTIONAL,
maxNumberEHC-Contexts-r16    ENUMERATED {cs2, cs4, cs8, cs16, cs32, cs64, cs128, cs256, cs512,
                             cs1024, cs2048, cs4096, cs8192, cs16384, cs32768, cs65536} OPTIONAL,
jointEHC-ROHC-Config-r16     ENUMERATED {supported}    OPTIONAL,
pdcp-DuplicationMoreThanTwoRLC-r16  ENUMERATED {supported}    OPTIONAL
]]
}

-- TAG-PDCP-PARAMETERS-STOP
-- ASN1STOP

```

## – *PDCP-ParametersMRDC*

The IE *PDCP-ParametersMRDC* is used to convey PDCP related capabilities for MR-DC.

### *PDCP-ParametersMRDC* information element

```

-- ASN1START
-- TAG-PDCP-PARAMETERSMRDC-START

PDCP-ParametersMRDC ::= SEQUENCE {
    pdcp-DuplicationSplitSRB    ENUMERATED {supported}    OPTIONAL,
    pdcp-DuplicationSplitDRB    ENUMERATED {supported}    OPTIONAL
}

PDCP-ParametersMRDC-v1610 ::= SEQUENCE {
    scg-DRB-NR-IAB-r16         ENUMERATED {supported}    OPTIONAL
}

-- TAG-PDCP-PARAMETERSMRDC-STOP
-- ASN1STOP

```

## – *Phy-Parameters*

The IE *Phy-Parameters* is used to convey the physical layer capabilities.

### *Phy-Parameters* information element

```

-- ASN1START
-- TAG-PHY-PARAMETERS-START

```

```

Phy-Parameters ::=
    phy-ParametersCommon
    phy-ParametersXDD-Diff
    phy-ParametersFRX-Diff
    phy-ParametersFR1
    phy-ParametersFR2
}

SEQUENCE {
    Phy-ParametersCommon
    Phy-ParametersXDD-Diff
    Phy-ParametersFRX-Diff
    Phy-ParametersFR1
    Phy-ParametersFR2
OPTIONAL,
OPTIONAL,
OPTIONAL,
OPTIONAL,
OPTIONAL
}

Phy-ParametersCommon ::=
    csi-RS-CFRA-ForHO
    dynamicPRB-BundlingDL
    sp-CSI-ReportPUCCH
    sp-CSI-ReportPUSCH
    nzp-CSI-RS-IntefMgmt
    type2-SP-CSI-Feedback-LongPUCCH
    precoderGranularityCORESET
    dynamicHARQ-ACK-Codebook
    semiStaticHARQ-ACK-Codebook
    spatialBundlingHARQ-ACK
    dynamicBetaOffsetInd-HARQ-ACK-CSI
    pucch-Repetition-F1-3-4
    ra-Type0-PUSCH
    dynamicSwitchRA-Type0-1-PDSCH
    dynamicSwitchRA-Type0-1-PUSCH
    pdsch-MappingTypeA
    pdsch-MappingTypeB
    interleavingVRB-ToPRB-PDSCH
    interSlotFreqHopping-PUSCH
    type1-PUSCH-RepetitionMultiSlots
    type2-PUSCH-RepetitionMultiSlots
    pusch-RepetitionMultiSlots
    pdsch-RepetitionMultiSlots
    downlinkSPS
    configuredUL-GrantType1
    configuredUL-GrantType2
    pre-EmptIndication-DL
    cbg-TransIndication-DL
    cbg-TransIndication-UL
    cbg-FlushIndication-DL
    dynamicHARQ-ACK-CodeB-CBG-Retx-DL
    rateMatchingResrcSetSemi-Static
    rateMatchingResrcSetDynamic
    bwp-SwitchingDelay
    . . .
    [[
    dummy
    ]],
    [[
    maxNumberSearchSpaces
    rateMatchingCtrlResrcSetDynamic
    maxLayersMIMO-Indication
    ]],
    [[

```

```

spCellPlacement          CarrierAggregationVariant          OPTIONAL
]],
[[
-- R1 9-1: Basic channel structure and procedure of 2-step RACH
twoStepRACH-r16          ENUMERATED {supported}              OPTIONAL,
-- R1 11-1: Monitoring DCI format 1_2 and DCI format 0_2
dci-Format1-2And0-2-r16  ENUMERATED {supported}              OPTIONAL,
-- R1 11-1a: Monitoring both DCI format 0_1/1_1 and DCI format 0_2/1_2 in the same search space
monitoringDCI-SameSearchSpace-r16  ENUMERATED {supported}              OPTIONAL,
-- R1 11-10: Type 2 configured grant release by DCI format 0_1
type2-CG-ReleaseDCI-0-1-r16  ENUMERATED {supported}              OPTIONAL,
-- R1 11-11: Type 2 configured grant release by DCI format 0_2
type2-CG-ReleaseDCI-0-2-r16  ENUMERATED {supported}              OPTIONAL,
-- R1 12-3: SPS release by DCI format 1_1
sps-ReleaseDCI-1-1-r16      ENUMERATED {supported}              OPTIONAL,
-- R1 12-3a: SPS release by DCI format 1_2
sps-ReleaseDCI-1-2-r16      ENUMERATED {supported}              OPTIONAL,
-- R1 14-8: CSI trigger states containing non-active BWP
csi-TriggerStateNon-ActiveBWP-r16  ENUMERATED {supported}              OPTIONAL,
-- R1 20-2: Support up to 4 SMTCs configured for an IAB node MT per frequency location, including IAB-specific SMTC window periodicities
seperateSMTC-InterIAB-Support-r16  ENUMERATED {supported}              OPTIONAL,
-- R1 20-3: Support RACH configuration separately from the RACH configuration for UE access, including new IAB-specific offset and scaling
factors
seperateRACH-IAB-Support-r16  ENUMERATED {supported}              OPTIONAL,
-- R1 20-5a: Support semi-static configuration/indication of UL-Flexible-DL slot formats for IAB-MT resources
ul-flexibleDL-SlotFormatSemiStatic-IAB-r16  ENUMERATED {supported}              OPTIONAL,
-- R1 20-5b: Support dynamic indication of UL-Flexible-DL slot formats for IAB-MT resources
ul-flexibleDL-SlotFormatDynamics-IAB-r16    ENUMERATED {supported}              OPTIONAL,
dft-S-OFDM-WaveformUL-IAB-r16  ENUMERATED {supported}              OPTIONAL,
-- R1 20-6: Support DCI Format 2_5 based indication of soft resource availability to an IAB node
dci-25-AI-RNTI-Support-IAB-r16  ENUMERATED {supported}              OPTIONAL,
-- R1 20-7: Support T_delta reception.
t-DeltaReceptionSupport-IAB-r16  ENUMERATED {supported}              OPTIONAL,
-- R1 20-8: Support of Desired guard symbol reporting and provided guard symbol reception.
guardSymbolReportReception-IAB-r16  ENUMERATED {supported}              OPTIONAL,
-- R1 18-8 HARQ-ACK codebook type and spatial bundling per PUCCH group
harqACK-CB-SpatialBundlingPUCCH-Group-r16  ENUMERATED {supported}              OPTIONAL,
-- R1 19-2: Cross Slot Scheduling
crossSlotScheduling-r16          SEQUENCE {
    non-SharedSpectrumChAccess-r16  ENUMERATED {supported}              OPTIONAL,
    sharedSpectrumChAccess-r16      ENUMERATED {supported}              OPTIONAL,
}
maxNumberSRS-PosPathLossEstimateAllServingCells-r16  ENUMERATED {n1, n4, n8, n16}          OPTIONAL,
extendedCG-Periodicities-r16      ENUMERATED {supported}              OPTIONAL,
extendedSPS-Periodicities-r16      ENUMERATED {supported}              OPTIONAL,
codebookVariantsList-r16          CodebookVariantsList-r16          OPTIONAL,
-- R1 11-6: PUSCH repetition Type A
pusch-RepetitionTypeA-r16          SEQUENCE {
    sharedSpectrumChAccess-r16      ENUMERATED {supported}              OPTIONAL,
    non-SharedSpectrumChAccess-r16  ENUMERATED {supported}              OPTIONAL,
}
-- R1 11-4b: DL priority indication in DCI with mixed DCI formats
dci-DL-PriorityIndicator-r16      ENUMERATED {supported}              OPTIONAL,
-- R1 12-1a: UL priority indication in DCI with mixed DCI formats

```

```

dci-UL-PriorityIndicator-r16          ENUMERATED {supported}          OPTIONAL,
-- R1 16-1e: Maximum number of configured pathloss reference RSs for PUSCH/PUCCH/SRS by RRC for MAC-CE based pathloss reference RS update
maxNumberPathlossRS-Update-r16      ENUMERATED {n4, n8, n16, n32, n64}  OPTIONAL,

-- R1 18-9: Usage of the PDSCH starting time for HARQ-ACK type 2 codebook
type2-HARQ-ACK-Codebook-r16         ENUMERATED {supported}          OPTIONAL,
-- R1 16-1g-1: Resources for beam management, pathloss measurement, BFD, RLM and new beam identification across frequency ranges
maxTotalResourcesForAcrossFreqRanges-r16 SEQUENCE {
  maxNumberResWithinSlotAcrossCC-AcrossFR-r16 ENUMERATED {n2, n4, n8, n12, n16, n32, n64, n128}  OPTIONAL,
  maxNumberResAcrossCC-AcrossFR-r16          ENUMERATED {n2, n4, n8, n12, n16, n32, n40, n48, n64, n72, n80, n96, n128, n256}
}
-- R1 16-2a-4: HARQ-ACK for multi-DCI based multi-TRP - separate
harqACK-separateMultiDCI-MultiTRP-r16 SEQUENCE {
  maxNumberLongPUCCHs-r16              ENUMERATED {longAndLong, longAndShort, shortAndShort}  OPTIONAL,
}
-- R1 16-2a-4: HARQ-ACK for multi-DCI based multi-TRP - joint
harqACK-jointMultiDCI-MultiTRP-r16    ENUMERATED {supported}          OPTIONAL,
-- R4 9-1: BWP switching on multiple CCs RRM requirements
bwp-SwitchingMultiCCs-r16             CHOICE {
  type1-r16                            ENUMERATED {us100, us200},
  type2-r16                            ENUMERATED {us200, us400, us800, us1000}
}
}}

Phy-ParametersXDD-Diff ::= SEQUENCE {
  dynamicSFI                          ENUMERATED {supported}          OPTIONAL,
  twoPUCCH-F0-2-ConsecSymbols          ENUMERATED {supported}          OPTIONAL,
  twoDifferentTPC-Loop-PUSCH          ENUMERATED {supported}          OPTIONAL,
  twoDifferentTPC-Loop-PUCCH          ENUMERATED {supported}          OPTIONAL,
  . . . ,
  [[
  dl-SchedulingOffset-PDSCH-TypeA     ENUMERATED {supported}          OPTIONAL,
  dl-SchedulingOffset-PDSCH-TypeB     ENUMERATED {supported}          OPTIONAL,
  ul-SchedulingOffset                  ENUMERATED {supported}          OPTIONAL
  ]]
}

Phy-ParametersFRX-Diff ::= SEQUENCE {
  dynamicSFI                          ENUMERATED {supported}          OPTIONAL,
  dummy1                              BIT STRING (SIZE (2))          OPTIONAL,
  twoFL-DMRS                          BIT STRING (SIZE (2))          OPTIONAL,
  dummy2                              BIT STRING (SIZE (2))          OPTIONAL,
  dummy3                              BIT STRING (SIZE (2))          OPTIONAL,
  supportedDMRS-TypeDL                 ENUMERATED {type1, type1And2}   OPTIONAL,
  supportedDMRS-TypeUL                 ENUMERATED {type1, type1And2}   OPTIONAL,
  semiOpenLoopCSI                     ENUMERATED {supported}          OPTIONAL,
  csi-ReportWithoutPMI                 ENUMERATED {supported}          OPTIONAL,
  csi-ReportWithoutCQI                 ENUMERATED {supported}          OPTIONAL,
  onePortsPTRS                        BIT STRING (SIZE (2))          OPTIONAL,
  twoPUCCH-F0-2-ConsecSymbols          ENUMERATED {supported}          OPTIONAL,
  pucch-F2-WithFH                      ENUMERATED {supported}          OPTIONAL,
  pucch-F3-WithFH                      ENUMERATED {supported}          OPTIONAL,

```

```

pucch-F4-WithFH          ENUMERATED {supported}          OPTIONAL,
pucch-F0-2WithoutFH     ENUMERATED {notSupported}        OPTIONAL,
pucch-F1-3-4WithoutFH   ENUMERATED {notSupported}        OPTIONAL,
mux-SR-HARQ-ACK-CSI-PUCCH-MultiPerSlot  ENUMERATED {supported}          OPTIONAL,
uci-CodeBlockSegmentation  ENUMERATED {supported}          OPTIONAL,
onePUCCH-LongAndShortFormat  ENUMERATED {supported}          OPTIONAL,
twoPUCCH-AnyOthersInSlot   ENUMERATED {supported}          OPTIONAL,
intraSlotFreqHopping-PUSCH  ENUMERATED {supported}          OPTIONAL,
pusch-LBRM                ENUMERATED {supported}          OPTIONAL,
pdccch-BlindDetectionCA    INTEGER (4..16)                 OPTIONAL,
tpc-PUSCH-RNTI            ENUMERATED {supported}          OPTIONAL,
tpc-PUCCH-RNTI            ENUMERATED {supported}          OPTIONAL,
tpc-SRS-RNTI              ENUMERATED {supported}          OPTIONAL,
absoluteTPC-Command        ENUMERATED {supported}          OPTIONAL,
twoDifferentTPC-Loop-PUSCH  ENUMERATED {supported}          OPTIONAL,
twoDifferentTPC-Loop-PUCCH  ENUMERATED {supported}          OPTIONAL,
pusch-HalfPi-BPSK          ENUMERATED {supported}          OPTIONAL,
pucch-F3-4-HalfPi-BPSK     ENUMERATED {supported}          OPTIONAL,
almostContiguousCP-OFDM-UL  ENUMERATED {supported}          OPTIONAL,
sp-CSI-RS                  ENUMERATED {supported}          OPTIONAL,
sp-CSI-IM                  ENUMERATED {supported}          OPTIONAL,
tdd-MultiDL-UL-SwitchPerSlot  ENUMERATED {supported}          OPTIONAL,
multipleCORESET            ENUMERATED {supported}          OPTIONAL,
...
[[
csi-RS-IM-ReceptionForFeedback  CSI-RS-IM-ReceptionForFeedback  OPTIONAL,
csi-RS-ProcFrameworkForSRS      CSI-RS-ProcFrameworkForSRS      OPTIONAL,
csi-ReportFramework            CSI-ReportFramework             OPTIONAL,
mux-SR-HARQ-ACK-CSI-PUCCH-OncePerSlot  SEQUENCE {
    sameSymbol          ENUMERATED {supported}          OPTIONAL,
    diffSymbol          ENUMERATED {supported}          OPTIONAL
}
mux-SR-HARQ-ACK-PUCCH          ENUMERATED {supported}          OPTIONAL,
mux-MultipleGroupCtrlCH-Overlap  ENUMERATED {supported}          OPTIONAL,
dl-SchedulingOffset-PDSCH-TypeA  ENUMERATED {supported}          OPTIONAL,
dl-SchedulingOffset-PDSCH-TypeB  ENUMERATED {supported}          OPTIONAL,
ul-SchedulingOffset            ENUMERATED {supported}          OPTIONAL,
dl-64QAM-MCS-TableAlt          ENUMERATED {supported}          OPTIONAL,
ul-64QAM-MCS-TableAlt          ENUMERATED {supported}          OPTIONAL,
cqi-TableAlt                    ENUMERATED {supported}          OPTIONAL,
oneFL-DMRS-TwoAdditionalDMRS-UL  ENUMERATED {supported}          OPTIONAL,
twoFL-DMRS-TwoAdditionalDMRS-UL  ENUMERATED {supported}          OPTIONAL,
oneFL-DMRS-ThreeAdditionalDMRS-UL  ENUMERATED {supported}          OPTIONAL
]],
[[
pdccch-BlindDetectionNRDC        SEQUENCE {
    pdccch-BlindDetectionMCG-UE  INTEGER (1..15),
    pdccch-BlindDetectionSCG-UE  INTEGER (1..15)
}
mux-HARQ-ACK-PUSCH-DiffSymbol     ENUMERATED {supported}          OPTIONAL
]],
[[
-- R1 11-1b: Type 1 HARQ-ACK codebook support for relative TDRA for DL
type1-HARQ-ACK-Codebook-r16      ENUMERATED {supported}          OPTIONAL,

```

```

-- R1 11-8: Enhanced UL power control scheme
enhancedPowerControl-r16      ENUMERATED {supported}          OPTIONAL,
-- R1 16-1b-1: TCI state activation across multiple CCs
simultaneousTCI-ActMultipleCC-r16  ENUMERATED {supported}          OPTIONAL,
-- R1 16-1b-2: Spatial relation update across multiple CCs
simultaneousSpatialRelationMultipleCC-r16  ENUMERATED {supported}          OPTIONAL,
cli-RSSI-FDM-DL-r16           ENUMERATED {supported}          OPTIONAL,
cli-SRS-RSRP-FDM-DL-r16      ENUMERATED {supported}          OPTIONAL,
-- R1 19-3: Maximum MIMO Layer Adaptation
maxLayersMIMO-Adaptation-r16      ENUMERATED {supported}          OPTIONAL,
-- R1 12-5: Configuration of aggregation factor per SPS configuration
aggregationFactorSPS-DL-r16      ENUMERATED {supported}          OPTIONAL,
-- R1 16-1g: Resources for beam management, pathloss measurement, BFD, RLM and new beam identification
maxTotalResourcesForOneFreqRange-r16  SEQUENCE {
    maxNumberResWithinSlotAcrossCC-OneFR-r16  ENUMERATED {n2, n4, n8, n12, n16, n32, n64, n128}  OPTIONAL,
    maxNumberResAcrossCC-OneFR-r16           ENUMERATED {n2, n4, n8, n12, n16, n32, n40, n48, n64, n72, n80, n96, n128, n256}
                                          OPTIONAL
}
-- R1 16-7: Extension of the maximum number of configured aperiodic CSI report settings
csi-ReportFrameworkExt-r16      CSI-ReportFrameworkExt-r16  OPTIONAL
}}
}

Phy-ParametersFR1 ::=          SEQUENCE {
    pdcch-MonitoringSingleOccasion  ENUMERATED {supported}          OPTIONAL,
    scs-60kHz                       ENUMERATED {supported}          OPTIONAL,
    pdsch-256QAM-FR1                ENUMERATED {supported}          OPTIONAL,
    pdsch-RE-MappingFR1-PerSymbol   ENUMERATED {n10, n20}          OPTIONAL,
    ...,
    [[
    pdsch-RE-MappingFR1-PerSlot      ENUMERATED {n16, n32, n48, n64, n80, n96, n112, n128,
n144, n160, n176, n192, n208, n224, n240, n256}  OPTIONAL
    ]]
}

Phy-ParametersFR2 ::=          SEQUENCE {
    dummy                            ENUMERATED {supported}          OPTIONAL,
    pdsch-RE-MappingFR2-PerSymbol    ENUMERATED {n6, n20}          OPTIONAL,
    ...,
    [[
    pCell-FR2                        ENUMERATED {supported}          OPTIONAL,
    pdsch-RE-MappingFR2-PerSlot      ENUMERATED {n16, n32, n48, n64, n80, n96, n112, n128,
n144, n160, n176, n192, n208, n224, n240, n256}  OPTIONAL
    ]],
    [[
    -- R1 16-1c: Support of default spatial relation and pathloss reference RS for dedicated-PUCCH/SRS and PUSCH
    defaultSpatialRelationPathlossRS-r16  ENUMERATED {supported}          OPTIONAL,
    -- R1 16-1d: Support of spatial relation update for AP-SRS via MAC CE
    spatialRelationUpdateAP-SRS-r16      ENUMERATED {supported}          OPTIONAL,
    maxNumberSRS-PosSpatialRelationsAllServingCells-r16  ENUMERATED {n0, n1, n2, n4, n8, n16}  OPTIONAL
    ]]
}

-- TAG-PHY-PARAMETERS-STOP

```



```
-- ASN1STOP
```

**Phy-ParametersFRX-Diff field description**

**csi-RS-IM-ReceptionForFeedback/ csi-RS-ProcFrameworkForSRS/ csi-ReportFramework**

These fields are optionally present in *fr1-fr2-Add-UE-NR-Capabilities* in *UE-NR-Capability*. They shall not be set in any other instance of the IE *Phy-ParametersFRX-Diff*. If the network configures the UE with serving cells on both FR1 and FR2 bands, these parameters, if present, limit the corresponding parameters in *MIMO-ParametersPerBand*.

– **Phy-ParametersMRDC**

The IE *Phy-ParametersMRDC* is used to convey physical layer capabilities for MR-DC.

**Phy-ParametersMRDC information element**

```
-- ASN1START
-- TAG-PHY-PARAMETERSMRDC-START

Phy-ParametersMRDC ::=
  naics-Capability-List          SEQUENCE {
    ...
    [[
      spCellPlacement            CarrierAggregationVariant          OPTIONAL
    ]],
    [[
      -- R1 18-3b: Semi-statically configured LTE UL transmissions in all UL subframes not limited to tdm-pattern in case of TDD PCell
      tdd-PCellUL-TX-AllUL-Subframe-r16  ENUMERATED {supported}          OPTIONAL,
      -- R1 18-3a: Semi-statically configured LTE UL transmissions in all UL subframes not limited to tdm-pattern in case of FDD PCell
      fdd-PCellUL-TX-AllUL-Subframe-r16  ENUMERATED {supported}          OPTIONAL
    ]]
  }

NAICS-Capability-Entry ::=
  numberOfNAICS-CapableCC        INTEGER(1..5),
  numberOfAggregatedPRB         ENUMERATED {n50, n75, n100, n125, n150, n175, n200, n225,
    ...
    n250, n275, n300, n350, n400, n450, n500, spare},
  ...
}

-- TAG-PHY-PARAMETERSMRDC-STOP
-- ASN1STOP
```

**PHY-ParametersMRDC field descriptions**

**naics-Capability-List**

Indicates that UE in MR-DC supports NAICS as defined in TS 36.331 [10].

## – PowSav-Parameters

The IE *PowSav-Parameters* is used to convey the capabilities supported by the UE for the power saving preferences.

### **PowSav-Parameters information element**

```

-- ASN1START
-- TAG-POWSAV-PARAMETERS-START

PowSav-Parameters-r16 ::=          SEQUENCE {
    powSav-ParametersCommon-r16    PowSav-ParametersCommon-r16          OPTIONAL,
    powSav-ParametersFRX-Diff-r16  PowSav-ParametersFRX-Diff-r16     OPTIONAL,
    ...
}

PowSav-ParametersCommon-r16 ::=  SEQUENCE {
    drx-Preference-r16              ENUMERATED {supported}           OPTIONAL,
    maxCC-Preference-r16            ENUMERATED {supported}           OPTIONAL,
    releasePreference-r16           ENUMERATED {supported}           OPTIONAL,
    -- R1 19-4a: UE assistance information
    minSchedulingOffsetPreference-r16  ENUMERATED {supported}       OPTIONAL,
    ...
}

PowSav-ParametersFRX-Diff-r16 ::= SEQUENCE {
    maxBW-Preference-r16            ENUMERATED {supported}           OPTIONAL,
    maxMIMO-LayerPreference-r16     ENUMERATED {supported}           OPTIONAL,
    ...
}

-- TAG-POWSAV-PARAMETERS-STOP
-- ASN1STOP

```

## – ProcessingParameters

The IE *ProcessingParameters* is used to indicate PDSCH/PUSCH processing capabilities supported by the UE.

### **ProcessingParameters information element**

```

-- ASN1START
-- TAG-PROCESSINGPARAMETERS-START

ProcessingParameters ::=          SEQUENCE {
    fallback                        ENUMERATED {sc, cap1-only},
    differentTB-PerSlot            SEQUENCE {
        upto1                      NumberOfCarriers                OPTIONAL,
        upto2                      NumberOfCarriers                OPTIONAL,
        upto4                      NumberOfCarriers                OPTIONAL,
        upto7                      NumberOfCarriers                OPTIONAL
    }
}

```

```

}
NumberOfCarriers ::= INTEGER (1..16)

-- TAG-PROCESSINGPARAMETERS-STOP
-- ASN1STOP

```

## – *RAT-Type*

The IE *RAT-Type* is used to indicate the radio access technology (RAT), including NR, of the requested/transferred UE capabilities.

### *RAT-Type* information element

```

-- ASN1START
-- TAG-RAT-TYPE-START

RAT-Type ::= ENUMERATED {nr, eutra-nr, eutra, utra-fdd-v1610, ...}

-- TAG-RAT-TYPE-STOP
-- ASN1STOP

```

## – *RF-Parameters*

The IE *RF-Parameters* is used to convey RF-related capabilities for NR operation.

### *RF-Parameters* information element

```

-- ASN1START
-- TAG-RF-PARAMETERS-START

RF-Parameters ::= SEQUENCE {
  supportedBandListNR                SEQUENCE (SIZE (1..maxBands)) OF BandNR,
  supportedBandCombinationList       BandCombinationList                OPTIONAL,
  appliedFreqBandListFilter          FreqBandList                      OPTIONAL,
  ...,
  [[
  supportedBandCombinationList-v1540 BandCombinationList-v1540        OPTIONAL,
  srs-SwitchingTimeRequested         ENUMERATED {true}              OPTIONAL
  ]],
  [[
  supportedBandCombinationList-v1550 BandCombinationList-v1550        OPTIONAL
  ]],
  [[
  supportedBandCombinationList-v1560 BandCombinationList-v1560        OPTIONAL
  ]],
  [[
  supportedBandCombinationList-v1610 BandCombinationList-v1610        OPTIONAL,
  supportedBandCombinationListSidelinkEUTRA-NR-r16 BandCombinationListSidelinkEUTRA-NR-r16 OPTIONAL,

```

```

supportedBandCombinationList-UplinkTxSwitch-r16      BandCombinationList-UplinkTxSwitch-r16      OPTIONAL
  ]]
}

BandNR ::=
bandNR
modifiedMPR-Behaviour                               BIT STRING (SIZE (8))                               OPTIONAL,
mimo-ParametersPerBand                             MIMO-ParametersPerBand                             OPTIONAL,
extendedCP                                          ENUMERATED {supported}                              OPTIONAL,
multipleTCI                                         ENUMERATED {supported}                              OPTIONAL,
bwp-WithoutRestriction                             ENUMERATED {supported}                              OPTIONAL,
bwp-SameNumerology                                 ENUMERATED {upto2, upto4}                            OPTIONAL,
bwp-DiffNumerology                                 ENUMERATED {upto4}                                  OPTIONAL,
crossCarrierScheduling-SameSCS                     ENUMERATED {supported}                              OPTIONAL,
pdsch-256QAM-FR2                                   ENUMERATED {supported}                              OPTIONAL,
pusch-256QAM                                        ENUMERATED {supported}                              OPTIONAL,
ue-PowerClass                                       ENUMERATED {pc1, pc2, pc3, pc4}                    OPTIONAL,
rateMatchingLTE-CRS                                 ENUMERATED {supported}                              OPTIONAL,
channelBWs-DL
  fr1
    scs-15kHz                                       BIT STRING (SIZE (10))                             OPTIONAL,
    scs-30kHz                                       BIT STRING (SIZE (10))                             OPTIONAL,
    scs-60kHz                                       BIT STRING (SIZE (10))                             OPTIONAL,
  },
  fr2
    scs-60kHz                                       BIT STRING (SIZE (3))                              OPTIONAL,
    scs-120kHz                                      BIT STRING (SIZE (3))                              OPTIONAL,
  }
}
channelBWs-UL                                       CHOICE {
  fr1
    scs-15kHz                                       BIT STRING (SIZE (10))                             OPTIONAL,
    scs-30kHz                                       BIT STRING (SIZE (10))                             OPTIONAL,
    scs-60kHz                                       BIT STRING (SIZE (10))                             OPTIONAL,
  },
  fr2
    scs-60kHz                                       BIT STRING (SIZE (3))                              OPTIONAL,
    scs-120kHz                                      BIT STRING (SIZE (3))                              OPTIONAL,
  }
}
...
[[
maxUplinkDutyCycle-PC2-FR1                          ENUMERATED {n60, n70, n80, n90, n100}             OPTIONAL
]],
[[
pucch-SpatialRelInfoMAC-CE                         ENUMERATED {supported}                             OPTIONAL,
powerBoosting-pi2BPSK                               ENUMERATED {supported}                             OPTIONAL
]],
[[
maxUplinkDutyCycle-FR2                              ENUMERATED {n15, n20, n25, n30, n40, n50, n60, n70, n80, n90, n100}   OPTIONAL
]],
[[
channelBWs-DL-v1590                                CHOICE {
  fr1
    SEQUENCE {

```

```

        scs-15kHz          BIT STRING (SIZE (16))          OPTIONAL,
        scs-30kHz          BIT STRING (SIZE (16))          OPTIONAL,
        scs-60kHz          BIT STRING (SIZE (16))          OPTIONAL
    },
    fr2                    SEQUENCE {
        scs-60kHz          BIT STRING (SIZE (8))          OPTIONAL,
        scs-120kHz         BIT STRING (SIZE (8))          OPTIONAL
    }
}
channelBWs-UL-v1590      CHOICE {
    fr1                    SEQUENCE {
        scs-15kHz          BIT STRING (SIZE (16))          OPTIONAL,
        scs-30kHz          BIT STRING (SIZE (16))          OPTIONAL,
        scs-60kHz          BIT STRING (SIZE (16))          OPTIONAL
    },
    fr2                    SEQUENCE {
        scs-60kHz          BIT STRING (SIZE (8))          OPTIONAL,
        scs-120kHz         BIT STRING (SIZE (8))          OPTIONAL
    }
}
}
]],
[[
asymmetricBandwidthCombinationSet BIT STRING (SIZE (1..32)) OPTIONAL
]],
[[
-- R1 10: NR-unlicensed
sharedSpectrumChAccessParamsPerBand-r16 SharedSpectrumChAccessParamsPerBand-r16 OPTIONAL,
-- R1 11-7b: Independent cancellation of the overlapping PUSCHs in an intra-band UL CA
cancelOverlappingPUSCH-r16          ENUMERATED {supported}          OPTIONAL,
-- R1 14-1: Multiple LTE-CRS rate matching patterns
multipleRateMatchingEUTRA-CRS-r16   SEQUENCE {
    maxNumberPatterns-r16            INTEGER (2..6),
    maxNumberNon-OverlapPatterns-r16 INTEGER (1..3)
}
-- R1 14-1a: Two LTE-CRS overlapping rate matching patterns within a part of NR carrier using 15 kHz overlapping with a LTE carrier
overlapRateMatchingEUTRA-CRS-r16    ENUMERATED {supported}          OPTIONAL,
-- R1 14-2: PDSCH Type B mapping of length 9 and 10 OFDM symbols
pdsch-MappingTypeB-Alt-r16          ENUMERATED {supported}          OPTIONAL,
-- R1 14-3: One slot periodic TRS configuration for FR1
oneSlotPeriodicTRS-r16              ENUMERATED {supported}          OPTIONAL,
olpc-SRS-Pos-r16                    OLPC-SRS-Pos-r16                OPTIONAL,
spatialRelationsSRS-Pos-r16          SpatialRelationsSRS-Pos-r16    OPTIONAL,
simulSRS-MIMO-TransWithinBand-r16    ENUMERATED {n2}              OPTIONAL,
channelBW-DL-IAB-r16                 CHOICE {
    fr1-100mhz                     SEQUENCE {
        scs-15kHz                    ENUMERATED {supported}          OPTIONAL,
        scs-30kHz                    ENUMERATED {supported}          OPTIONAL,
        scs-60kHz                    ENUMERATED {supported}          OPTIONAL
    },
    fr2-200mhz                     SEQUENCE {
        scs-60kHz                    ENUMERATED {supported}          OPTIONAL,
        scs-120kHz                   ENUMERATED {supported}          OPTIONAL
    }
}
}
]]
}

```

```

channelBW-UL-IAB-r16
  fr1-100mhz
    scs-15kHz
    scs-30kHz
    scs-60kHz
  },
  fr2-200mhz
    scs-60kHz
    scs-120kHz
  }
}
rasterShift7dot5-IAB-r16
ue-PowerClass-v1610
condHandover-r16
condHandoverFailure-r16
condHandoverTwoTriggerEvents-r16
condPSCellChange-r16
condPSCellChangeTwoTriggerEvents-r16
mpr-PowerBoost-FR2-r16

-- R1 11-9: Multiple active configured grant configurations for a BWP of a serving cell
activeConfiguredGrant-r16
maxNumberConfigsPerBWP-r16
maxNumberConfigsAllCC-r16
}
-- R1 11-9a: Joint release in a DCI for two or more configured grant Type 2 configurations for a given BWP of a serving cell
jointReleaseConfiguredGrantType2-r16
-- R1 12-2: Multiple SPS configurations
sps-r16
maxNumberConfigsPerBWP-r16
maxNumberConfigsAllCC-r16
}
-- R1 12-2a: Joint release in a DCI for two or more SPS configurations for a given BWP of a serving cell
jointReleaseSPS-r16
-- R1 13-19: Simultaneous positioning SRS and MIMO SRS transmission within a band across multiple CCs
simulSRS-TransWithinBand-r16
trs-AdditionalBandwidth-r16
handoverIntraF-IAB-r16
]]
}

-- TAG-RF-PARAMETERS-STOP
-- ASN1STOP

```

<b>RF-Parameters field descriptions</b>
<p><b><i>appliedFreqBandListFilter</i></b>            In this field the UE mirrors the <i>FreqBandList</i> that the NW provided in the capability enquiry, if any. The UE filtered the band combinations in the <i>supportedBandCombinationList</i> in accordance with this <i>appliedFreqBandListFilter</i>. The UE does not include this field if the UE capability is requested by E-UTRAN and the network request includes the field <i>eutra-nr-only</i> [10].</p>
<p><b><i>supportedBandCombinationList</i></b>            A list of band combinations that the UE supports for NR (and NR-DC, if requested). The <i>FeatureSetCombinationId</i>s in this list refer to the <i>FeatureSetCombination</i> entries in the <i>featureSetCombinations</i> list in the <i>UE-NR-Capability</i> IE. The UE does not include this field if the UE capability is requested by E-UTRAN and the network request includes the field <i>eutra-nr-only</i> [10].</p>
<p><b><i>supportedBandCombinationList-UplinkTxSwitch</i></b>            A list of band combinations that the UE supports dynamic uplink Tx switching for NR UL CA and SUL. The <i>FeatureSetCombinationId</i>s in this list refer to the <i>FeatureSetCombination</i> entries in the <i>featureSetCombinations</i> list in the <i>UE-NR-Capability</i> IE. The UE does not include this field if the UE capability is requested by E-UTRAN and the network request includes the field <i>eutra-nr-only</i> [10].</p>

## – *RF-ParametersMRDC*

The IE *RF-ParametersMRDC* is used to convey RF related capabilities for MR-DC.

### ***RF-ParametersMRDC* information element**

```

-- ASN1START
-- TAG-RF-PARAMETERSMRDC-START

RF-ParametersMRDC ::=
    supportedBandCombinationList      SEQUENCE {
        supportedBandCombinationList  BandCombinationList           OPTIONAL,
        appliedFreqBandListFilter     FreqBandList                OPTIONAL,
        ...
    },
    [[
        srs-SwitchingTimeRequested    ENUMERATED {true}          OPTIONAL,
        supportedBandCombinationList-v1540 BandCombinationList-v1540  OPTIONAL
    ]],
    [[
        supportedBandCombinationList-v1550 BandCombinationList-v1550  OPTIONAL
    ]],
    [[
        supportedBandCombinationList-v1560 BandCombinationList-v1560  OPTIONAL,
        supportedBandCombinationListNEDC-Only BandCombinationList      OPTIONAL
    ]],
    [[
        supportedBandCombinationList-v1570 BandCombinationList-v1570  OPTIONAL
    ]],
    [[
        supportedBandCombinationList-v1580 BandCombinationList-v1580  OPTIONAL
    ]],
    [[
        supportedBandCombinationList-v1590 BandCombinationList-v1590  OPTIONAL
    ]],
    [[
        supportedBandCombinationListNEDC-Only-v15a0 SEQUENCE {

```

```

supportedBandCombinationList-v1540      BandCombinationList-v1540      OPTIONAL,
supportedBandCombinationList-v1560      BandCombinationList-v1560      OPTIONAL,
supportedBandCombinationList-v1570      BandCombinationList-v1570      OPTIONAL,
supportedBandCombinationList-v1580      BandCombinationList-v1580      OPTIONAL,
supportedBandCombinationList-v1590      BandCombinationList-v1590      OPTIONAL
}
]],
[[
supportedBandCombinationList-v1610      BandCombinationList-v1610      OPTIONAL,
supportedBandCombinationListNEDC-Only-v1610 BandCombinationList-v1610      OPTIONAL,
supportedBandCombinationList-UplinkTxSwitch-r16 BandCombinationList-UplinkTxSwitch-r16 OPTIONAL
]]
}
-- TAG-RF-PARAMETERSMRDC-STOP
-- ASN1STOP

```

#### RF-ParametersMRDC field descriptions

##### **appliedFreqBandListFilter**

In this field the UE mirrors the *FreqBandList* that the NW provided in the capability enquiry, if any. The UE filtered the band combinations in the *supportedBandCombinationList* in accordance with this *appliedFreqBandListFilter*.

##### **supportedBandCombinationList**

A list of band combinations that the UE supports for (NG)EN-DC, or both (NG)EN-DC and NE-DC. The *FeatureSetCombinationIds* in this list refer to the *FeatureSetCombination* entries in the *featureSetCombinations* list in the *UE-MRDC-Capability* IE.

##### **supportedBandCombinationListNEDC-Only, supportedBandCombinationListNEDC-Only-v1610**

A list of band combinations that the UE supports only for NE-DC. The *FeatureSetCombinationIds* in this list refer to the *FeatureSetCombination* entries in the *featureSetCombinations* list in the *UE-MRDC-Capability* IE.

##### **supportedBandCombinationList-UplinkTxSwitch**

A list of band combinations that the UE supports dynamic UL Tx switching for (NG)EN-DC. The *FeatureSetCombinationIds* in this list refer to the *FeatureSetCombination* entries in the *featureSetCombinations* list in the *UE-MRDC-Capability* IE.

## – RLC-Parameters

The IE *RLC-Parameters* is used to convey capabilities related to RLC.

#### RLC-Parameters information element

```

-- ASN1START
-- TAG-RLC-PARAMETERS-START

RLC-Parameters ::= SEQUENCE {
  am-WithShortSN      ENUMERATED {supported}  OPTIONAL,
  um-WithShortSN      ENUMERATED {supported}  OPTIONAL,
  um-WithLongSN       ENUMERATED {supported}  OPTIONAL,
  ...,
  [[
  extendedT-PollRetransmit-r16  ENUMERATED {supported}  OPTIONAL,
  extendedT-StatusProhibit-r16  ENUMERATED {supported}  OPTIONAL
  ]]]

```



```

    ]]
  }
-- TAG-RLC-PARAMETERS-STOP
-- ASN1STOP

```

## – SDAP-Parameters

The IE *SDAP-Parameters* is used to convey capabilities related to SDAP.

### **SDAP-Parameters information element**

```

-- ASN1START
-- TAG-SDAP-PARAMETERS-START

SDAP-Parameters ::= SEQUENCE {
  as-ReflectiveQoS          ENUMERATED {true}          OPTIONAL,
  ...,
  [[
  sdap-QoS-IAB-r16         ENUMERATED {supported}     OPTIONAL,
  sdapHeaderIAB-r16       ENUMERATED {supported}     OPTIONAL
  ]]
}

-- TAG-SDAP-PARAMETERS-STOP
-- ASN1STOP

```

## – SidelinkParameters

The IE *SidelinkParameters* is used to convey capabilities related to NR and E-UTRA sidelink communications.

### **SidelinkParameters information element**

```

-- ASN1START
-- TAG-SIDELINKPARAMETERS-START

SidelinkParameters-r16 ::= SEQUENCE {
  sidelinkParametersNR-r16          SidelinkParametersNR-r16          OPTIONAL,
  sidelinkParametersEUTRA-r16      SidelinkParametersEUTRA-r16      OPTIONAL
}

SidelinkParametersNR-r16 ::= SEQUENCE {
  rlc-ParametersSidelink-r16        RLC-ParametersSidelink-r16        OPTIONAL,
  mac-ParametersSidelink-r16        MAC-ParametersSidelink-r16        OPTIONAL,
  fdd-Add-UE-Sidelink-Capabilities-r16  UE-SidelinkCapabilityAddXDD-Mode-r16  OPTIONAL,
  tdd-Add-UE-Sidelink-Capabilities-r16  UE-SidelinkCapabilityAddXDD-Mode-r16  OPTIONAL,
  supportedBandListSidelink-r16      SEQUENCE (SIZE (1..maxBands)) OF BandSidelink-r16  OPTIONAL,

```

```

}
...
SidelinkParametersEUTRA-r16 ::= SEQUENCE {
    sl-ParametersEUTRA1-r16          OCTET STRING          OPTIONAL,
    sl-ParametersEUTRA2-r16          OCTET STRING          OPTIONAL,
    sl-ParametersEUTRA3-r16          OCTET STRING          OPTIONAL,
    supportedBandListSidelinkEUTRA-r16 SEQUENCE (SIZE (1..maxBandsEUTRA)) OF BandSidelinkEUTRA-r16 OPTIONAL,
    ...
}

RLC-ParametersSidelink-r16 ::= SEQUENCE {
    am-WithLongSN-Sidelink-r16      ENUMERATED {supported}    OPTIONAL,
    um-WithLongSN-Sidelink-r16      ENUMERATED {supported}    OPTIONAL,
    ...
}

MAC-ParametersSidelink-r16 ::= SEQUENCE {
    mac-ParametersSidelinkCommon-r16 MAC-ParametersSidelinkCommon-r16    OPTIONAL,
    mac-ParametersSidelinkXDD-Diff-r16 MAC-ParametersSidelinkXDD-Diff-r16    OPTIONAL,
    ...
}

UE-SidelinkCapabilityAddXDD-Mode-r16 ::= SEQUENCE {
    mac-ParametersSidelinkXDD-Diff-r16      MAC-ParametersSidelinkXDD-Diff-r16    OPTIONAL
}

MAC-ParametersSidelinkCommon-r16 ::= SEQUENCE {
    lcp-RestrictionSidelink-r16            ENUMERATED {supported}    OPTIONAL,
    multipleConfiguredGrantsSidelink-r16   ENUMERATED {supported}    OPTIONAL,
    ...
}

MAC-ParametersSidelinkXDD-Diff-r16 ::= SEQUENCE {
    multiplesR-ConfigurationsSidelink-r16  ENUMERATED {supported}    OPTIONAL,
    logicalChannelSR-DelayTimerSidelink-r16 ENUMERATED {supported}    OPTIONAL,
    ...
}

BandSidelinkEUTRA-r16 ::=
    SEQUENCE {
        freqBandSidelinkEUTRA-r16          FreqBandIndicatorEUTRA,
        -- R1 15-7: Transmitting LTE sidelink mode 3 scheduled by NR Uu
        gnb-ScheduledMode3SidelinkEUTRA-r16 SEQUENCE {
            gnb-ScheduledMode3DelaySidelinkEUTRA-r16 ENUMERATED {ms0, ms0dot25, ms0dot5, ms0dot625, ms0dot75, ms1,
                ms1dot25, ms1dot5, ms1dot75, ms2, ms2dot5, ms3, ms4,
                ms5, ms6, ms8, ms10, ms20}
        }
        -- R1 15-9: Transmitting LTE sidelink mode 4 configured by NR Uu
        gnb-ScheduledMode4SidelinkEUTRA-r16 ENUMERATED {supported}    OPTIONAL
    }

BandSidelink-r16 ::= SEQUENCE {
    freqBandSidelink-r16          FreqBandIndicatorNR,
    --15-1

```

```

sl-Reception-r16
  harq-RxProcessSidelink-r16
  pscch-RxSidelink-r16
  scs-CP-PatternRxSidelink-r16
    fr1-r16
      scs-15kHz-r16
      scs-30kHz-r16
      scs-60kHz-r16
    },
    fr2-r16
      scs-60kHz-r16
      scs-120kHz-r16
  }
}
extendedCP-RxSidelink-r16
}
--15-2
sl-TransmissionModel-r16
  harq-TxProcessModeOneSidelink-r16
  scs-CP-PatternTxSidelinkModeOne-r16
    fr1-r16
      scs-15kHz-r16
      scs-30kHz-r16
      scs-60kHz-r16
    },
    fr2-r16
      scs-60kHz-r16
      scs-120kHz-r16
  }
},
extendedCP-TxSidelink-r16
harq-ReportOnPUCCH-r16
}
--15-4
sync-Sidelink-r16
  gNB-Sync-r16
  gNB-GNSS-UE-SyncWithPriorityOnGNB-ENB-r16
  gNB-GNSS-UE-SyncWithPriorityOnGNSS-r16
}
--15-10
sl-Tx-256QAM-r16
--15-11
psfch-FormatZeroSidelink-r16
  psfch-RxNumber
  psfch-TxNumber
}
--15-12
lowSE-64QAM-MCS-TableSidelink-r16
--15-15
enb-sync-Sidelink-r16
...
}
-- TAG-SIDELINKPARAMETERS-STOP

```

```

SEQUENCE {
  ENUMERATED {n16, n24, n32, n48, n64},
  ENUMERATED {value1, value2},
  CHOICE {
    SEQUENCE {
      BIT STRING (SIZE (16))
      BIT STRING (SIZE (16))
      BIT STRING (SIZE (16))
    }
    SEQUENCE {
      BIT STRING (SIZE (16))
      BIT STRING (SIZE (16))
    }
  }
}
ENUMERATED {supported}
}
}
SEQUENCE {
  ENUMERATED {n8, n16},
  CHOICE {
    SEQUENCE {
      BIT STRING (SIZE (16))
      BIT STRING (SIZE (16))
      BIT STRING (SIZE (16))
    }
    SEQUENCE {
      BIT STRING (SIZE (16))
      BIT STRING (SIZE (16))
    }
  }
}
ENUMERATED {supported}
ENUMERATED {supported}
}
}
SEQUENCE {
  ENUMERATED {supported}
  ENUMERATED {supported}
  ENUMERATED {supported}
}
}
ENUMERATED {supported}
}
SEQUENCE {
  ENUMERATED {n5, n15, n25, n32, n35, n45, n50, n64},
  ENUMERATED {n4, n8, n16}
}
}
ENUMERATED {supported}
}
ENUMERATED {supported}
}

```

```

-- TAG-SIDELINKPARAMETERS-STOP

```

```
-- ASN1STOP
```

### SidelinkParametersEUTRA field descriptions

#### *sl-ParametersEUTRA1, sl-ParametersEUTRA2, sl-ParametersEUTRA3*

This field includes IE of *SL-Parameters-v1430* (where *v2x-eNB-Scheduled-r14* and *V2X-SupportedBandCombination-r14* shall not be included), *SL-Parameters-v1530* (where *V2X-SupportedBandCombination-r1530* shall not be included) and *SL-Parameters-v1540* respectively defined in 36.331 [10]. It is used for reporting the per-UE capability for V2X sidelink communication.

## – SON-Parameters

The IE *SON-Parameters* contains SON related parameters.

### SON-Parameters information element

```
-- ASN1START
-- TAG-SON-PARAMETERS-START

SON-Parameters-r16 ::= SEQUENCE {
    rach-Report-r16      ENUMERATED {supported}    OPTIONAL,
    ...
}

-- TAG-SON-PARAMETERS-STOP
-- ASN1STOP
```

## – SpatialRelationsSRS-Pos

The IE *SpatialRelationsSRS-Pos* is used to convey spatial relation for SRS for positioning related parameters.

### SpatialRelationsSRS-Pos information element

```
-- ASN1START
-- TAG-SPATIALRELATIONSSRS-POS-START

SpatialRelationsSRS-Pos-r16 ::= SEQUENCE {
    spatialRelation-SRS-PosBasedOnSSB-Serving-r16    ENUMERATED {supported}    OPTIONAL,
    spatialRelation-SRS-PosBasedOnCSI-RS-Serving-r16    ENUMERATED {supported}    OPTIONAL,
    spatialRelation-SRS-PosBasedOnPRS-Serving-r16    ENUMERATED {supported}    OPTIONAL,
    spatialRelation-SRS-PosBasedOnSRS-r16            ENUMERATED {supported}    OPTIONAL,
    spatialRelation-SRS-PosBasedOnSSB-Neigh-r16      ENUMERATED {supported}    OPTIONAL,
    spatialRelation-SRS-PosBasedOnPRS-Neigh-r16      ENUMERATED {supported}    OPTIONAL
}

--TAG-SPATIALRELATIONSSRS-POS-STOP
-- ASN1STOP
```

## – SRS-SwitchingTimeNR

The IE *SRS-SwitchingTimeNR* is used to indicate the SRS carrier switching time supported by the UE for one NR band pair.

### **SRS-SwitchingTimeNR information element**

```
-- ASN1START
-- TAG-SRS-SWITCHINGTIMENR-START

SRS-SwitchingTimeNR ::= SEQUENCE {
    switchingTimeDL      ENUMERATED {n0us, n30us, n100us, n140us, n200us, n300us, n500us, n900us} OPTIONAL,
    switchingTimeUL      ENUMERATED {n0us, n30us, n100us, n140us, n200us, n300us, n500us, n900us} OPTIONAL
}

-- TAG-SRS-SWITCHINGTIMENR-STOP
-- ASN1STOP
```

## – SRS-SwitchingTimeEUTRA

The IE *SRS-SwitchingTimeEUTRA* is used to indicate the SRS carrier switching time supported by the UE for one E-UTRA band pair.

### **SRS-SwitchingTimeEUTRA information element**

```
-- ASN1START
-- TAG-SRS-SWITCHINGTIMEEUTRA-START

SRS-SwitchingTimeEUTRA ::= SEQUENCE {
    switchingTimeDL      ENUMERATED {n0, n0dot5, n1, n1dot5, n2, n2dot5, n3, n3dot5, n4, n4dot5, n5, n5dot5, n6, n6dot5, n7}
                                                                    OPTIONAL,
    switchingTimeUL      ENUMERATED {n0, n0dot5, n1, n1dot5, n2, n2dot5, n3, n3dot5, n4, n4dot5, n5, n5dot5, n6, n6dot5, n7}
                                                                    OPTIONAL
}

-- TAG-SRS-SWITCHINGTIMEEUTRA-STOP
-- ASN1STOP
```

## – SupportedBandwidth

The IE *SupportedBandwidth* is used to indicate the maximum channel bandwidth supported by the UE on one carrier of a band of a band combination.

### **SupportedBandwidth information element**

```
-- ASN1START
-- TAG-SUPPORTEDBANDWIDTH-START
```

```
SupportedBandwidth ::= CHOICE {
  fr1      ENUMERATED {mhz5, mhz10, mhz15, mhz20, mhz25, mhz30, mhz40, mhz50, mhz60, mhz80, mhz100},
  fr2      ENUMERATED {mhz50, mhz100, mhz200, mhz400}
}

-- TAG-SUPPORTEDBANDWIDTH-STOP
-- ASN1STOP
```

## – *UE-BasedPerfMeas-Parameters*

The IE *UE-BasedPerfMeas-Parameters* contains UE-based performance measurement parameters.

### ***UE-BasedPerfMeas-Parameters* information element**

```
-- ASN1START
-- TAG-UE-BASEDPERFMEAS-PARAMETERS-START

UE-BasedPerfMeas-Parameters-r16 ::= SEQUENCE {
  barometerMeasReport-r16      ENUMERATED {supported}          OPTIONAL,
  immMeasBT-r16                 ENUMERATED {supported}          OPTIONAL,
  immMeasWLAN-r16               ENUMERATED {supported}          OPTIONAL,
  loggedMeasBT-r16              ENUMERATED {supported}          OPTIONAL,
  loggedMeasurements-r16        ENUMERATED {supported}          OPTIONAL,
  loggedMeasWLAN-r16            ENUMERATED {supported}          OPTIONAL,
  orientationMeasReport-r16     ENUMERATED {supported}          OPTIONAL,
  speedMeasReport-r16           ENUMERATED {supported}          OPTIONAL,
  gnss-Location-r16             ENUMERATED {supported}          OPTIONAL,
  ulPDCP-Delay-r16             ENUMERATED {supported}          OPTIONAL,
  ...
}

-- TAG-UE-BASEDPERFMEAS-PARAMETERS-STOP
-- ASN1STOP
```

## – *UE-CapabilityRAT-ContainerList*

The IE *UE-CapabilityRAT-ContainerList* contains a list of radio access technology specific capability containers.

### ***UE-CapabilityRAT-ContainerList* information element**

```
-- ASN1START
-- TAG-UE-CAPABILITYRAT-CONTAINERLIST-START

UE-CapabilityRAT-ContainerList ::= SEQUENCE (SIZE (0..maxRAT-CapabilityContainers)) OF UE-CapabilityRAT-Container

UE-CapabilityRAT-Container ::= SEQUENCE {
  rat-Type
```

```

    ue-CapabilityRAT-Container          OCTET STRING
}
-- TAG-UE-CAPABILITYRAT-CONTAINERLIST-STOP
-- ASN1STOP

```

#### **UE-CapabilityRAT-ContainerList field descriptions**

##### **ue-CapabilityRAT-Container**

Container for the UE capabilities of the indicated RAT. The encoding is defined in the specification of each RAT:  
 For *rat-Type* set to *nr*: the encoding of UE capabilities is defined in *UE-NR-Capability*.  
 For *rat-Type* set to *eutra-nr*: the encoding of UE capabilities is defined in *UE-MRDC-Capability*.  
 For *rat-Type* set to *eutra*: the encoding of UE capabilities is defined in *UE-EUTRA-Capability* specified in TS 36.331 [10].  
 For *rat-Type* set to *utra-fdd*: the octet string contains the INTER RAT HANDOVER INFO message defined in TS 25.331 [45].

#### – **UE-CapabilityRAT-RequestList**

The IE *UE-CapabilityRAT-RequestList* is used to request UE capabilities for one or more RATs from the UE.

#### **UE-CapabilityRAT-RequestList information element**

```

-- ASN1START
-- TAG-UE-CAPABILITYRAT-REQUESTLIST-START

UE-CapabilityRAT-RequestList ::=      SEQUENCE (SIZE (1..maxRAT-CapabilityContainers)) OF UE-CapabilityRAT-Request

UE-CapabilityRAT-Request ::=          SEQUENCE {
    rat-Type                          RAT-Type,
    capabilityRequestFilter           OCTET STRING                OPTIONAL,  -- Need N
    ...
}

-- TAG-UE-CAPABILITYRAT-REQUESTLIST-STOP
-- ASN1STOP

```

#### **UE-CapabilityRAT-Request field descriptions**

##### **capabilityRequestFilter**

Information by which the network requests the UE to filter the UE capabilities.  
 For *rat-Type* set to *nr* or *eutra-nr*: the encoding of the *capabilityRequestFilter* is defined in *UE-CapabilityRequestFilterNR*.  
 For *rat-Type* set to *eutra*: the encoding of the *capabilityRequestFilter* is defined by *UECapabilityEnquiry* message defined in TS36.331 [10], in which *RAT-Type* in *UE-CapabilityRequest* includes only '*eutra*'.

##### **rat-Type**

The RAT type for which the NW requests UE capabilities.

– *UE-CapabilityRequestFilterCommon*

The IE *UE-CapabilityRequestFilterCommon* is used to request filtered UE capabilities. The filter is common for all capability containers that are requested.

***UE-CapabilityRequestFilterCommon* information element**

```
-- ASN1START
-- TAG-UE-CAPABILITYREQUESTFILTERCOMMON-START

UE-CapabilityRequestFilterCommon ::=
  mrdc-Request          SEQUENCE {
    omitEN-DC           ENUMERATED {true}          OPTIONAL,    -- Need N
    includeNR-DC        ENUMERATED {true}          OPTIONAL,    -- Need N
    includeNE-DC        ENUMERATED {true}          OPTIONAL,    -- Need N
  }
  ...,
  [[
    codebookTypeRequest-r16 SEQUENCE {
      type1-SinglePanel-r16  ENUMERATED {true}          OPTIONAL,    -- Need N
      type1-MultiPanel-r16   ENUMERATED {true}          OPTIONAL,    -- Need N
      type2-r16              ENUMERATED {true}          OPTIONAL,    -- Need N
      type2-PortSelection-r16 ENUMERATED {true}          OPTIONAL,    -- Need N
    }
    uplinkTxSwitchRequest-r16 ENUMERATED {true}        OPTIONAL,    -- Need N
  ]]
}

-- TAG-UE-CAPABILITYREQUESTFILTERCOMMON-STOP
-- ASN1STOP
```



<i>UE-CapabilityRequestFilterCommon field descriptions</i>
<p><b>codebookTypeRequest</b> Only if this field is present, the UE includes <i>SupportedCSI-RS-Resource</i> supported for the codebook type(s) requested within this field (i.e. type I single/multi-panel, type II and type II port selection) into <i>codebookVariantsList</i>, <i>codebookParametersPerBand</i> and <i>codebookParametersPerBC</i>. If this field is present and none of the codebook types is requested within this field (i.e. empty field), the UE includes <i>SupportedCSI-RS-Resource</i> supported for all codebook types into <i>codebookVariantsList</i>, <i>codebookParametersPerBand</i> and <i>codebookParametersPerBC</i>.</p>
<p><b>includeNE-DC</b> Only if this field is present, the UE supporting NE-DC shall indicate support for NE-DC in band combinations and include feature set combinations which are applicable to NE-DC. Band combinations supporting both NE-DC and (NG)EN-DC shall be included in <i>supportedBandCombinationList</i>, band combinations supporting only NE-DC shall be included in <i>supportedBandCombinationListNE-DC-Only</i>.</p>
<p><b>includeNR-DC</b> Only if this field is present, the UE supporting NR-DC shall indicate support for NR-DC in band combinations and include feature set combinations which are applicable to NR-DC.</p>
<p><b>omitEN-DC</b> Only if this field is present, the UE shall omit band combinations and feature set combinations which are only applicable to (NG)EN-DC.</p>
<p><b>uplinkTxSwitchRequest</b> Only if this field is present, the UE supporting dynamic UL Tx switching shall indicate support for UL Tx switching in band combinations which are applicable to inter-band UL CA, SUL and (NG)EN-DC.</p>

## – *UE-CapabilityRequestFilterNR*

The IE *UE-CapabilityRequestFilterNR* is used to request filtered UE capabilities.

### *UE-CapabilityRequestFilterNR* information element

```

-- ASN1START
-- TAG-UE-CAPABILITYREQUESTFILTERNR-START

UE-CapabilityRequestFilterNR ::=
    SEQUENCE {
        frequencyBandListFilter          FreqBandList          OPTIONAL,  -- Need N
        nonCriticalExtension              UE-CapabilityRequestFilterNR-v1540  OPTIONAL
    }

UE-CapabilityRequestFilterNR-v1540 ::=
    SEQUENCE {
        srs-SwitchingTimeRequest        ENUMERATED {true}      OPTIONAL,  -- Need N
        nonCriticalExtension              SEQUENCE {}           OPTIONAL
    }

-- TAG-UE-CAPABILITYREQUESTFILTERNR-STOP
-- ASN1STOP

```

## – *UE-MRDC-Capability*

The IE *UE-MRDC-Capability* is used to convey the UE Radio Access Capability Parameters for MR-DC, see TS 38.306 [26].

**UE-MRDC-Capability information element**

```

-- ASN1START
-- TAG-UE-MRDC-CAPABILITY-START

UE-MRDC-Capability ::=
    measAndMobParametersMRDC                SEQUENCE {
        phy-ParametersMRDC-v1530            MeasAndMobParametersMRDC                OPTIONAL,
        rf-ParametersMRDC                    Phy-ParametersMRDC                    OPTIONAL,
        generalParametersMRDC                RF-ParametersMRDC,
        fdd-Add-UE-MRDC-Capabilities         GeneralParametersMRDC-XDD-Diff         OPTIONAL,
        tdd-Add-UE-MRDC-Capabilities         UE-MRDC-CapabilityAddXDD-Mode         OPTIONAL,
        fr1-Add-UE-MRDC-Capabilities         UE-MRDC-CapabilityAddXDD-Mode         OPTIONAL,
        fr2-Add-UE-MRDC-Capabilities         UE-MRDC-CapabilityAddFRX-Mode         OPTIONAL,
        featureSetCombinations              UE-MRDC-CapabilityAddFRX-Mode         OPTIONAL,
        pdcp-ParametersMRDC-v1530           SEQUENCE (SIZE (1..maxFeatureSetCombinations)) OF FeatureSetCombination OPTIONAL,
        lateNonCriticalExtension             PDCP-ParametersMRDC                   OPTIONAL,
        nonCriticalExtension                  OCTET STRING                           OPTIONAL,
    }
    UE-MRDC-Capability-v1560                OPTIONAL

UE-MRDC-Capability-v1560 ::=
    receivedFilters                          OCTET STRING (CONTAINING UECapabilityEnquiry-v1560-IEs) OPTIONAL,
    measAndMobParametersMRDC-v1560          MeasAndMobParametersMRDC-v1560        OPTIONAL,
    fdd-Add-UE-MRDC-Capabilities-v1560     UE-MRDC-CapabilityAddXDD-Mode-v1560   OPTIONAL,
    tdd-Add-UE-MRDC-Capabilities-v1560     UE-MRDC-CapabilityAddXDD-Mode-v1560   OPTIONAL,
    nonCriticalExtension                     UE-MRDC-Capability-v1610              OPTIONAL

UE-MRDC-Capability-v1610 ::=
    measAndMobParametersMRDC-v1610         MeasAndMobParametersMRDC-v1610        OPTIONAL,
    generalParametersMRDC-v1610            GeneralParametersMRDC-v1610            OPTIONAL,
    pdcp-ParametersMRDC-v1610              PDCP-ParametersMRDC-v1610             OPTIONAL,
    nonCriticalExtension                     SEQUENCE {}                             OPTIONAL

UE-MRDC-CapabilityAddXDD-Mode ::=
    measAndMobParametersMRDC-XDD-Diff      MeasAndMobParametersMRDC-XDD-Diff     OPTIONAL,
    generalParametersMRDC-XDD-Diff         GeneralParametersMRDC-XDD-Diff         OPTIONAL

UE-MRDC-CapabilityAddXDD-Mode-v1560 ::=
    measAndMobParametersMRDC-XDD-Diff-v1560 MeasAndMobParametersMRDC-XDD-Diff-v1560 OPTIONAL

UE-MRDC-CapabilityAddFRX-Mode ::=
    measAndMobParametersMRDC-FRX-Diff      MeasAndMobParametersMRDC-FRX-Diff     OPTIONAL

GeneralParametersMRDC-XDD-Diff ::=
    splitSRB-WithOneUL-Path                ENUMERATED {supported}                 OPTIONAL,
    splitDRB-withUL-Both-MCG-SCG          ENUMERATED {supported}                 OPTIONAL,
    srb3                                    ENUMERATED {supported}                 OPTIONAL,
    v2x-EUTRA                              ENUMERATED {supported}                 OPTIONAL

```

```

}
...
}
GeneralParametersMRDC-v1610 ::= SEQUENCE {
    flc-OverEUTRA-r16          ENUMERATED {supported}          OPTIONAL
}
-- TAG-UE-MRDC-CAPABILITY-STOP
-- ASN1STOP

```

### **UE-MRDC-Capability field descriptions**

#### **featureSetCombinations**

A list of *FeatureSetCombination*:s for *supportedBandCombinationList* and *supportedBandCombinationListNEDC-Only* in *UE-MRDC-Capability*. The *FeatureSetDownlink*:s and *FeatureSetUplink*:s referred to from these *FeatureSetCombination*:s are defined in the *featureSets* list in *UE-NR-Capability*.

## – UE-NR-Capability

The IE *UE-NR-Capability* is used to convey the NR UE Radio Access Capability Parameters, see TS 38.306 [26].

### **UE-NR-Capability information element**

```

-- ASN1START
-- TAG-UE-NR-CAPABILITY-START

UE-NR-Capability ::=
    accessStratumRelease      AccessStratumRelease,
    pdcp-Parameters           PDCP-Parameters,
    rlc-Parameters            RLC-Parameters          OPTIONAL,
    mac-Parameters            MAC-Parameters          OPTIONAL,
    phy-Parameters            Phy-Parameters,
    rf-Parameters             RF-Parameters,
    measAndMobParameters      MeasAndMobParameters    OPTIONAL,
    fdd-Add-UE-NR-Capabilities UE-NR-CapabilityAddXDD-Mode  OPTIONAL,
    tdd-Add-UE-NR-Capabilities UE-NR-CapabilityAddXDD-Mode  OPTIONAL,
    fr1-Add-UE-NR-Capabilities UE-NR-CapabilityAddFRX-Mode  OPTIONAL,
    fr2-Add-UE-NR-Capabilities UE-NR-CapabilityAddFRX-Mode  OPTIONAL,
    featureSets                FeatureSets            OPTIONAL,
    featureSetCombinations     SEQUENCE (SIZE (1..maxFeatureSetCombinations)) OF FeatureSetCombination  OPTIONAL,

    lateNonCriticalExtension   OCTET STRING          OPTIONAL,
    nonCriticalExtension        UE-NR-Capability-v1530  OPTIONAL
}

UE-NR-Capability-v1530 ::=
    fdd-Add-UE-NR-Capabilities-v1530 UE-NR-CapabilityAddXDD-Mode-v1530  OPTIONAL,
    tdd-Add-UE-NR-Capabilities-v1530 UE-NR-CapabilityAddXDD-Mode-v1530  OPTIONAL,
    dummy                            ENUMERATED {supported}          OPTIONAL,
    interRAT-Parameters              InterRAT-Parameters          OPTIONAL,
    inactiveState                     ENUMERATED {supported}          OPTIONAL,

```



```

UE-NR-CapabilityAddXDD-Mode ::= SEQUENCE {
    phy-ParametersXDD-Diff          Phy-ParametersXDD-Diff          OPTIONAL,
    mac-ParametersXDD-Diff          MAC-ParametersXDD-Diff          OPTIONAL,
    measAndMobParametersXDD-Diff    MeasAndMobParametersXDD-Diff    OPTIONAL
}

UE-NR-CapabilityAddXDD-Mode-v1530 ::= SEQUENCE {
    eutra-ParametersXDD-Diff        EUTRA-ParametersXDD-Diff
}

UE-NR-CapabilityAddFRX-Mode ::= SEQUENCE {
    phy-ParametersFRX-Diff          Phy-ParametersFRX-Diff          OPTIONAL,
    measAndMobParametersFRX-Diff    MeasAndMobParametersFRX-Diff    OPTIONAL
}

UE-NR-CapabilityAddFRX-Mode-v1540 ::= SEQUENCE {
    ims-ParametersFRX-Diff          IMS-ParametersFRX-Diff          OPTIONAL
}

UE-NR-CapabilityAddFRX-Mode-v1610 ::= SEQUENCE {
    powSav-ParametersFRX-Diff-r16   PowSav-ParametersFRX-Diff-r16   OPTIONAL,
    mac-ParametersFRX-Diff-r16      MAC-ParametersFRX-Diff-r16      OPTIONAL
}

BAP-Parameters-r16 ::= SEQUENCE {
    flowControlBH-RLC-ChannelBased-r16  ENUMERATED {supported}          OPTIONAL,
    flowControlRouting-ID-Based-r16      ENUMERATED {supported}          OPTIONAL
}

-- TAG-UE-NR-CAPABILITY-STOP
-- ASN1STOP

```

#### **UE-NR-Capability field descriptions**

##### **featureSetCombinations**

A list of *FeatureSetCombination*:s for *supportedBandCombinationList* in *UE-NR-Capability*. The *FeatureSetDownlink*:s and *FeatureSetUplink*:s referred to from these *FeatureSetCombination*:s are defined in the *featureSets* list in *UE-NR-Capability*.

#### **UE-NR-Capability-v1540 field descriptions**

##### **fr1-fr2-Add-UE-NR-Capabilities**

This instance of *UE-NR-CapabilityAddFRX-Mode* does not include any other fields than *csi-RS-IM-ReceptionForFeedback*/ *csi-RS-ProcFrameworkForSRS*/ *csi-ReportFramework*.

#### – *SharedSpectrumChAccessParamsPerBand*

The IE *SharedSpectrumChAccessParamsPerBand* is used to convey shared channel access related parameters specific for a certain frequency band (not per feature set or band combination).

**SharedSpectrumChAccessParamsPerBand information element**

```
-- ASN1START
-- TAG-SHAREDSPECTRUMCHACCESSPARAMSPERBAND-START
```

```
SharedSpectrumChAccessParamsPerBand-r16 ::= SEQUENCE {
    -- R1 10-1: UL channel access for dynamic channel access mode
    ul-DynamicChAccess-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-1a: UL channel access for semi-static channel access mode
    ul-Semi-StaticChAccess-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-2: SSB-based RRM for dynamic channel access mode
    ssb-RRM-DynamicChAccess-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-2a: SSB-based RRM for semi-static channel access mode
    ssb-RRM-Semi-StaticChAccess-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-2b: MIB reading on unlicensed cell
    mib-Acquisition-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-2c: SSB-based RLM for dynamic channel access mode
    ssb-RLM-DynamicChAccess-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-2d: SSB-based RLM for semi-static channel access mode
    ssb-RLM-Semi-StaticChAccess-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-2e: SIB1 reception on unlicensed cell
    sibil-Acquisition-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-2f: Support monitoring of extended RAR window
    extendedRAR-Window-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-2g: SSB-based BFD/CBD for dynamic channel access mode
    ssb-BFD-CBD-dynamicChannelAccess-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-2h: SSB-based BFD/CBD for semi-static channel access mode
    ssb-BFD-CBD-semi-staticChannelAccess-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-2i: CSI-RS-based BFD/CBD for NR-U
    csi-RS-BFD-CBD-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-7: UL channel access for 10 MHz SCell
    ul-ChannelBW-SCell-10mhz-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-10: RSSI and channel occupancy measurement and reporting
    rssi-ChannelOccupancyReporting-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-11: SRS starting position at any OFDM symbol in a slot
    srs-StartAnyOFDM-Symbol-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-20: Support search space set configuration with freqMonitorLocation-r16
    searchSpaceFreqMonitorLocation-r16 INTEGER (1..5) OPTIONAL,
    -- R1 10-20a: Support coreset configuration with rb-Offset
    coreset-RB-Offset-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-23: CGI reading on unlicensed cell for ANR functionality
    cgi-Acquisition-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-25: Enable configured UL transmissions when DCI 2_0 is configured but not detected
    configuredUL-Tx-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-27: Wideband PRACH
    prach-Wideband-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-29: Support available RB set indicator field in DCI 2_0
    dci-AvailableRB-Set-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-30: Support channel occupancy duration indicator field in DCI 2_0
    dci-ChOccupancyDuration-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-8: Type B PDSCH length {3, 5, 6, 8, 9, 10, 11, 12, 13} without DMRS shift due to CRS collision
    typeB-PDSCH-length-r16 ENUMERATED {supported} OPTIONAL,
    -- R1 10-9: Search space set group switching with explicit DCI 2_0 bit field trigger or with implicit PDCCH decoding with DCI 2_0 monitoring
```

```

searchSpaceSetGroupSwitchingwithDCI-r16          ENUMERATED {supported}          OPTIONAL,
-- R1 10-9b: Search space set group switching with implicit PDCCH decoding without DCI 2_0 monitoring FFS:per band or per UE
searchSpaceSetGroupSwitchingwithoutDCI-r16       ENUMERATED {supported}          OPTIONAL,
-- R1 10-9d: Support Search space set group switching capability 2
searchSpaceSetGroupSwitchingcapability2-r16      ENUMERATED {supported}          OPTIONAL,
-- R1 10-14: Non-numerical PDSCH to HARQ-ACK timing
non-numericalPDSCH-HARQ-timing-r16              ENUMERATED {supported}          OPTIONAL,
-- R1 10-15: Enhanced dynamic HARQ codebook
enhancedDynamicHARQ-codebook-r16                 ENUMERATED {supported}          OPTIONAL,
-- R1 10-16: One-shot HARQ ACK feedback
oneShotHARQ-feedback-r16                         ENUMERATED {supported}          OPTIONAL,
-- R1 10-17: Multi-PUSCH UL grant
multiPUSCH-UL-grant-r16                          ENUMERATED {supported}          OPTIONAL,
-- R1 10-26: CSI-RS based RLM for NR-U
csi-RS-RLM-r16                                   ENUMERATED {supported}          OPTIONAL,
-- R1 10-26a: CSI-RS based RRM for NR-U
csi-RS-RRM-r16                                   ENUMERATED {supported}          OPTIONAL,
-- R1 10-31: Support of P/SP-CSI-RS reception with CSI-RS-ValidationWith-DCI-r16 configured
periodicAndSemi-PersistentCSI-RS-r16            ENUMERATED {supported}          OPTIONAL,
-- R1 10-3: PRB interlace mapping for PUSCH
pusch-PRB-interlace-r16                          ENUMERATED {supported}          OPTIONAL,
-- R1 10-3a: PRB interlace mapping for PUCCH
pucch-F0-F1-PRB-Interlace-r16                   ENUMERATED {supported}          OPTIONAL,
-- R1 10-12: OCC for PRB interlace mapping for PF2 and PF3
occ-PRB-PF2-PF3-r16                              ENUMERATED {supported}          OPTIONAL,
-- R1 10-13a: Extended CP range of more than one symbol for CG-PUSCH
extCP-rangeCG-PUSCH-r16                          ENUMERATED {supported}          OPTIONAL,
-- R1 10-18: Configured grant with retransmission in CG resources
configuredGrantWithReTx-r16                      ENUMERATED {supported}          OPTIONAL,
-- R1 10-21a: Support using ED threshold given by gNB for UL to DL COT sharing
ed-Threshold-r16                                 ENUMERATED {supported}          OPTIONAL,
-- R1 10-21b: Support UL to DL COT sharing
ul-DL-COT-Sharing-r16                            ENUMERATED {supported}          OPTIONAL,
-- R1 10-24: CG-UCI multiplexing with HARQ ACK
mux-CG-UCI-HARQ-ACK-r16                          ENUMERATED {supported}          OPTIONAL,
-- R1 10-28: Configured grant with Rel-16 enhanced resource configuration
cg-resourceConfig-r16                            ENUMERATED {supported}          OPTIONAL
}

-- TAG-SHAREDSPECTRUMCHACCESSPARAMSPERBAND-STOP
-- ASN1STOP

```

## 6.3.4 Other information elements

### – *AbsoluteTimeInfo*

The IE *AbsoluteTimeInfo* indicates an absolute time in a format YY-MM-DD HH:MM:SS and using BCD encoding. The first/ leftmost bit of the bit string contains the most significant bit of the most significant digit of the year and so on.

#### ***AbsoluteTimeInfo* information element**

```
-- ASN1START
-- TAG-ABSOLUTETIMEINFO-START

AbsoluteTimeInfo-r16 ::= BIT STRING (SIZE (48))

-- TAG-ABSOLUTETIMEINFO-STOP
-- ASN1STOP
```

### – *AreaConfiguration*

The *AreaConfiguration* indicates area for which UE is requested to perform measurement logging. If not configured, measurement logging is not restricted to specific cells or tracking areas but applies as long as the RPLMN is contained in *plmn-IdentityList* stored in *VarLogMeasReport*.

#### ***AreaConfiguration* information element**

```
-- ASN1START
-- TAG-AREACONFIGURATION-START

AreaConfiguration-r16 ::= SEQUENCE {
    areaConfig-r16           AreaConfig-r16,
    interFreqTargetList-r16 SEQUENCE(SIZE (1..maxFreq)) OF InterFreqTargetInfo-r16 OPTIONAL -- Need R
}

AreaConfig-r16 ::= CHOICE {
    cellGlobalIdList-r16      CellGlobalIdList-r16,
    trackingAreaCodeList-r16  TrackingAreaCodeList-r16,
    trackingAreaIdentityList-r16 TrackingAreaIdentityList-r16
}

InterFreqTargetInfo-r16 ::= SEQUENCE {
    dl-CarrierFreq           ARFCN-ValueNR,
    cellList                 SEQUENCE (SIZE (1..32)) OF PhysCellId OPTIONAL
}

CellGlobalIdList-r16 ::= SEQUENCE (SIZE (1..32)) OF CGI-Info-Logging-r16

TrackingAreaCodeList-r16 ::= SEQUENCE (SIZE (1..8)) OF TrackingAreaCode

TrackingAreaIdentityList-r16 ::= SEQUENCE (SIZE (1..8)) OF TrackingAreaIdentity-r16
```



```

TrackingAreaIdentity-r16 ::= SEQUENCE {
    plmn-Identity-r16          PLMN-Identity,
    trackingAreaCode-r16      TrackingAreaCode
}

-- TAG-AREACONFIGURATION-STOP
-- ASN1STOP

```

#### AreaConfiguration field descriptions

##### **InterFreqTargetInfo**

If configured, it indicates the frequency for which UE is requested to perform measurement logging for neighbour cells. UE should perform measurement logging for the frequency in SIB4 of the current serving cell whose DL-carrierfrequency is included in the InterFreqTargetList. If not configured, the UE should perform measurement logging for all the neighbour cells.

## – *BT-NameList*

The IE *BT-NameList* is used to indicate the names of the Bluetooth beacon which the UE is configured to measure.

#### **BT-NameList information element**

```

-- ASN1START
-- TAG-BTNAMELIST-START

BT-NameList-r16 ::= SEQUENCE (SIZE (1..maxBT-Name-r16)) OF BT-Name-r16

BT-Name-r16 ::= OCTET STRING (SIZE (1..248))

-- TAG-BTNAMELIST-STOP
-- ASN1STOP

```

#### **BT-NameList field descriptions**

##### **bt-Name**

If configured, the UE only performs Bluetooth measurements according to the names identified. For each name, it refers to LOCAL NAME defined in Bluetooth specification [51].

## – *EUTRA-AllowedMeasBandwidth*

The IE *EUTRA-AllowedMeasBandwidth* is used to indicate the maximum allowed measurement bandwidth on a carrier frequency as defined by the parameter Transmission Bandwidth Configuration "N<sub>RB</sub>" in TS 36.104 [33]. The values *mbw6*, *mbw15*, *mbw25*, *mbw50*, *mbw75*, *mbw100* indicate 6, 15, 25, 50, 75 and 100 resource blocks, respectively.

***EUTRA-AllowedMeasBandwidth* information element**

```

-- ASN1START
-- TAG-EUTRA-ALLOWEDMEASBANDWIDTH-START

EUTRA-AllowedMeasBandwidth ::=          ENUMERATED {mbw6, mbw15, mbw25, mbw50, mbw75, mbw100}

-- TAG-EUTRA-ALLOWEDMEASBANDWIDTH-STOP
-- ASN1STOP

```

***EUTRA-MBSFN-SubframeConfigList***

The IE *EUTRA-MBSFN-SubframeConfigList* is used to define an E-UTRA MBSFN subframe pattern (for the purpose of NR rate matching).

***EUTRA-MBSFN-SubframeConfigList* information element**

```

-- ASN1START
-- TAG-EUTRA-MBSFN-SUBFRAMECONFIGLIST-START

EUTRA-MBSFN-SubframeConfigList ::= SEQUENCE (SIZE (1..maxMBSFN-Allocations)) OF EUTRA-MBSFN-SubframeConfig

EUTRA-MBSFN-SubframeConfig ::= SEQUENCE {
    radioframeAllocationPeriod      ENUMERATED {n1, n2, n4, n8, n16, n32},
    radioframeAllocationOffset      INTEGER (0..7),
    subframeAllocation1             CHOICE {
        oneFrame                    BIT STRING (SIZE(6)),
        fourFrames                  BIT STRING (SIZE(24))
    },
    subframeAllocation2             CHOICE {
        oneFrame                    BIT STRING (SIZE(2)),
        fourFrames                  BIT STRING (SIZE(8))
    }
    ...
}
OPTIONAL, -- Need R

-- TAG-EUTRA-MBSFN-SUBFRAMECONFIGLIST-STOP
-- ASN1STOP

```

<i>EUTRA-MBSFN-SubframeConfig</i> field descriptions
<b>radioframeAllocationOffset</b> Field as defined in <i>MBSFN-SubframeConfig</i> in TS 36.331 [10].
<b>radioframeAllocationPeriod</b> Field as defined in <i>MBSFN-SubframeConfig</i> in TS 36.331 [10], where <i>SFN</i> refers to the SFN of the NR serving cell.
<b>subframeAllocation1</b> Field as defined in <i>MBSFN-SubframeConfig</i> in TS 36.331 [10], where the UE assumes the duplex mode (FDD or TDD) of the NR cell for which the <i>E-UTRA-MBSFN-SubframeConfig</i> is provided.
<b>subframeAllocation2</b> Field as defined in <i>MBSFN-SubframeConfig-v1430</i> in TS 36.331 [10], where the UE assumes the duplex mode (FDD or TDD) of the NR cell for which the <i>E-UTRA-MBSFN-SubframeConfig</i> is provided.

## – *EUTRA-MultiBandInfoList*

The IE *EUTRA-MultiBandInfoList* indicates the list of frequency bands in addition to the band represented by *CarrierFreq* for which cell reselection parameters are common, and a list of *additionalPmax* and *additionalSpectrumEmission*.

### *EUTRA-MultiBandInfoList* information element

```
-- ASN1START
-- TAG-EUTRA-MULTIBANDINFOLIST-START

EUTRA-MultiBandInfoList ::=      SEQUENCE (SIZE (1..maxMultiBands)) OF EUTRA-MultiBandInfo

EUTRA-MultiBandInfo ::=          SEQUENCE {
    eutra-FreqBandIndicator      FreqBandIndicatorEUTRA,
    eutra-NS-PmaxList            EUTRA-NS-PmaxList                OPTIONAL  -- Need R
}

-- TAG-EUTRA-MULTIBANDINFOLIST-STOP
-- ASN1STOP
```

## – *EUTRA-NS-PmaxList*

The IE *EUTRA-NS-PmaxList* concerns a list of *additionalPmax* and *additionalSpectrumEmission*, as defined in TS 36.101 [22], table 6.2.4-1 for UEs neither in CE nor BL UEs and TS 36.101 [22], table 6.2.4E-1 for UEs in CE or BL UEs, for a given frequency band.

### *EUTRA-NS-PmaxList* information element

```
-- ASN1START
-- TAG-EUTRA-NS-PMAXLIST-START

EUTRA-NS-PmaxList ::=          SEQUENCE (SIZE (1..maxEUTRA-NS-Pmax)) OF EUTRA-NS-PmaxValue

EUTRA-NS-PmaxValue ::=        SEQUENCE {
```

```

    additionalPmax                INTEGER (-30..33)                OPTIONAL, -- Need R
    additionalSpectrumEmission    INTEGER (1..288)                OPTIONAL  -- Need R
}

-- TAG-EUTRA-NS-PMAXLIST-STOP
-- ASN1STOP

```

## – EUTRA-PhysCellId

The IE *EUTRA-PhysCellId* is used to indicate the physical layer identity of the cell, as defined in TS 36.211 [31].

### EUTRA-PhysCellId information element

```

-- ASN1START
-- TAG-EUTRA-PHYSCELLID-START

EUTRA-PhysCellId ::=                INTEGER (0..503)

-- TAG-EUTRA-PHYSCELLID-STOP
-- ASN1STOP

```

## – EUTRA-PhysCellIdRange

The IE *EUTRA-PhysCellIdRange* is used to encode either a single or a range of physical cell identities. The range is encoded by using a *start* value and by indicating the number of consecutive physical cell identities (including *start*) in the range. For fields comprising multiple occurrences of *EUTRA-PhysCellIdRange*, NW may configure overlapping ranges of physical cell identities.

### EUTRA-PhysCellIdRange information element

```

-- ASN1START
-- TAG-EUTRA-PHYSCELLIDRANGE-START

EUTRA-PhysCellIdRange ::=          SEQUENCE {
    start                EUTRA-PhysCellId,
    range                ENUMERATED {n4, n8, n12, n16, n24, n32, n48, n64, n84, n96,
                                     n128, n168, n252, n504, spare2, spare1}
}

-- TAG-EUTRA-PHYSCELLIDRANGE-STOP
-- ASN1STOP

```

## – *EUTRA-PresenceAntennaPort1*

The IE *EUTRA-PresenceAntennaPort1* is used to indicate whether all the neighbouring cells use Antenna Port 1. When set to *true*, the UE may assume that at least two cell-specific antenna ports are used in all neighbouring cells.

### ***EUTRA-PresenceAntennaPort1* information element**

```
-- ASN1START
-- TAG-EUTRA-PRESENCEANTENNA-PORT1-START

EUTRA-PresenceAntennaPort1 ::=          BOOLEAN

-- TAG-EUTRA-PRESENCEANTENNA-PORT1-STOP
-- ASN1STOP
```

## – *EUTRA-Q-OffsetRange*

The IE *EUTRA-Q-OffsetRange* is used to indicate a cell, or frequency specific offset to be applied when evaluating triggering conditions for measurement reporting. The value in dB. Value *dB-24* corresponds to -24 dB, value *dB-22* corresponds to -22 dB and so on.

### ***EUTRA-Q-OffsetRange* information element**

```
-- ASN1START
-- TAG-EUTRA-Q-OFFSETRANGE-START

EUTRA-Q-OffsetRange ::=          ENUMERATED {
    dB-24, dB-22, dB-20, dB-18, dB-16, dB-14,
    dB-12, dB-10, dB-8, dB-6, dB-5, dB-4, dB-3,
    dB-2, dB-1, dB0, dB1, dB2, dB3, dB4, dB5,
    dB6, dB8, dB10, dB12, dB14, dB16, dB18,
    dB20, dB22, dB24}

-- TAG-EUTRA-Q-OFFSETRANGE-STOP
-- ASN1STOP
```

## – *IAB-IP-Address*

The IE *IAB-IP-Address* is used to indicate the IP address/prefix.

### ***IAB-IP-Address* information element**

```
-- ASN1START
-- TAG-IABIPADDRESS-START

IAB-IP-Address-r16 ::= CHOICE {
    ipv4-Address-r16          BIT STRING (SIZE(32)),
```

```

    ipv6-Address-r16                BIT STRING (SIZE(128)),
    ipv6-Prefix-r16                 BIT STRING (SIZE(64)),
    ...
}
-- TAG-IABIPADDRESS-STOP
-- ASN1STOP

```

<i>IAB-IP-Address</i> field descriptions
<b><i>IPv4-Address</i></b> This field is used to provide the allocated IPv4 address.
<b><i>IPv6-Address</i></b> This field is used to provide the allocated IPv6 address.
<b><i>IPv6-Prefix</i></b> This field is used to provide the allocated IPv6 prefix.

### – *IAB-IP-AddressIndex*

The IE *IAB-IP-AddressIndex* is used to identify a configuration of an IP address.

#### *IAB-IP-AddressIndex* information element

```

-- ASN1START
-- TAG-IABIPADDRESSINDEX-START

IAB-IP-AddressIndex-r16 ::= INTEGER (1..maxIAB-IP-Address-r16)

-- TAG-IABIPADDRESSINDEX-STOP
-- ASN1STOP

```

### – *IAB-IP-Usage*

The IE *IAB-IP-Usage* is used to indicate the usage of the assigned IP address/prefix.

#### *IAB-IP-Usage* information element

```

-- ASN1START
-- TAG-IAB-IP-USAGE-START

IAB-IP-Usage-r16 ::= ENUMERATED {f1-c, f1-U, non-F1, spare}

-- TAG-IAB-IP-USAGE-STOP
-- ASN1STOP

```

## – *LoggingDuration*

The *LoggingDuration* indicates the duration for which UE is requested to perform measurement logging. Value min10 corresponds to 10 minutes, value min20 corresponds to 20 minutes and so on.

### ***LoggingDuration* information element**

```
-- ASN1START
-- TAG-LOGGINGDURATION-START

LoggingDuration-r16 ::= ENUMERATED {
    min10, min20, min40, min60, min90, min120, spare2, spare1}

-- TAG-LOGGINGDURATION-STOP
-- ASN1STOP
```

## – *LoggingInterval*

The *LoggingInterval* indicates the periodicity for logging measurement results. Value ms1280 corresponds to 1.28s, value ms2560 corresponds to 2.56s and so on. Value infinity means it is equal to the configured value of the *LoggingDuration* IE.

### ***LoggingInterval* information element**

```
-- ASN1START
-- TAG-LOGGINGINTERVAL-START

LoggingInterval-r16 ::= ENUMERATED {
    ms320, ms640, ms1280, ms2560, ms5120, ms10240, ms20480,
    ms30720, ms40960, ms61440 , infinity}

-- TAG-LOGGINGINTERVAL-STOP
-- ASN1STOP
```

## – *LogMeasResultListBT*

The IE *LogMeasResultListBT* covers measured results for Bluetooth.

### ***LogMeasResultListBT* information element**

```
-- ASN1START
-- TAG-LOGMEASRESULTLISTBT-START

LogMeasResultListBT-r16 ::= SEQUENCE (SIZE (1..maxBT-IdReport-r16)) OF LogMeasResultBT-r16

LogMeasResultBT-r16 ::= SEQUENCE {
    bt-Addr-r16          BIT STRING (SIZE (48)),
```

```

    rssi-BT-r16                INTEGER (-128..127)    OPTIONAL,
    ...
}
-- TAG-LOGMEASRESULTLISTBT-STOP
-- ASN1STOP

```

<i>LogMeasResultListBT</i> field descriptions
<b>bt-Addr</b> This field indicates the Bluetooth public address of the Bluetooth beacon as defined in TS 37.355 [49].
<b>rssi-BT</b> This field provides the beacon received signal strength indicator (RSSI) in dBm as defined in TS 37.355 [49].

## – *LogMeasResultListWLAN*

The IE *LogMeasResultListWLAN* covers measured results for WLAN.

### *LogMeasResultListWLAN* information element

```

-- ASN1START
-- TAG-LOGMEASRESULTLISTWLAN-START

LogMeasResultListWLAN-r16 ::= SEQUENCE (SIZE (1..maxWLAN-Id-Report-r16)) OF LogMeasResultWLAN-r16

LogMeasResultWLAN-r16 ::= SEQUENCE {
    wlan-Identifiers-r16      WLAN-Identifiers-r16,
    rssiWLAN-r16              WLAN-RSSI-Range-r16          OPTIONAL,
    rtt-WLAN-r16              WLAN-RTT-r16                  OPTIONAL,
    ...
}

WLAN-Identifiers-r16 ::= SEQUENCE {
    ssid-r16                  OCTET STRING (SIZE (1..32))  OPTIONAL,
    bssid-r16                 OCTET STRING (SIZE (6))       OPTIONAL,
    hessid-r16                 OCTET STRING (SIZE (6))       OPTIONAL,
    ...
}

WLAN-RSSI-Range-r16 ::= INTEGER(0..141)

WLAN-RTT-r16 ::= SEQUENCE {
    rttValue-r16              INTEGER (0..16777215),
    rttUnits-r16              ENUMERATED {
        microseconds,
        hundredsofnanoseconds,
        tensofnanoseconds,
        nanoseconds,
        tenthssofnanoseconds,
        ...},
}

```



```

    rttAccuracy-r16                INTEGER (0..255)                OPTIONAL,
    ...
}
-- ASN1STOP
-- TAG-LOGMEASRESULTLISTWLAN-STOP

```

<b>LogMeasResultListWLAN field descriptions</b>
<p><b>Bssid</b> Basic Service Set Identifier (BSSID) defined in IEEE 802.11-2012 [50].</p>
<p><b>Hessid</b> Homogenous Extended Service Set Identifier (HESSID) defined in IEEE 802.11-2012 [50].</p>
<p><b>rssiwLAN</b> Measured WLAN RSSI result in dBm. The IE WLAN-RSSI-Range specifies the value range used in WLAN RSSI measurements and thresholds. Integer value for WLAN RSSI measurements is according to mapping table in TS 36.133 [40]. Value 0 corresponds to -infinity, value 1 to -100dBm, value 2 to -99dBm, and so on (i.e. in steps of 1dBm) until value 140, which corresponds to 39dBm, while value 141 corresponds to +infinity.</p>
<p><b>rtt-WLAN</b> This field provides the measured roundtrip time between the target device and WLAN AP and optionally the accuracy expressed as the standard deviation of the delay. Units for each of these are 1000ns, 100ns, 10ns, 1ns, and 0.1ns as defined in TS 37.355 [49].</p>
<p><b>rttValue</b> This field specifies the Round Trip Time (RTT) measurement between the target device and WLAN AP in units given by the field rttUnits as defined in TS 37.355 [49].</p>
<p><b>rttUnits</b> This field specifies the Units for the fields rttValue and rttAccuracy. The available Units are 1000ns, 100ns, 10ns, 1ns, and 0.1ns as defined in TS 37.355 [49].</p>
<p><b>rttAccuracy</b> This field provides the estimated accuracy of the provided rttValue expressed as the standard deviation in units given by the field rttUnits as defined in TS 37.355 [49].</p>
<p><b>Ssid</b> Service Set Identifier (SSID) defined in IEEE 802.11-2012 [50].</p>
<p><b>Wlan-Identifiers</b> Indicates the WLAN parameters used for identification of the WLAN for which the measurement results are applicable.</p>

## – OtherConfig

The IE *OtherConfig* contains configuration related to miscellaneous other configurations.

### **OtherConfig information element**

```

-- ASN1START
-- TAG-OTHERCONFIG-START

OtherConfig ::=
    SEQUENCE {
        delayBudgetReportingConfig CHOICE {
            release NULL,
            setup SEQUENCE {
                delayBudgetReportingProhibitTimer ENUMERATED {s0, s0dot4, s0dot8, s1dot6, s3, s6, s12, s30}
            }
        }
    }

```

OPTIONAL      -- Need M

```

}
OtherConfig-v1540 ::= SEQUENCE {
    overheatingAssistanceConfig SetupRelease {OverheatingAssistanceConfig} OPTIONAL, -- Need M
    ...
}
CandidateServingFreqListNR-r16 ::= SEQUENCE (SIZE (1..maxFreqIDC-r16)) OF ARFCN-ValueNR

OtherConfig-v1610 ::= SEQUENCE {
    idc-AssistanceConfig-r16 SetupRelease {IDC-AssistanceConfig-r16} OPTIONAL, -- Need M
    drx-PreferenceConfig-r16 SetupRelease {DRX-PreferenceConfig-r16} OPTIONAL, -- Need M
    maxBW-PreferenceConfig-r16 SetupRelease {MaxBW-PreferenceConfig-r16} OPTIONAL, -- Need M
    maxCC-PreferenceConfig-r16 SetupRelease {MaxCC-PreferenceConfig-r16} OPTIONAL, -- Need M
    maxMIMO-LayerPreferenceConfig-r16 SetupRelease {MaxMIMO-LayerPreferenceConfig-r16} OPTIONAL, -- Need M
    minSchedulingOffsetPreferenceConfig-r16 SetupRelease {MinSchedulingOffsetPreferenceConfig-r16} OPTIONAL, -- Need M
    releasePreferenceConfig-r16 SetupRelease {ReleasePreferenceConfig-r16} OPTIONAL, -- Need M
    referenceTimePreferenceReporting-r16 ENUMERATED {true} OPTIONAL, -- Need R
    btNameList-r16 SetupRelease {BT-NameList-r16} OPTIONAL, -- Need M
    wlanNameList-r16 SetupRelease {WLAN-NameList-r16} OPTIONAL, -- Need M
    sensorNameList-r16 SetupRelease {Sensor-NameList-r16} OPTIONAL, -- Need M
    obtainCommonLocation-r16 ENUMERATED {true} OPTIONAL, -- Need R
    sl-AssistanceConfigNR-r16 ENUMERATED{true} OPTIONAL -- Need R
}

OverheatingAssistanceConfig ::= SEQUENCE {
    overheatingIndicationProhibitTimer ENUMERATED {s0, s0dot5, s1, s2, s5, s10, s20, s30,
    s60, s90, s120, s300, s600, spare3, spare2, spare1}
}

IDC-AssistanceConfig-r16 ::= SEQUENCE {
    candidateServingFreqListNR-r16 CandidateServingFreqListNR-r16 OPTIONAL, -- Need R
    ...
}

DRX-PreferenceConfig-r16 ::= SEQUENCE {
    drx-PreferenceProhibitTimer-r16 ENUMERATED {
    s0, s0dot5, s1, s2, s3, s4, s5, s6, s7,
    s8, s9, s10, s20, s30, spare2, spare1}
}

MaxBW-PreferenceConfig-r16 ::= SEQUENCE {
    maxBW-PreferenceProhibitTimer-r16 ENUMERATED {
    s0, s0dot5, s1, s2, s3, s4, s5, s6, s7,
    s8, s9, s10, s20, s30, spare2, spare1}
}

MaxCC-PreferenceConfig-r16 ::= SEQUENCE {
    maxCC-PreferenceProhibitTimer-r16 ENUMERATED {
    s0, s0dot5, s1, s2, s3, s4, s5, s6, s7,
    s8, s9, s10, s20, s30, spare2, spare1}
}

MaxMIMO-LayerPreferenceConfig-r16 ::= SEQUENCE {
    maxMIMO-LayerPreferenceProhibitTimer-r16 ENUMERATED {

```

```

    s0, s0dot5, s1, s2, s3, s4, s5, s6, s7,
    s8, s9, s10, s20, s30, spare2, spare1}
}

MinSchedulingOffsetPreferenceConfig-r16 ::= SEQUENCE {
    minSchedulingOffsetPreferenceProhibitTimer-r16 ENUMERATED {
        s0, s0dot5, s1, s2, s3, s4, s5, s6, s7,
        s8, s9, s10, s20, s30, spare2, spare1}
}

ReleasePreferenceConfig-r16 ::= SEQUENCE {
    releasePreferenceProhibitTimer-r16 ENUMERATED {
        s0, s0dot5, s1, s2, s3, s4, s5, s6, s7,
        s8, s9, s10, s20, s30, infinity, spare1},
    connectedReporting ENUMERATED {true} OPTIONAL -- Need R
}

-- TAG-OTHERCONFIG-STOP
-- ASN1STOP
```

<b>OtherConfig field descriptions</b>
<p><b>candidateServingFreqListNR</b> Indicates for each candidate NR serving cells, the center frequency around which UE is requested to report IDC issues.</p>
<p><b>connectedReporting</b> Indicates that the UE can report a preference to remain in RRC_CONNECTED state following a report to leave RRC_CONNECTED state. If absent, the UE cannot report a preference to stay in RRC_CONNECTED state.</p>
<p><b>delayBudgetReportingProhibitTimer</b> Prohibit timer for delay budget reporting. Value in seconds. Value <i>s0</i> means prohibit timer is set to 0 seconds, value <i>s0dot4</i> means prohibit timer is set to 0.4 seconds, and so on.</p>
<p><b>drx-PreferenceConfig</b> Configuration for the UE to report assistance information to inform the gNB about the UE's DRX preferences for power saving.</p>
<p><b>drx-PreferenceProhibitTimer</b> Prohibit timer for DRX preferences assistance information reporting. Value in seconds. Value <i>s0</i> means prohibit timer is set to 0 seconds, value <i>s0dot5</i> means prohibit timer is set to 0.5 seconds, value <i>s1</i> means prohibit timer is set to 1 second and so on.</p>
<p><b>idc-AssistanceConfig</b> Configuration for the UE to report assistance information to inform the gNB about UE detected IDC problem.</p>
<p><b>maxBW-PreferenceConfig</b> Configuration for the UE to report assistance information to inform the gNB about the UE's preferred bandwidth for power saving.</p>
<p><b>maxBW-PreferenceProhibitTimer</b> Prohibit timer for preferred bandwidth assistance information reporting. Value in seconds. Value <i>s0</i> means prohibit timer is set to 0 seconds, value <i>s0dot5</i> means prohibit timer is set to 0.5 seconds, value <i>s1</i> means prohibit timer is set to 1 second and so on.</p>
<p><b>maxCC-PreferenceConfig</b> Configuration for the UE to report assistance information to inform the gNB about the UE's preferred number of carriers for power saving.</p>
<p><b>maxCC-PreferenceProhibitTimer</b> Prohibit timer for preferred number of carriers assistance information reporting. Value in seconds. Value <i>s0</i> means prohibit timer is set to 0 seconds, value <i>s0dot5</i> means prohibit timer is set to 0.5 seconds, value <i>s1</i> means prohibit timer is set to 1 second and so on.</p>
<p><b>maxMIMO-LayerPreferenceConfig</b> Configuration for the UE to report assistance information to inform the gNB about the UE's preferred number of MIMO layers for power saving.</p>
<p><b>maxMIMO-LayerPreferenceProhibitTimer</b> Prohibit timer for preferred number of number of MIMO layers assistance information reporting. Value in seconds. Value <i>s0</i> means prohibit timer is set to 0 seconds, value <i>s0dot5</i> means prohibit timer is set to 0.5 seconds, value <i>s1</i> means prohibit timer is set to 1 second and so on.</p>
<p><b>minSchedulingOffsetPreferenceConfig</b> Configuration for the UE to report assistance information to inform the gNB about the UE's preferred <i>minimumSchedulingOffset</i> value for cross-slot scheduling for power saving.</p>
<p><b>minSchedulingOffsetPreferenceProhibitTimer</b> Prohibit timer for preferred <i>minimumSchedulingOffset</i> assistance information reporting. Value in seconds. Value <i>s0</i> means prohibit timer is set to 0 seconds, value <i>s0dot5</i> means prohibit timer is set to 0.5 seconds, value <i>s1</i> means prohibit timer is set to 1 second and so on.</p>
<p><b>obtainCommonLocation</b> Requests the UE to attempt to have detailed location information available using GNSS. NR configures the field if <i>includeCommonLocationInfo</i> is configured for one or more measurements.</p>
<p><b>overheatingAssistanceConfig</b> Configuration for the UE to report assistance information to inform the gNB about UE detected internal overheating.</p>
<p><b>overheatingIndicationProhibitTimer</b> Prohibit timer for overheating assistance information reporting. Value in seconds. Value <i>s0</i> means prohibit timer is set to 0 seconds, value <i>s0dot5</i> means prohibit timer is set to 0.5 seconds, value <i>s1</i> means prohibit timer is set to 1 second and so on.</p>
<p><b>referenceTimePreferenceReporting</b> If present, the field indicates the UE is configured to provide reference time assistance information.</p>

<b>releasePreferenceConfig</b> Configuration for the UE to report assistance information to inform the gNB about the UE's preference to leave RRC_CONNECTED state.
<b>releasePreferenceProhibitTimer</b> Prohibit timer for release preference assistance information reporting. Value in seconds. Value <i>s0</i> means prohibit timer is set to 0 seconds, value <i>s0dot5</i> means prohibit timer is set to 0.5 seconds, value <i>s1</i> means prohibit timer is set to 1 second and so on. Value <i>infinity</i> means that once a UE has reported a release preference, the UE cannot report a release preference again during the RRC connection.
<b>sensorNameList</b> Configuration for the UE to report measurements from specific sensors.
<b>sl-AssistanceConfigNR</b> Indicate whether UE is configured to provide configured grant assistance information for NR sidelink communication.

– *PhysCellIdUTRA-FDD*

The IE *PhysCellIdUTRA-FDD* is used to indicate the physical layer identity of the cell, i.e. the primary scrambling code, as defined in TS 25.331 [45].

***PhysCellIdUTRA-FDD* information element**

```
-- ASN1START
-- TAG-PHYSCCELLIDUTRA-FDD-START

PhysCellIdUTRA-FDD-r16 ::=          INTEGER (0..511)

-- TAG-PHYSCCELLIDUTRA-FDD-STOP
-- ASN1STOP
```

– *RRC-TransactionIdentifier*

The IE *RRC-TransactionIdentifier* is used, together with the message type, for the identification of an RRC procedure (transaction).

***RRC-TransactionIdentifier* information element**

```
-- ASN1START
-- TAG-RRC-TRANSACTIONIDENTIFIER-START

RRC-TransactionIdentifier ::=      INTEGER (0..3)

-- TAG-RRC-TRANSACTIONIDENTIFIER-STOP
-- ASN1STOP
```

– *Sensor-NameList*

The IE *Sensor-NameList* is used to indicate the names of the sensors which the UE is configured to measure.

**Sensor-NameList** information element

```

-- ASN1START
-- TAG-SENSORNAMELIST-START

Sensor-NameList-r16 ::= SEQUENCE {
    measUncomBarPre-r16      ENUMERATED {true}          OPTIONAL, -- Need R
    measUeSpeed             ENUMERATED {true}          OPTIONAL, -- Need R
    measUeOrientation       ENUMERATED {true}          OPTIONAL, -- Need R
}

-- TAG-SENSORNAMELIST-STOP
-- ASN1STOP

```

**Sensor-NameList** field descriptions**measUncomBarPre**

If configured, the UE reports the uncompensated Barometric pressure measurement as defined in uncompensatedBarometricPressure-r16.

**measUeSpeed**

If configured, the UE reports the UE speed measurement as defined in TS 37.355 [49].

**measUeOrientation**

If configured, the UE reports the UE orientation information as defined in TS 37.355 [49].

– **TraceReference**

The *TraceReference* contains parameter Trace Reference as defined in TS 32.422 [52].

**TraceReference** information element

```

-- ASN1START
-- TAG-TRACEREFERENCE-START

TraceReference-r16 ::= SEQUENCE {
    plmn-Identity-r16      PLMN-Identity,
    traceId-r16           OCTET STRING (SIZE (3))
}

-- TAG-TRACEREFERENCE-STOP
-- ASN1STOP

```

– **UE-MeasurementsAvailable-r16**

The IE *UE-MeasurementsAvailable* is used to indicate all relevant available indicators for UE measurements.

**UE-MeasurementsAvailable** information element

```

-- ASN1START
-- TAG-UE-MeasurementsAvailable-START

UE-MeasurementsAvailable-r16 ::=
    logMeasAvailable-r16          ENUMERATED {true}          OPTIONAL,
    logMeasAvailableBT-r16       ENUMERATED {true}          OPTIONAL,
    logMeasAvailableWLAN-r16     ENUMERATED {true}          OPTIONAL,
    connEstFailInfoAvailable-r16 ENUMERATED {true}          OPTIONAL,
    rlf-InfoAvailable-r16       ENUMERATED {true}          OPTIONAL,
    ...
}

-- TAG-UE-MeasurementsAvailable-STOP
-- ASN1STOP

```

– **UTRA-FDD-Q-OffsetRange**

The IE *UTRA-FDD-Q-OffsetRange* is used to indicate a frequency specific offset to be applied when evaluating triggering conditions for measurement reporting. The value is in dB. Value *dB-24* corresponds to -24 dB, value *dB-22* corresponds to -22 dB and so on.

**UTRA-FDD-Q-OffsetRange** information element

```

-- ASN1START
-- TAG-UTRA-FDD-Q-OFFSETRANGE-START

UTRA-FDD-Q-OffsetRange-r16 ::=
    ENUMERATED {
        dB-24, dB-22, dB-20, dB-18, dB-16, dB-14,
        dB-12, dB-10, dB-8, dB-6, dB-5, dB-4, dB-3,
        dB-2, dB-1, dB0, dB1, dB2, dB3, dB4, dB5,
        dB6, dB8, dB10, dB12, dB14, dB16, dB18,
        dB20, dB22, dB24}

-- TAG-UTRA-FDD-Q-OFFSETRANGE-STOP
-- ASN1STOP

```

– **VisitedCellInfoList**

The IE *VisitedCellInfoList* includes the mobility history information of maximum of 16 most recently visited cells or time spent in any cell selection state and/or camped on any cell state in NR or E-UTRA. The most recently visited cell is stored first in the list. The list includes cells visited in RRC\_IDLE, RRC\_INACTIVE and RRC\_CONNECTED states for NR and RRC\_IDLE and RRC\_CONNECTED for E-UTRA.

**VisitedCellInfoList** information element

```

-- ASN1START
-- TAG-VISITEDCELLINFOLIST-START

```

```

VisitedCellInfoList-r16 ::= SEQUENCE (SIZE (1..maxCellHistory-r16)) OF VisitedCellInfo-r16

VisitedCellInfo-r16 ::= SEQUENCE {
  visitedCellId-r16 CHOICE {
    nr-CellId-r16 CHOICE {
      cgi-Info CGI-Info-Logging-r16,
      pci-arfcn-r16 SEQUENCE {
        physCellId-r16 PhysCellId,
        carrierFreq-r16 ARFCN-ValueNR
      }
    },
    eutra-CellId-r16 CHOICE {
      cellGlobalId-r16 CGI-InfoEUTRA,
      pci-arfcn-r16 SEQUENCE {
        physCellId-r16 EUTRA-PhysCellId,
        carrierFreq-r16 ARFCN-ValueEUTRA
      }
    }
  },
  timeSpent-r16 OPTIONAL,
  INTEGER (0..4095),
  ...
}

-- TAG-VISITEDCELLINFOLIST-STOP
-- ASN1STOP

```

#### **VisitedCellInfoList field descriptions**

##### ***timeSpent***

This field indicates the duration of stay in the cell or in any cell selection state and/or camped on any cell state in NR or E-UTRA approximated to the closest second. If the duration of stay exceeds 4095s, the UE shall set it to 4095s.

##### ***visitedCellId***

This field indicates the visited cell id including NR and E-UTRA cells.

## – **WLAN-NameList**

The IE *WLAN-NameList* is used to indicate the names of the WLAN AP for which the UE is configured to measure.

#### **WLAN-NameList information element**

```

-- ASN1START
-- TAG-WLANNAMELIST-START

WLAN-NameList-r16 ::= SEQUENCE (SIZE (1..maxWLAN-Name-r16)) OF WLAN-Name-r16

WLAN-Name-r16 ::= OCTET STRING (SIZE (1..32))

-- ASN1STOP
-- TAG-WLANNAMELIST-STOP

```



**WLAN-NameList field descriptions****WLAN-Name**

If configured, the UE only performs WLAN measurements according to the names identified. For each name, it refers to Service Set Identifier (SSID) defined in IEEE 802.11-2012 [50].

## 6.3.5 Sidelink information elements

### – *SL-BWP-Config*

The IE *SL-BWP-Config* is used to configure the UE specific NR sidelink communication on one particular sidelink bandwidth part.

**SL-BWP-Config information element**

```

-- ASN1START
-- TAG-SL-BWP-CONFIG-START

SL-BWP-Config-r16 ::=
    SEQUENCE {
        sl-BWP-Id
        sl-BWP-Generic-r16          OPTIONAL,    -- Need M
        sl-BWP-PoolConfig-r16     OPTIONAL,    -- Need M
        ...
    }

SL-BWP-Generic-r16 ::=
    SEQUENCE {
        sl-BWP-r16                OPTIONAL,    -- Need M
        sl-LengthSymbols-r16      ENUMERATED {sym7, sym8, sym9, sym10, sym11, sym12, sym13, sym14} OPTIONAL,    -- Need M
        sl-StartSymbol-r16        ENUMERATED {sym0, sym1, sym2, sym3, sym4, sym5, sym6, sym7} OPTIONAL,    -- Need M
        sl-PSBCH-Config-r16       SetupRelease {SL-PSBCH-Config-r16} OPTIONAL,    -- Need M
        sl-TxDirectCurrentLocation-r16 INTEGER (0..3301) OPTIONAL,    -- Need M
        ...
    }

-- TAG-SL-BWP-CONFIG-STOP
-- ASN1STOP

```

**SL-BWP-Config field descriptions****sl-BWP-Generic**

This field indicates the generic parameters on the configured sidelink BWP.

**sl-BWP-PoolConfig**

This field indicates the resource pool configurations on the configured sidelink BWP.

<b>SL-BWP-Generic field descriptions</b>
<b>sl-LengthSymbols</b> This field indicates the number of symbols used for sidelink in a slot without SL-SSB. A single value can be (pre)configured per sidelink bandwidth part.
<b>sl-StartSymbol</b> This field indicates the starting symbol used for sidelink in a slot without SL-SSB. A single value can be (pre)configured per sidelink bandwidth part.
<b>sl-TxDirectCurrentLocation</b> The sidelink Tx/Rx Direct Current location for the carrier. Only values in the value range of this field between 0 and 3299, which indicate the subcarrier index within the carrier corresponding to the numerology of the corresponding sidelink BWP and value 3300, which indicates "Outside the carrier" and value 3301, which indicates "Undetermined position within the carrier" are used in this version of the specification.

## – SL-BWP-ConfigCommon

The IE *SL-BWP-ConfigCommon* is used to configure the cell-specific configuration information on one particular sidelink bandwidth part.

### **SL-BWP-ConfigCommon information element**

```

-- ASN1START
-- TAG-SL-BWP-CONFIGCOMMON-START

SL-BWP-ConfigCommon-r16 ::=
    SEQUENCE {
        sl-BWP-Generic-r16          SL-BWP-Generic-r16          OPTIONAL, -- Need R
        sl-BWP-PoolConfigCommon-r16 SL-BWP-PoolConfigCommon-r16  OPTIONAL, -- Need R
        ...
    }

-- TAG-SL-BWP-CONFIGCOMMON-STOP
-- ASN1STOP

```

<b>SL-BWP-ConfigCommon field descriptions</b>
<b>genericParameters</b> This field indicates the generic parameters on the configured sidelink BWP.
<b>sl-BWP-PoolConfigCommon</b> This field indicates the resource pool configurations on the configured sidelink BWP.

## – SL-BWP-PoolConfig

The IE *SL-BWP-PoolConfig* is used to configure NR sidelink communication resource pool.

### **SL-BWP-PoolConfig information element**

```

-- ASN1START
-- TAG-SL-BWP-POOLCONFIG-START

SL-BWP-PoolConfig-r16 ::=
    SEQUENCE {

```

```

sl-RxPool-r16                SEQUENCE (SIZE (1..maxNrofRXPool-r16)) OF SL-ResourcePool-r16    OPTIONAL,    -- Cond HO
sl-TxPoolSelectedNormal-r16  SL-TxPoolDedicated-r16                OPTIONAL,    -- Need M
sl-TxPoolScheduling-r16     SL-TxPoolDedicated-r16                OPTIONAL,    -- Need N
sl-TxPoolExceptional-r16    SL-ResourcePoolConfig-r16            OPTIONAL,    -- Need M
}

SL-TxPoolDedicated-r16 ::= SEQUENCE {
  sl-PoolToReleaseList-r16 SEQUENCE (SIZE (1..maxNrofTXPool-r16)) OF SL-ResourcePoolID-r16    OPTIONAL,    -- Need N
  sl-PoolToAddModList-r16 SEQUENCE (SIZE (1..maxNrofTXPool-r16)) OF SL-ResourcePoolConfig-r16    OPTIONAL,    -- Need N
}

SL-ResourcePoolConfig-r16 ::= SEQUENCE {
  sl-ResourcePoolID-r16    SL-ResourcePoolID-r16,
  sl-ResourcePool-r16     SL-ResourcePool-r16                                OPTIONAL,    -- Need M
}

SL-ResourcePoolID-r16 ::= INTEGER (1..maxNrofPoolID-r16)

-- TAG-SL-BWP-POOLCONFIG-STOP
-- ASN1STOP

```

<b>SL-BWP-Pool-Config field descriptions</b>	
<b>sl-RxPool</b>	Indicates the receiving resource pool on the configured BWP. For the PSFCH related configuration, if configured, will be used for PSFCH transmission/reception. If the field is included, it replaces any previous list, i.e. all the entries of the list are replaced and each of the SL-ResourcePool entries is considered to be newly created.
<b>sl-TxPoolExceptional</b>	Indicates the resources by which the UE is allowed to transmit NR sidelink communication in exceptional conditions on the configured BWP. For the PSFCH related configuration, if configured, will be used for PSFCH transmission/reception.
<b>sl-TxPoolScheduling</b>	Indicates the resources by which the UE is allowed to transmit NR sidelink communication based on network scheduling on the configured BWP. For the PSFCH related configuration, if configured, will be used for PSFCH transmission/reception.
<b>sl-TxPoolSelectedNormal</b>	Indicates the resources by which the UE is allowed to transmit NR sidelink communication by UE autonomous resource selection on the configured BWP. For the PSFCH related configuration, if configured, will be used for PSFCH transmission/reception.

Conditional Presence	Explanation
<i>HO</i>	This field is optionally present, need M, in an <i>RRCReconfiguration</i> message including <i>reconfigurationWithSync</i> for the handover case; otherwise it is absent, Need M.

– **SL-BWP-PoolConfigCommon**

The IE *SL-BWP-PoolConfigCommon* is used to configure the cell-specific NR sidelink communication resource pool.

**SL-BWP-PoolConfigCommon information element**

-- ASN1START

```

-- TAG-SL-BWP-POOLCONFIGCOMMON-START
SL-BWP-PoolConfigCommon-r16 ::= SEQUENCE {
  sl-RxPool-r16 SEQUENCE (SIZE (1..maxNrofRXPool-r16)) OF SL-ResourcePool-r16 OPTIONAL, -- Need R
  sl-TxPoolSelectedNormal-r16 SEQUENCE (SIZE (1..maxNrofTXPool-r16)) OF SL-ResourcePoolConfig-r16 OPTIONAL, -- Need R
  sl-TxPoolExceptional-r16 SL-ResourcePoolConfig-r16 OPTIONAL -- Need R
}
-- TAG-SL-BWP-POOLCONFIGCOMMON-STOP
-- ASN1STOP

```

### SL-CBR-PriorityTxConfigList

The IE *SL-CBR-PriorityTxConfigList* indicates the mapping between PSSCH transmission parameter (such as MCS, PRB number, retransmission number, CR limit) sets by using the indexes of the configurations provided in *sl-CBR-PSSCH-TxConfigList*, CBR ranges by an index to the entry of the CBR range configuration in *sl-CBR-RangeConfigList*, and priority ranges. It also indicates the default PSSCH transmission parameters to be used when CBR measurement results are not available.

#### SL-CBR-PriorityTxConfigList information element

```

-- ASN1START
-- TAG-SL-CBR-PRIORITYTXCONFIGLIST-START
SL-CBR-PriorityTxConfigList-r16 ::= SEQUENCE (SIZE (1..8)) OF SL-PriorityTxConfigIndex-r16
SL-PriorityTxConfigIndex-r16 ::= SEQUENCE {
  sl-PriorityThreshold-r16 INTEGER (1..8) OPTIONAL, -- Need M
  sl-DefaultTxConfigIndex-r16 INTEGER (0..maxCBR-Level-1-r16) OPTIONAL, -- Need M
  sl-CBR-ConfigIndex-r16 INTEGER (0..maxCBR-Config-1-r16) OPTIONAL, -- Need M
  sl-Tx-ConfigIndexList-r16 SEQUENCE (SIZE (1..maxCBR-Level-r16)) OF SL-TxConfigIndex-r16 OPTIONAL -- Need M
}
SL-TxConfigIndex-r16 ::= INTEGER (0..maxTxConfig-1-r16)
-- TAG-SL-CBR-PRIORITYTXCONFIGLIST-STOP
-- ASN1STOP

```

#### SL-CBR-PriorityTxConfigList field descriptions

##### **sl-CBR-ConfigIndex**

Indicates the CBR ranges to be used by an index to the entry of the CBR range configuration in *sl-CBR-RangeConfigList*.

##### **sl-DefaultTxConfigIndex**

Indicates the PSSCH transmission parameters to be used by the UEs which do not have available CBR measurement results, by means of an index to the corresponding entry in *tx-ConfigIndexList*. Value 0 indicates the first entry in *tx-ConfigIndexList*. The field is ignored if the UE has available CBR measurement results.

##### **sl-PriorityThreshold**

Indicates the upper bound of priority range which is associated with the configurations in *sl-CBR-ConfigIndex* and in *sl-Tx-ConfigIndexList*. The upper bounds of the priority ranges are configured in ascending order for consecutive entries of *SL-Priority-TxConfigIndex* in *SL-CBR-PriorityTxConfigList*. For the first entry of *SL-Priority-TxConfigIndex*, the lower bound of the priority range is 1.

## – *SL-CBR-CommonTxConfigList*

The IE *SL-CBR-CommonTxConfigList* indicates the list of PSSCH transmission parameters (such as MCS, sub-channel number, retransmission number, CR limit) in *sl-CBR-PSSCH-TxConfigList*, and the list of CBR ranges in *sl-CBR-RangeConfigList*, to configure congestion control to the UE for sidelink communication.

### ***SL-CBR-CommonTxConfigList* information element**

```
-- ASN1START
-- TAG-SL-CBR-COMMONTXCONFIGLIST-START

SL-CBR-CommonTxConfigList-r16 ::= SEQUENCE {
    sl-CBR-RangeConfigList-r16 SEQUENCE (SIZE (1..maxCBR-Config-r16)) OF SL-CBR-LevelsConfig-r16 OPTIONAL, -- Need M
    sl-CBR-PSSCH-TxConfigList-r16 SEQUENCE (SIZE (1.. maxTxConfig-r16)) OF SL-CBR-PSSCH-TxConfig-r16 OPTIONAL -- Need M
}

SL-CBR-LevelsConfig-r16 ::= SEQUENCE (SIZE (1..maxCBR-Level-r16)) OF SL-CBR-r16

SL-CBR-PSSCH-TxConfig-r16 ::= SEQUENCE {
    sl-CR-Limit-r16 INTEGER(0..10000) OPTIONAL, -- Need M
    sl-TxParameters-r16 SL-PSSCH-TxParameters-r16 OPTIONAL -- Need M
}

SL-CBR-r16 ::= INTEGER (0..100)

-- TAG-SL-CBR-COMMONTXCONFIGLIST-STOP
-- ASN1STOP
```

#### ***SL-CBR-CommonTxConfigList* field descriptions**

##### ***sl-CBR-RangeConfigList***

Indicates the list of CBR ranges. Each entry of the list indicates in *SL-CBR-LevelsConfig* the upper bound of the CBR range for the respective entry. The upper bounds of the CBR ranges are configured in ascending order for consecutive entries of *sl-CBR-RangeConfigList*. For the first entry of *sl-CBR-RangeConfigList* the lower bound of the CBR range is 0. Value 0 corresponds to 0, value 1 to 0.01, value 2 to 0.02, and so on.

##### ***sl-CR-Limit***

Indicates the maximum limit on the occupancy ratio. Value 0 corresponds to 0, value 1 to 0.0001, value 2 to 0.0002, and so on (i.e. in steps of 0.0001) until value 10000, which corresponds to 1.

##### ***sl-CBR-PSSCH-TxConfigList***

Indicates the list of available PSSCH transmission parameters (such as MCS, sub-channel number, retransmission number and CR limit) configurations.

##### ***sl-TxParameters***

Indicates PSSCH transmission parameters.

– *SL-ConfigDedicatedNR*

The IE *SL-ConfigDedicatedNR* specifies the dedicated configuration information for NR sidelink communication.

***SL-ConfigDedicatedNR* information element**

```
-- ASN1START
-- TAG-SL-CONFIGDEDICATEDNR-START

SL-ConfigDedicatedNR-r16 ::=          SEQUENCE {
    sl-PHY-MAC-RLC-Config-r16          SL-PHY-MAC-RLC-Config-r16          OPTIONAL,    -- Need M
    sl-RadioBearerToReleaseList-r16    SEQUENCE (SIZE (1..maxNrofSLRB-r16)) OF SLRB-Uu-ConfigIndex-r16  OPTIONAL,    -- Need N
    sl-RadioBearerToAddModList-r16     SEQUENCE (SIZE (1..maxNrofSLRB-r16)) OF SL-RadioBearerConfig-r16  OPTIONAL,    -- Need N
    sl-MeasConfigInfoToReleaseList-r16 SEQUENCE (SIZE (1..maxNrofSL-Dest-r16)) OF SL-DestinationIndex-r16  OPTIONAL,    -- Need N
    sl-MeasConfigInfoToAddModList-r16 SEQUENCE (SIZE (1..maxNrofSL-Dest-r16)) OF SL-MeasConfigInfo-r16    OPTIONAL,    -- Need M
    t400-r16                            ENUMERATED {ms100, ms200, ms300, ms400, ms600, ms1000, ms1500, ms2000} OPTIONAL,    -- Need M
    ...
}

SL-DestinationIndex-r16 ::=          INTEGER (0..maxNrofSL-Dest-1-r16)

SL-PHY-MAC-RLC-Config-r16 ::=       SEQUENCE {
    sl-ScheduledConfig-r16             SetupRelease { SL-ScheduledConfig-r16 }          OPTIONAL,    -- Need M
    sl-UE-SelectedConfig-r16           SetupRelease { SL-UE-SelectedConfig-r16 }          OPTIONAL,    -- Need M
    sl-FreqInfoToReleaseList-r16       SEQUENCE (SIZE (1..maxNrofFreqSL-r16)) OF SL-Freq-Id-r16          OPTIONAL,    -- Need N
    sl-FreqInfoToAddModList-r16        SEQUENCE (SIZE (1..maxNrofFreqSL-r16)) OF SL-FreqConfig-r16        OPTIONAL,    -- Need N
    sl-RLC-BearerToReleaseList-r16     SEQUENCE (SIZE (1..maxSL-LCID-r16)) OF SL-RLC-BearerConfigIndex-r16  OPTIONAL,    -- Need N
    sl-RLC-BearerToAddModList-r16      SEQUENCE (SIZE (1..maxSL-LCID-r16)) OF SL-RLC-BearerConfig-r16      OPTIONAL,    -- Need N
    sl-MaxNumConsecutiveDTX-r16        ENUMERATED {n1, n2, n3, n4, n6, n8, n16, n32}          OPTIONAL,    -- Need M
    sl-CSI-Acquisition-r16             ENUMERATED {enabled}                                OPTIONAL,    -- Need R
    sl-CSI-SchedulingRequestId-r16     SetupRelease {SchedulingRequestId}                OPTIONAL,    -- Need M
    sl-SSB-PriorityNR-r16              INTEGER (1..8)                                       OPTIONAL,    -- Need R
    networkControlledSyncTx-r16        ENUMERATED {on, off}                                OPTIONAL,    -- Need M
}

-- TAG-SL-CONFIGDEDICATEDNR-STOP
-- ASN1STOP
```

***SL-ConfigDedicatedNR* field descriptions**

***sl-MeasConfigInfoToAddModList***

This field indicates the RSRP measurement configurations for unicast destinations to add and/or modify.

***sl-MeasConfigInfoToReleaseList***

This field indicates the RSRP measurement configurations for unicast destinations to remove.

***sl-RadioBearerToAddModList***

This field indicates one or multiple sidelink radio bearer configurations.

<b>SL-PHY-MAC-RLC-Config field descriptions</b>
<p><b>NetworkControlledSyncTx</b> This field indicates whether the UE shall transmit synchronisation information (i.e. become synchronisation source). Value On indicates the UE to transmit synchronisation information while value Off indicates the UE to not transmit such information.</p>
<p><b>sl-maxNumConsecutiveDTX</b> This field indicates the maximum number of consecutive HARQ DTX before triggering sidelink RLF. Value n1 corresponds to 1, value n2 corresponds to 2, and so on.</p>
<p><b>sl-FreqInfoToAddModList</b> This field indicates the NR sidelink communication configuration on some carrier frequency (ies). In this release, only one entry can be configured in the list.</p>
<p><b>sl-RLC-BearerToAddModList</b> This field indicates one or multiple sidelink RLC bearer configurations.</p>
<p><b>sl-ScheduledConfig</b> Indicates the configuration for UE to transmit NR sidelink communication based on network scheduling. This field is not configured simultaneously with sl-UE-SelectedConfig.</p>
<p><b>sl-UE-SelectedConfig</b> Indicates the configuration used for UE autonomous resource selection. This field is not configured simultaneously with sl-ScheduledConfig.</p>
<p><b>sl-CSI-Acquisition</b> Indicates whether CSI reporting is enabled in sidelink unicast. If the field is absent, sidelink CSI reporting is disabled.</p>
<p><b>sl-CSI-SchedulingRequestId</b> If present, it indicates the scheduling request configuration applicable for sidelink CSI report MAC CE, as specified in TS 38.321 [3].</p>
<p><b>sl-SSB-PriorityNR</b> This field indicates the priority of NR sidelink SSB transmission and reception.</p>

## – SL-ConfiguredGrantConfig

The IE *SL-ConfiguredGrantConfig* specifies the configured grant configuration information for NR sidelink communication.

### **SL-ConfiguredGrantConfig information element**

```
-- ASN1START
-- TAG-SL-CONFIGUREDGRANTCONFIG-START
```

```
SL-ConfiguredGrantConfig-r16 ::=
  sl-ConfigIndexCG-r16          SEQUENCE {
    sl-ConfigIndexCG-r16,      SL-ConfigIndexCG-r16,
    sl-PeriodCG-r16           SL-PeriodCG-r16                OPTIONAL, -- Need M
    sl-NrOfHARQ-Processes-r16  INTEGER (1..16)           OPTIONAL, -- Need M
    sl-HARQ-ProcID-offset-r16  INTEGER (1..16)           OPTIONAL, -- Need M
    sl-CG-MaxTransNumList-r16  SL-CG-MaxTransNumList-r16  OPTIONAL, -- Need M
    rrc-ConfiguredSidelinkGrant-r16
      SEQUENCE {
        sl-TimeResourceCG-Type1-r16  INTEGER (0..496)          OPTIONAL, -- Need M
        sl-StartSubchannelCG-Type1-r16  INTEGER (0..26)          OPTIONAL, -- Need M
        sl-FreqResourceCG-Type1-r16    INTEGER (0..6929)        OPTIONAL, -- Need M
        sl-TimeOffsetCG-Type1-r16     INTEGER (0..7999)        OPTIONAL, -- Need R
        sl-N1PUCCH-AN-r16              PUCCH-ResourceId          OPTIONAL, -- Need M
        sl-PSFCH-ToPUCCH-CG-Type1-r16  INTEGER (0..15)         OPTIONAL, -- Need M
        sl-ResourcePoolID-r16          SL-ResourcePoolID-r16     OPTIONAL, -- Need M
        sl-TimeReferenceSFN-Type1-r16  ENUMERATED {sfn512}        OPTIONAL, -- Need S
      }
    ...
  }
```

```
SL-ConfigIndexCG-r16 ::=          INTEGER (1..maxNrofCG-SL-r16)

SL-CG-MaxTransNumList-r16 ::=     SEQUENCE (SIZE (1..8)) OF SL-CG-MaxTransNum-r16

SL-CG-MaxTransNum-r16 ::=         SEQUENCE {
    sl-Priority-r16                INTEGER (1..8),
    sl-MaxTransNum-r16             INTEGER (1..32)
}

SL-PeriodCG-r16 ::=              CHOICE{
    sl-PeriodCG1-r16               ENUMERATED {ms100, ms200, ms300, ms400, ms500, ms600, ms700, ms800, ms900, ms1000, spare6,
                                              spare5, spare4, spare3, spare2, spare1},
    sl-PeriodCG2-r16               INTEGER (1..99)
}

-- TAG-SL-CONFIGUREDGRANTCONFIG-STOP
-- ASN1STOP
```



<b>SL- ConfiguredGrantConfig field descriptions</b>
<b>sl-ConfigIndexCG</b> This field indicates the ID to identify configured grant for sidelink.
<b>sl-CG-MaxTransNumList</b> This field indicates the maximum number of times that a TB can be transmitted using the resources provided by the configured grant. <i>sl-Priority</i> corresponds to the logical channel priority.
<b>sl-FreqResourceCG-Type1</b> Indicates the frequency resource location of sidelink configured grant type 1. An index giving valid combinations of one or two starting sub-channel and length (jointly encoded) as resource indicator (RIV), as defined in TS 38.214 [19].
<b>sl-N1PUCCH-AN</b> This field indicates the HARQ resource for PUCCH for SL configured grant type 1 or SL configured type 2. The actual PUCCH-Resource is configured in sl-PUCCH-Config and referred to by its ID.
<b>sl-NrOfHARQ-Processes</b> This field indicates the number of HARQ processes configured for a specific configured grant. It applies for both Type 1 and Type 2.
<b>sl-PeriodCG</b> This field indicates the period of sidelink configured grant in the unit of ms.
<b>sl-PSFCH-ToPUCCH -CG-Type1</b> This field, for configured grant type 1, indicates slot offset between the PSFCH associated with the last PSSCH resource of each period and the PUCCH occasion used for reporting sidelink HARQ.
<b>sl-ResourcePoolID</b> Indicates the resource pool in which the configured sidelink grant Type 1 is applied.
<b>sl-StartSubchannelCG-Type1</b> This field indicates the starting sub-channel of sidelink configured grant Type 1. An index giving valid sub-channel index.
<b>sl-TimeOffsetCG-Type1</b> This field indicates the time offset related to SFN= <i>sl-TimeReferenceSFN-Type1</i> , as specified in TS 38.321 [3].
<b>sl-TimeReferenceSFN-Type1</b> Indicates SFN used for determination of the offset of a resource in time domain. If it is present, the UE uses the closest SFN with the indicated number preceding the reception of the sidelink configured grant configuration Type 1, see TS 38.321 [3], clause 5.8.3. If it is not present, the reference SFN is 0.
<b>sl-TimeResourceCG-Type1</b> This field indicates the time resource location of sidelink configured grant Type 1. An index giving valid combinations of up to two slot positions (jointly encoded) as time resource indicator (TRIV), as defined in TS 38.212 [17].

## – *SL-DestinationIdentity*

The IE *SL-DestinationIdentity* is used to identify a destination of a NR sidelink communication.

### ***SL-DestinationIdentity* information element**

```
-- ASN1START
-- TAG-SL-DESTINATIONIDENTITY-START

SL-DestinationIdentity-r16 ::=          BIT STRING (SIZE (24))

-- TAG-SL-DESTINATIONIDENTITY-STOP
-- ASN1STOP
```

– *SL-FreqConfig*

The IE *SL-FreqConfig* specifies the dedicated configuration information on one particular carrier frequency for NR sidelink communication.

***SL-FreqConfig* information element**

```

-- ASN1START
-- TAG-SL-FREQCONFIG-START

SL-FreqConfig-r16 ::=
    SEQUENCE {
        sl-Freq-Id-r16                SL-Freq-Id-r16,
        sl-SCS-SpecificCarrierList-r16 SEQUENCE (SIZE (1..maxSCSs)) OF SCS-SpecificCarrier,
        sl-AbsoluteFrequencyPointA-r16 ARFCN-ValueNR                                OPTIONAL, -- Need M
        sl-AbsoluteFrequencySSB-r16    ARFCN-ValueNR                                OPTIONAL, -- Need R
        frequencyShift7p5khzSL-r16    ENUMERATED {true}                          OPTIONAL, -- Cond V2X-SL-Shared
        valueN-r16                      INTEGER (-1..1),
        sl-BWP-ToReleaseList-r16        SEQUENCE (SIZE (1..maxNrofSL-BWPs-r16)) OF BWP-Id    OPTIONAL, -- Need N
        sl-BWP-ToAddModList-r16         SEQUENCE (SIZE (1..maxNrofSL-BWPs-r16)) OF SL-BWP-Config-r16 OPTIONAL, -- Need N
        sl-SyncConfigList-r16          SL-SyncConfigList-r16                        OPTIONAL, -- Need M
        sl-SyncPriority-r16             ENUMERATED {gnss, gnbEnb}                    OPTIONAL, -- Need M
    }

SL-Freq-Id-r16 ::=
    INTEGER (1.. maxNrofFreqSL-r16)

-- TAG-SL-FREQCONFIG-STOP
-- ASN1STOP

```

<b>SL-FreqConfig field descriptions</b>	
<b>frequencyShift7p5khzSL</b>	Enable the NR SL transmission with a 7.5 kHz shift to the LTE raster. If the field is absent, the frequency shift is disabled.
<b>sl-AbsoluteFrequencyPointA</b>	Absolute frequency of the reference resource block (Common RB 0). Its lowest subcarrier is also known as Point A.
<b>sl-AbsoluteFrequencySSB</b>	Indicates the frequency location of sidelink SSB. The transmission bandwidth for sidelink SSB is within the bandwidth of this sidelink BWP.
<b>sl-BWP-ToAddModList</b>	This field indicates the list of sidelink BWP(s) on which the NR sidelink communication configuration is to be added or reconfigured. In this release, only one BWP is allowed to be configured for NR sidelink communication.
<b>sl-BWP-ToReleaseList</b>	This field indicates the list of sidelink BWP(s) on which the NR sidelink communication configuration is to be released.
<b>sl-Freq-Id</b>	This field indicates the identity of the SL-FreqConfig configuration.
<b>sl-SCS-SpecificCarrierList</b>	A set of UE specific channel bandwidth and location configurations for different subcarrier spacings (numerologies). Defined in relation to Point A. The UE uses the configuration provided in this field only for the purpose of channel bandwidth and location determination. In this release, only one <i>SCS-SpecificCarrier</i> is allowed to be configured for NR sidelink communication.
<b>sl-SyncPriority</b>	This field indicates synchronization priority order, as specified in sub-clause 5.8.6.
<b>valueN</b>	Indicate the NR SL transmission with a valueN *5kHz shift to the LTE raster. (see [TS 38.101-1 [15]], clause X.X.X).

Conditional Presence	Explanation
V2X-SL-Shared	This field is mandatory present if the carrier frequency configured for NR sidelink communication is shared by V2X sidelink communication. It is absent, Need R, otherwise.

## – SL-FreqConfigCommon

The IE *FreqConfigCommon* specifies the cell-specific configuration information on one particular carrier frequency for NR sidelink communication.

### SL-FreqConfigCommon information element

```
-- ASN1START
-- TAG-SL-FREQCONFIGCOMMON-START

SL-FreqConfigCommon-r16 ::= SEQUENCE {
    sl-SCS-SpecificCarrierList-r16 SEQUENCE (SIZE (1..maxSCSs)) OF SCS-SpecificCarrier,
    sl-AbsoluteFrequencyPointA-r16 ARFCN-ValueNR,
    sl-AbsoluteFrequencySSB-r16 ARFCN-ValueNR,
    frequencyShift7p5khzSL-r16 ENUMERATED {true}
    valueN-r16 INTEGER (-1..1),
    sl-BWP-List-r16 SEQUENCE (SIZE (1..maxNrofSL-BWPs-r16)) OF SL-BWP-ConfigCommon-r16
    sl-SyncPriority-r16 ENUMERATED {gnss, gnbEnb}
    sl-NbAsSync-r16 BOOLEAN
}
```

```

sl-SyncConfigList-r16          SL-SyncConfigList-r16          OPTIONAL, -- Need R
...
}
-- TAG-SL-FREQCONFIGCOMMON-STOP
-- ASN1STOP

```

<b>SL-FreqConfigCommon field descriptions</b>	
<b>frequencyShift7p5khzSL</b>	Enable the NR SL transmission with a 7.5 kHz shift to the LTE raster. If the field is absent, the frequency shift is disabled.
<b>sl-AbsoluteFrequencyPointA</b>	Absolute frequency of the reference resource block (Common RB 0). Its lowest subcarrier is also known as Point A.
<b>sl-AbsoluteFrequencySSB</b>	Indicates the frequency location of sidelink SSB. The transmission bandwidth for sidelink SSB is within the bandwidth of this sidelink BWP.
<b>sl-BWP-List</b>	This field indicates the list of sidelink BWP(s) on which the NR sidelink communication configuration. In this release, only one BWP is allowed to be configured for NR sidelink communication.
<b>sl-NbAsSync</b>	This field indicates whether the network can be selected as synchronization reference directly/indirectly only, if <i>sl-SyncPriority</i> is set to gss. If this field is set to TRUE, the network is enabled to be selected as synchronization reference directly/indirectly. The field is only present in <i>SidelinkPreconfigNR</i> . Otherwise it is absent.
<b>sl-SyncPriority</b>	This field indicates synchronization priority order, as specified in sub-clause 5.8.6..
<b>sl-SyncConfigList</b>	This field indicates the configuration by which the UE is allowed to receive and transmit synchronisation information for NR sidelink communication. Network configures <i>sl-SyncConfig</i> including <i>txParameters</i> when configuring UEs to transmit synchronisation information.
<b>valueN</b>	Indicate the NR SL transmission with a valueN *5kHz shift to the LTE raster (see [TS 38.101-1 [15]], clause X.X.X).

<b>Conditional Presence</b>	<b>Explanation</b>
V2X-SL-Shared	This field is mandatory present if the carrier frequency configured for NR sidelink communication is shared by V2X sidelink communication. It is absent, Need R, otherwise.

– **SL-LogicalChannelConfig**

The IE *SL-LogicalChannelConfig* is used to configure the sidelink logical channel parameters.

**SL-LogicalChannelConfig information element**

```

-- ASN1START
-- TAG-SL-LOGICALCHANNELCONFIG-START

SL-LogicalChannelConfig-r16 ::=
    sl-Priority-r16          SEQUENCE {
        sl-PrioritisedBitRate-r16    INTEGER (1..8),
                                     ENUMERATED {kBps0, kBps8, kBps16, kBps32, kBps64, kBps128, kBps256, kBps512,
                                     kBps1024, kBps2048, kBps4096, kBps8192, kBps16384, kBps32768, kBps65536, infinity},

```

```

sl-BucketSizeDuration-r16      ENUMERATED {ms5, ms10, ms20, ms50, ms100, ms150, ms300, ms500, ms1000,
                                spare7, spare6, spare5, spare4, spare3, spare2, spare1},
sl-ConfiguredGrantType1Allowed-r16  ENUMERATED {true}
sl-HARQ-FeedbackEnabled-r16      ENUMERATED {enabled, disabled }
sl-AllowedCG-List-r16           SEQUENCE (SIZE (0.. maxNrofCG-SL-r16-1)) OF SL-ConfigIndexCG-r16

sl-AllowedSCS-List-r16          SEQUENCE (SIZE (1..maxSCSs)) OF SubcarrierSpacing
sl-MaxPUSCH-Duration-r16        ENUMERATED {ms0p02, ms0p04, ms0p0625, ms0p125, ms0p25, ms0p5, spare2, spare1}

sl-LogicalChannelGroup-r16      INTEGER (0..maxLCG-ID)
sl-SchedulingRequestId-r16      SchedulingRequestId
sl-LogicalChannelSR-DelayTimerApplied-r16  BOOLEAN
...
}
-- TAG-SL-LOGICALCHANNELCONFIG-STOP
-- ASN1STOP

```

<b>SL-LogicalChannelConfig field descriptions</b>
<p><b>sl-AllowedCG-List</b> This restriction applies only when the SL grant is a configured grant. If present, SL MAC SDUs from this logical channel can only be mapped to the indicated configured grant configuration. If the size of the sequence is zero, then UL MAC SDUs from this logical channel cannot be mapped to any configured grant configurations. If the field is not present, UL MAC SDUs from this logical channel can be mapped to any configured grant configurations. Corresponds to "sl-AllowedCG-List" as specified in TS 38.321 [3].</p>
<p><b>sl-AllowedSCS-List</b> If present, indicate the numerology of UL-SCH resources that this sidelink logical channel is mapped to, when checking the SR trigger condition. Corresponds to 'sl-AllowedSCS-List' in TS 38.321 [3].</p>
<p><b>sl-BucketSizeDuration</b> Value in ms. <i>ms5</i> corresponds to 5 ms, value <i>ms10</i> corresponds to 10 ms, and so on.</p>
<p><b>sl-ConfiguredGrantType1Allowed</b> If present, SL MAC SDUs from this sidelink logical channel can be transmitted on a sidelink configured grant type 1. Corresponds to 'sl-configuredGrantType1Allowed' in TS 38.321 [3].</p>
<p><b>sl-HARQ-FeedbackEnabled</b> If present, indicate the HARQ feedback enabled/disabled restriction in LCP for this sidelink logical channel. If set to enabled, the sidelink logical channel will be multiplexed only with a logical channel which enabling the HARQ feedback. If set to <i>disabled</i>, the sidelink logical channel cannot be multiplexed with a logical channel which enabling the HARQ feedback. Corresponds to 'sl-HARQ-FeedbackEnabled' in TS 38.321 [3]. If this field of at least one sidelink logical channel for the UE is set to enabled, sl-PSFCH-Config should be mandatory present in at least one of the SL-ResourcePool.</p>
<p><b>sl-LogicalChannelGroup</b> ID of the sidelink logical channel group, as specified in TS 38.321 [3], which the sidelink logical channel belongs to.</p>
<p><b>sl-LogicalChannelSR-DelayTimerApplied</b> Indicates whether to apply the delay timer for SR transmission for this sidelink logical channel. Set to false if <i>logicalChannelSR-DelayTimer</i> is not included in <i>sl-BSR-Config</i>.</p>
<p><b>sl-MaxPUSCH-Duration</b> If present, indicate the maximum PUSCH duration of UL-SCH resources that this sidelink logical channel is mapped to, when checking the SR trigger condition. Corresponds to "sl-MaxPUSCH-Duration" in TS 38.321 [3].</p>
<p><b>sl-PrioritisedBitRate</b> Value in kiloBytes/s. Value <i>kBps0</i> corresponds to 0 kiloBytes/s, value <i>kBps8</i> corresponds to 8 kiloBytes/s, value <i>kBps16</i> corresponds to 16 kiloBytes/s, and so on.</p>
<p><b>sl-Priority</b> Sidelink logical channel priority, as specified in TS 38.321 [3].</p>
<p><b>sl-SchedulingRequestld</b> If present, it indicates the scheduling request configuration applicable for this sidelink logical channel, as specified in TS 38.321 [3].</p>

## – SL-MeasConfigCommon

The IE *SL-MeasConfigCommon* is used to set the cell specific SL RSRP measurement configurations for unicast destinations.

### SL-MeasConfigCommon information element

```

-- ASN1START
-- TAG-SL-MEASCONFIGCOMMON-START

SL-MeasConfigCommon-r16 ::=
    SEQUENCE {
        sl-MeasObjectListCommon-r16          SL-MeasObjectList-r16          OPTIONAL, -- Need R
        sl-ReportConfigListCommon-r16        SL-ReportConfigList-r16       OPTIONAL, -- Need R
        sl-MeasIdListCommon-r16              SL-MeasIdList-r16            OPTIONAL, -- Need R
        sl-QuantityConfigCommon-r16          SL-QuantityConfig-r16        OPTIONAL, -- Need R
    }

```

```

}
...
-- TAG-SL-MEASCONFIGCOMMON-STOP
-- ASN1STOP

```

#### **SL-MeasConfigCommon field descriptions**

<b>sl-MeasIdListCommon</b> List of sidelink measurement identities
<b>sl-MeasObjectListCommon</b> List of sidelink measurement objects.
<b>sl-QuantityConfigCommon</b> Indicates the layer 3 filtering coefficient for sidelink measurement.
<b>sl-ReportConfigListCommon</b> List of sidelink measurement reporting configurations.

#### – **SL-MeasConfigInfo**

The IE *SL-MeasConfigInfo* is used to set RSRP measurement configurations for unicast destinations.

#### **SL-MeasConfigInfo information element**

```

-- ASN1START
-- TAG-SL-MEASCONFIGINFO-START

SL-MeasConfigInfo-r16 ::=
    SEQUENCE {
        sl-DestinationIndex-r16
        sl-MeasConfig-r16
        ...
    }

SL-MeasConfig-r16 ::=
    SEQUENCE {
        sl-MeasObjectToRemoveList-r16
        sl-MeasObjectToAddModList-r16
        sl-ReportConfigToRemoveList-r16
        sl-ReportConfigToAddModList-r16
        sl-MeasIdToRemoveList-r16
        sl-MeasIdToAddModList-r16
        sl-QuantityConfig-r16
        ...
    }
    OPTIONAL, -- Need N
    OPTIONAL, -- Need N
    OPTIONAL, -- Need N
    OPTIONAL, -- Need N
    OPTIONAL, -- Need N
    OPTIONAL, -- Need N
    OPTIONAL, -- Need M

SL-MeasObjectToRemoveList-r16 ::= SEQUENCE (SIZE (1..maxNrofSL-ObjectId-r16)) OF SL-MeasObjectId-r16

SL-ReportConfigToRemoveList-r16 ::= SEQUENCE (SIZE (1..maxNrofSL-ReportConfigId-r16)) OF SL-ReportConfigId-r16

SL-MeasIdToRemoveList-r16 ::= SEQUENCE (SIZE (1..maxNrofSL-MeasId-r16)) OF SL-MeasId-r16

```

```
-- TAG-SL-MEASCONFIGINFO-STOP
-- ASN1STOP
```

<b><i>SL-MeasConfigInfo</i> field descriptions</b>
<b><i>sl-MeasIdToAddModList</i></b> List of sidelink measurement identities to add and/or modify.
<b><i>sl-MeasIdToRemoveList</i></b> List of sidelink measurement identities to remove.
<b><i>sl-MeasObjectToAddModList</i></b> List of sidelink measurement objects to add and/or modify.
<b><i>sl-MeasObjectToRemoveList</i></b> List of sidelink measurement objects to remove.
<b><i>sl-QuantityConfig</i></b> Indicates the layer 3 filtering coefficient for sidelink measurement.
<b><i>sl-ReportConfigToAddModList</i></b> List of sidelink measurement reporting configurations to add and/or modify.
<b><i>sl-ReportConfigToRemoveList</i></b> List of sidelink measurement reporting configurations to remove.

## – *SL-MeasIdList*

The IE *SL-MeasIdList* concerns a list of SL measurement identities to add or modify for a destination, with for each entry the *sl-MeasId*, the associated *sl-MeasObjectId* and the associated *sl-ReportConfigId*.

### ***SL-MeasIdList* information element**

```
-- ASN1START
-- TAG-SL-MEASIDLIST-START

SL-MeasIdList-r16 ::=
    SEQUENCE (SIZE (1..maxNrofSL-MeasId-r16)) OF SL-MeasIdInfo-r16

SL-MeasIdInfo-r16 ::=
    SEQUENCE {
        sl-MeasId-r16
            SL-MeasId-r16,
        sl-MeasObjectId-r16
            SL-MeasObjectId-r16,
        sl-ReportConfigId-r16
            SL-ReportConfigId-r16,
        ...
    }

SL-MeasId-r16 ::=
    INTEGER (1..maxNrofSL-MeasId-r16)

-- TAG-SL-MEASIDLIST-STOP
-- ASN1STOP
```



## – *SL-MeasObjectList*

The IE *SL-MeasObjectList* concerns a list of SL measurement objects to add or modify for a destination.

### ***SL-MeasObjectList* information element**

```
-- ASN1START
-- TAG-SL-MEASOBJECTLIST-START

SL-MeasObjectList-r16 ::=
    SEQUENCE (SIZE (1..maxNrofSL-ObjectId-r16)) OF SL-MeasObjectInfo-r16

SL-MeasObjectInfo-r16 ::=
    SEQUENCE {
        sl-MeasObjectId-r16      SL-MeasObjectId-r16,
        sl-MeasObject-r16       SL-MeasObject-r16,
        ...
    }

SL-MeasObjectId-r16 ::=
    INTEGER (1..maxNrofSL-ObjectId-r16)

SL-MeasObject-r16 ::=
    SEQUENCE {
        frequencyInfoSL-r16     ARFCN-ValueNR,
        ...
    }

-- TAG-SL-MEASOBJECTLIST-STOP
-- ASN1STOP
```

### ***SL-MeasObjectList* field descriptions**

#### ***sl-MeasObjectId***

It is used to identify a sidelink measurement object configuration.

#### ***sl-MeasObject***

It specifies information applicable for sidelink DMRS measurement.

## – *SL-PDCP-Config*

The IE *SL-PDCP-Config* is used to set the configurable PDCP parameters for a sidelink radio bearer.

### ***SL-PDCP-Config* information element**

```
-- ASN1START
-- TAG-SL-PDCP-CONFIG-START

SL-PDCP-Config-r16 ::=
    SEQUENCE {
        sl-DiscardTimer-r16      ENUMERATED {ms3, ms10, ms20, ms25, ms30, ms40, ms50, ms60, ms75, ms100, ms150, ms200,
        ms250, ms300, ms500, ms750, ms1500, infinity}
        sl-PDCP-SN-Size-r16      ENUMERATED {len12bits, len18bits}
        sl-OutOfOrderDelivery    ENUMERATED { true }
    }
    OPTIONAL, -- Cond Setup
    OPTIONAL, -- Cond Setup2
    OPTIONAL, -- Need R
```

```

}
...
-- TAG-SL-PDCP-CONFIG-STOP
-- ASN1STOP
    
```

<b>SL-PDCP-Config field descriptions</b>	
<b>sl-DiscardTimer</b>	Value in ms of <i>discardTimer</i> specified in TS 38.323 [5]. Value <i>ms50</i> corresponds to 50 ms, value <i>ms100</i> corresponds to 100 ms and so on.
<b>sl-OutOfOrderDelivery</b>	Indicates whether or not <i>outOfOrderDelivery</i> specified in TS 38.323 [5] is configured. This field should be either always present or always absent, after the radio bearer is established.
<b>sl-PDCP-SN-Size</b>	PDCP sequence number size for unicast NR sidelink communication, 12 or 18 bits, as specified in TS 38.323 [5]. For groupcast and broadcast NR sidelink communication, only 12 bits is applicable, as specified in 9.1.1.5.

Conditional Presence	Explanation
<i>Setup</i>	The field is mandatory present in case of sidelink DRB setup via dedicated signaling and in case of sidelink DRB configuration via system information and pre-configuration; otherwise the field is optionally present, need M.
<i>Setup2</i>	The field is mandatory present in case of sidelink DRB setup via dedicated signaling and in case of sidelink DRB configuration via system information and pre-configuration for RLC-AM and RLC-UM for unicast NR sidelink communication; otherwise the field is not present, Need M.

– **SL-PSBCH-Config**

The IE *SL-PSBCH-Config* indicates PSBCH transmission parameters on each sidelink bandwidth part.

**SL-PSBCH-Config information element**

```

-- ASN1START
-- TAG-SL-PSBCH-CONFIG-START

SL-PSBCH-Config-r16 ::= SEQUENCE {
    dl-P0-PSBCH-r16          INTEGER (-16..15)                OPTIONAL,    -- Need M
    dl-Alpha-PSBCH-r16      ENUMERATED {alpha0, alpha04, alpha05, alpha06, alpha07, alpha08, alpha09, alpha1} OPTIONAL,    -- Need M
    ...
}

-- TAG-SL-PSBCH-CONFIG-STOP
-- ASN1STOP
    
```

<i>SL-PSBCH-Config</i> field descriptions
<b><i>dl-Alpha-PSBCH</i></b> Indicates alpha value for DL pathloss based power control for PSBCH. When the field is absent the UE applies the value 1
<b><i>dl-P0-PSBCH</i></b> Indicates P0 value for DL pathloss based power control for PSBCH. If not configured, DL pathloss based power control is disabled for PSBCH.

## – *SL-PSSCH-TxConfigList*

The IE *SL-PSSCH-TxConfigList* indicates PSSCH transmission parameters. When lower layers select parameters from the range indicated in IE *SL-PSSCH-TxConfigList*, the UE considers both configurations in IE *SL-PSSCH-TxConfigList* and the CBR-dependent configurations represented in IE *SL-CBR-PriorityTxConfigList*. Only one IE *SL-PSSCH-TxConfig* is provided per *SL-TypeTxSync*.

### *SL-PSSCH-TxConfigList* information element

```
-- ASN1START
-- TAG-SL-PSSCH-TXCONFIGLIST-START

SL-PSSCH-TxConfigList-r16 ::= SEQUENCE (SIZE (1..maxPSSCH-TxConfig-r16)) OF SL-PSSCH-TxConfig-r16

SL-PSSCH-TxConfig-r16 ::= SEQUENCE {
    sl-TypeTxSync-r16          SL-TypeTxSync-r16                OPTIONAL,    -- Need R
    sl-ThresUE-Speed-r16      ENUMERATED {kmph60, kmph80, kmph100, kmph120,
                                          kmph140, kmph160, kmph180, kmph200},
    sl-ParametersAboveThres-r16 SL-PSSCH-TxParameters-r16,
    sl-ParametersBelowThres-r16 SL-PSSCH-TxParameters-r16,
    ...
}

SL-PSSCH-TxParameters-r16 ::= SEQUENCE {
    sl-MinMCS-PSSCH-r16      INTEGER (0..27),
    sl-MaxMCS-PSSCH-r16      INTEGER (0..31),
    sl-MinSubChannelNumPSSCH-r16 INTEGER (1..27),
    sl-MaxSubChannelNumPSSCH-r16 INTEGER (1..27),
    sl-MaxTxTransNumPSSCH-r16 INTEGER (1..32),
    sl-MaxTxPower-r16        SL-TxPower-r16                    OPTIONAL    -- Cond CBR
}

-- TAG-SL-PSSCH-TXCONFIGLIST-STOP
-- ASN1STOP
```

<b>SL-PSSCH-TxConfigList field descriptions</b>
<b>sl-MaxTxTransNumPSSCH</b> Indicates the maximum transmission number (including new transmission and retransmission) for PSSCH.
<b>sl-MaxTxPower</b> This field indicates the maximum transmission power for transmission on PSSCH and PSCCH.
<b>sl-MinMCS-PSSCH, sl-MaxMCS-PSSCH</b> This field indicates the minimum and maximum MCS values used for transmissions on PSSCH.
<b>sl-MinSubChannelNumPSSCH, sl-MaxSubChannelNumPSSCH</b> This field indicates the minimum and maximum number of sub-channels which may be used for transmissions on PSSCH.
<b>sl-TypeTxSync</b> This field indicates the synchronization reference type. For configurations by the eNB/gNB, only gnbEnb can be configured; and for pre-configuration or when this field is absent, the configuration is applicable for all synchronization reference types.
<b>sl-ThresUE-Speed</b> This field indicates a UE absolute speed threshold.

<b>Conditional Presence</b>	<b>Explanation</b>
<i>CBR</i>	The field is optionally present, Need R, when in <i>SL-CBR-CommonTxConfigList</i> in <i>SL-UE-SelectedConfig</i> in <i>SIB12</i> or <i>SidelinkPreconfigNR</i> ; otherwise the field is not present, need R.

### – *SL-QoS-FlowIdentity*

The IE *SL-QoS-FlowIdentity* is used to identify a sidelink QoS flow.

#### **SL-QoS-FlowIdentity information element**

```
-- ASN1START
-- TAG-SL-QOS-FLOWIDENTITY-START

SL-QoS-FlowIdentity-r16 ::=
    INTEGER (1..maxNrofSL-QFIs-r16)

-- TAG-SL-QOS-FLOWIDENTITY-STOP
-- ASN1STOP
```

### – *SL-QoS-Profile*

The IE *SL-QoS-Profile* is used to give the QoS parameters for a sidelink QoS flow. Need codes or conditions specified for *SL-QoS-Profile* do not apply, in case *SL-QoS-Profile* is included in *SidelinkUEInformationNR*.

#### **SL-QoS-Profile information element**

```
-- ASN1START
-- TAG-SL-QOS-PROFILE-START
```

```

SL-QoS-Profile-r16 ::= SEQUENCE {
    sl-PQI-r16                SL-PQI-r16                OPTIONAL, -- Need R
    sl-GFBR-r16              INTEGER (0..4000000000)     OPTIONAL, -- Need R
    sl-MFBR-r16              INTEGER (0..4000000000)     OPTIONAL, -- Need R
    sl-Range-r16             INTEGER (1..1000)           OPTIONAL, -- Need R
    ...
}

SL-PQI-r16 ::= CHOICE {
    sl-StandardizedPQI-r16  INTEGER (0..255),
    sl-Non-StandardizedPQI-r16 SEQUENCE {
        sl-ResourceType-r16  ENUMERATED {gbr, non-GBR, delayCriticalGBR, spare1} OPTIONAL, -- Need R
        sl-PriorityLevel-r16 INTEGER (1..8)                                OPTIONAL, -- Need R
        sl-PacketDelayBudget-r16 INTEGER (0..1023)                          OPTIONAL, -- Need R
        sl-PacketErrorRate-r16 INTEGER (0..9)                                OPTIONAL, -- Need R
        sl-AveragingWindow-r16 INTEGER (0..4095)                            OPTIONAL, -- Need R
        sl-MaxDataBurstVolume-r16 INTEGER (0..4095)                          OPTIONAL, -- Need R
        ...
    }
}

-- TAG-SL-QOS-PROFILE-STOP
-- ASN1STOP

```

#### **SL-QoS-Profile field descriptions**

**sl-GFBR**

Indicate the guaranteed bit rate for a GBR QoS flow. The unit is: Kbit/s

**sl-MFBR**

Indicate the maximum bit rate for a GBR QoS flow. The unit is: Kbit/s

**sl-PQI**

This field indicates either the PQI for standardized PQI or non-standardized QoS parameters.

**sl-Range**

This field indicates the range parameter of the QoS flow, as defined in clause 5.4.1.1.1, TS 23.287 [55]. It is present only for groupcast. The unit is meter.

#### **SL-PQI field descriptions**

**sl-AveragingWindow**

Indicates the Averaging Window for a QoS flow, and applies to GBR QoS flows only. Unit: ms. The default value of the IE is 2000ms.

**sl-MaxDataBurstVolume**

Indicates the Maximum Data Burst Volume for a QoS flow, and applies to delay critical GBR QoS flows only. Unit: byte.

**sl-PacketDelayBudget**

Indicates the Packet Delay Budget for a QoS flow. Upper bound value for the delay that a packet may experience expressed in unit of 0.5ms.

**sl-PacketErrorRate**

Indicates the Packet Error Rate for a QoS flow. The packet error rate is expressed as Scalar x 10-k where k is the Exponent.

**sl-PriorityLevel**

Indicates the Priority Level for a QoS flow. Values ordered in decreasing order of priority, i.e. with 1 as the highest priority and 8 as the lowest priority.

**sl-StandardizedPQI**

Indicate the PQI for standardized PQI.

## – *SL-QuantityConfig*

The IE *SL-QuantityConfig* specifies the layer 3 filtering coefficients for NR SL RSRP measurement for a destination.

### ***SL-QuantityConfig* information element**

```
-- ASN1START
-- TAG-SL-QUANTITYCONFIG-START

SL-QuantityConfig-r16 ::=
    sl-FilterCoefficientDMRS-r16          SEQUENCE {
        FilterCoefficient                DEFAULT fc4,
        ...
    }

-- TAG-SL-QuantityConfig-STOP
-- ASN1STOP
```

#### ***SL-QuantityConfig* field descriptions**

##### ***sl-FilterCoefficientDMRS***

DMRS based L3 filter configuration:

Specifies L3 filter configuration for sidelink RSRP measurement result from the L1 filter(s), as defined in TS 38.215 [9].

## – *SL-RadioBearerConfig*

The IE *SL-RadioBearerConfig* specifies the sidelink DRB configuration information for NR sidelink communication.

### ***SL-RadioBearerConfig* information element**

```
-- ASN1START
-- TAG-SL-RADIOBEARERCONFIG-START

SL-RadioBearerConfig-r16 ::=
    slrb-Uu-ConfigIndex-r16          SLRB-Uu-ConfigIndex-r16,
    sl-SDAP-Config-r16                SL-SDAP-Config-r16                OPTIONAL,    -- Cond SLRBSetup
    sl-PDCP-Config-r16                SL-PDCP-Config-r16                OPTIONAL,    -- Cond SLRBSetup
    sl-TransRange-r16                ENUMERATED {m20, m50, m80, m100, m120, m150, m180, m200, m220, m250, m270, m300, m350, m370,
        m400, m420, m450, m480, m500, m550, m600, m700, m1000, spare9, spare8, spare7, spare6,
        spare5, spare4, spare3, spare2, spare1}                OPTIONAL,    -- Need R
    ...
}

-- TAG-SL-RADIOBEARERCONFIG-STOP
-- ASN1STOP
```

<i>SL-RadioBearerCoonfig</i> field descriptions
<b><i>sl-PDCP-Config</i></b> This field indicates the PDCP parameters for the sidelink DRB.
<b><i>sl-SDAP-Config</i></b> This field indicates how to map sidelink QoS flows to sidelink DRB.
<b><i>slrb-Uu-ConfigIndex</i></b> This field indicates the index of sidelink DRB configuration.
<b><i>sl-TransRange</i></b> This field indicates the transmission range of the sidelink DRB. The unit is meter.

Conditional Presence	Explanation
<i>SLRBSetup</i>	The field is mandatory present in case of sidelink DRB setup via the dedicated signalling and in case of sidelink DRB configuration via system information and pre-configuration; otherwise the field is optionally present, need M.

## – *SL-ReportConfigList*

The IE *SL-ReportConfigList* concerns a list of SL measurement reporting configurations to add or modify for a destination.

### *SL-ReportConfigList* information element

```

-- ASN1START
-- TAG-SL-REPORTCONFIGLIST-START

SL-ReportConfigList-r16 ::=          SEQUENCE (SIZE (1..maxNrofSL-ReportConfigId-r16)) OF SL-ReportConfigInfo-r16

SL-ReportConfigInfo-r16 ::=          SEQUENCE {
    sl-ReportConfigId-r16             SL-ReportConfigId-r16,
    sl-ReportConfig-r16              SL-ReportConfig-r16,
    ...
}

SL-ReportConfigId-r16 ::=            INTEGER (1..maxNrofSL-ReportConfigId-r16)

SL-ReportConfig-r16 ::=              SEQUENCE {
    sl-ReportType-r16                CHOICE {
        sl-Periodical-r16            SL-PeriodicalReportConfig-r16,
        sl-EventTriggered-r16       SL-EventTriggerConfig-r16,
        ...
    },
    ...
}

SL-PeriodicalReportConfig-r16 ::=    SEQUENCE {
    sl-ReportInterval-r16            ReportInterval,
    sl-ReportAmount-r16              ENUMERATED {r1, r2, r4, r8, r16, r32, r64, infinity},
    sl-ReportQuantity-r16            SL-MeasReportQuantity-r16,
    sl-RS-Type-r16                   SL-RS-Type-r16,
}

```

```

}
...
}
SL-EventTriggerConfig-r16 ::= SEQUENCE {
  sl-EventId-r16 CHOICE {
    eventS1-r16 SEQUENCE {
      sl-Threshold-r16
      sl-ReportOnLeave-r16
      sl-Hysteresis-r16
      sl-TimeToTrigger-r16
      ...
    },
    eventS2-r16 SEQUENCE {
      s2-Threshold-r16
      sl-ReportOnLeave-r16
      sl-Hysteresis-r16
      sl-TimeToTrigger-r16
      ...
    },
    ...
  },
  sl-ReportInterval-r16 ReportInterval,
  sl-ReportAmount-r16 ENUMERATED {r1, r2, r4, r8, r16, r32, r64, infinity},
  sl-ReportQuantity-r16 SL-MeasReportQuantity-r16,
  sl-RS-Type-r16 SL-RS-Type-r16,
  ...
}
SL-MeasReportQuantity-r16 ::= CHOICE {
  sl-RSRP-r16 BOOLEAN,
  ...
}
SL-MeasTriggerQuantity-r16 ::= CHOICE {
  sl-RSRP-r16 RSRP-Range,
  ...
}
SL-RS-Type-r16 ::= ENUMERATED {dmrs, spare3, spare2, spare1}
-- TAG-SL-REPORTCONFIGLIST-STOP
-- ASN1STOP

```

<i>SL-ReportConfig</i> field descriptions
---

<b><i>sl-ReportType</i></b>
-----------------------------

Type of the configured sidelink measurement report.
---



<b><i>SL-EventTriggerConfig</i> field descriptions</b>
<b><i>sl-EventId</i></b> Choice of sidelink measurement event triggered reporting criteria.
<b><i>sl-ReportAmount</i></b> Number of sidelink measurement reports applicable for <i>sl-EventTriggered</i> report type.
<b><i>sl-ReportInterval</i></b> Indicates the interval between periodical reports (i.e., when <i>sl-ReportAmount</i> exceeds 1) for <i>sl-EventTriggered</i> report type.
<b><i>sl-ReportOnLeave</i></b> indicates whether or not the UE shall initiate the sidelink measurement reporting procedure when the leaving condition is meet for a frequency in <i>sl-FrequencyTriggeredList</i> , as specified in 5.8.10.4.1.
<b><i>sl-ReportQuantity</i></b> The sidelink measurement quantities to be included in the sidelink measurement report.
<b><i>sl-TimeToTrigger</i></b> Time during which specific criteria for the event needs to be met in order to trigger a sidelink measurement report.
<b><i>sl-Threshold</i></b> Threshold used for events S1 and S2 specified in subclauses 5.8.10.4.2 and 5.8.10.4.3, respectively.

<b><i>SL-PeriodicReportConfig</i> field descriptions</b>
<b><i>sl-ReportAmount</i></b> Number of sidelink measurement reports applicable for <i>sl-Periodical</i> report type.
<b><i>sl-ReportInterval</i></b> Indicates the interval between periodical reports (i.e., when <i>sl-ReportAmount</i> exceeds 1) for <i>sl-Periodical</i> report type.
<b><i>sl-ReportQuantity</i></b> The sidelink measurement quantities to be included in the sidelink measurement report.

## – *SL-ResourcePool*

The IE *SL-ResourcePool* specifies the configuration information for NR sidelink communication resource pool.

### ***SL-ResourcePool* information element**

```

-- ASN1START
-- TAG-SL-RESOURCEPOOL-START

SL-ResourcePool-r16 ::=
    SEQUENCE {
        sl-PSCCH-Config-r16          SetupRelease { SL-PSCCH-Config-r16 }    OPTIONAL, -- Need M
        sl-PSSCH-Config-r16         SetupRelease { SL-PSSCH-Config-r16 }    OPTIONAL, -- Need M
        sl-PSFCH-Config-r16         SetupRelease { SL-PSFCH-Config-r16 }    OPTIONAL, -- Need M
        sl-SyncAllowed-r16          SL-SyncAllowed-r16                    OPTIONAL, -- Need M
        sl-SubchannelSize-r16       ENUMERATED {n10, n12, n15, n20, n25, n50, n75, n100}    OPTIONAL, -- Need M
        sl-TimeResource-r16         INTEGER (10..160)                      OPTIONAL, -- Need M
        sl-StartRB-Subchannel-r16   INTEGER (0..265)                       OPTIONAL, -- Need M
        sl-NumSubchannel-r16        INTEGER (1..27)                        OPTIONAL, -- Need M
        sl-Additional-MCS-Table-r16 ENUMERATED {qam256, qam64LowSE, qam256-qam64LowSE }    OPTIONAL, -- Need M
        sl-ThreshS-RSSI-CBR-r16     INTEGER (0..45)                         OPTIONAL, -- Need M
        sl-TimeWindowSizeCBR-r16    ENUMERATED {ms100, slot100}            OPTIONAL, -- Need M
    }

```

sl-TimeWindowSizeCR-r16	ENUMERATED {ms1000, slot1000}	OPTIONAL,	-- Need M
sl-PTRS-Config-r16	SL-PTRS-Config-r16	OPTIONAL,	-- Need M
sl-UE-SelectedConfigRP-r16	SL-UE-SelectedConfigRP-r16	OPTIONAL,	-- Need M
sl-RxParametersNcell-r16	SEQUENCE {		
sl-TDD-Configuration-r16	TDD-UL-DL-ConfigCommon	OPTIONAL,	-- Need M
sl-SyncConfigIndex-r16	INTEGER (0..15)		
}		OPTIONAL,	-- Need M
sl-ZoneConfigMCR-List-r16	SEQUENCE (SIZE (16)) OF SL-ZoneConfigMCR-r16	OPTIONAL,	-- Need M
sl-FilterCoefficient-r16	FilterCoefficient	OPTIONAL,	-- Need M
sl-RB-Number-r16	INTEGER (10..275)	OPTIONAL,	-- Need M
sl-PreemptionEnable-r16	ENUMERATED {enabled, p11, p12, p13, p14, p15, p16, p17, p18}	OPTIONAL,	-- Need R
sl-PriorityThreshold-UL-URLLC-r16	INTEGER (1..9)	OPTIONAL,	-- Need M
sl-PriorityThreshold-r16	INTEGER (1..9)	OPTIONAL,	-- Need M
sl-X-Overhead-r16	ENUMERATED {n0,n3, n6, n9}	OPTIONAL,	-- Need S
sl-PowerControl-r16	SL-PowerControl-r16	OPTIONAL,	-- Need M
sl-TxPercentageList-r16	SL-TxPercentageList-r16	OPTIONAL,	-- Need M
sl-MinMaxMCS-List-r16	SL-MinMaxMCS-List-r16	OPTIONAL,	-- Need M
...			
}			
SL-ZoneConfigMCR-r16 ::=	SEQUENCE {		
sl-ZoneConfigMCR-Index-r16	INTEGER (0..15),		
sl-TransRange-r16	ENUMERATED {m20, m50, m80, m100, m120, m150, m180, m200, m220, m250, m270, m300, m350, m370, m400, m420, m450, m480, m500, m550, m600, m700, m1000, spare9, spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1}		
		OPTIONAL,	-- Need M
sl-ZoneConfig-r16	SL-ZoneConfig-r16	OPTIONAL,	-- Need M
...			
}			
SL-SyncAllowed-r16 ::=	SEQUENCE {		
gnss-Sync-r16	ENUMERATED {true}	OPTIONAL,	-- Need R
gnbEnb-Sync-r16	ENUMERATED {true}	OPTIONAL,	-- Need R
ue-Sync-r16	ENUMERATED {true}	OPTIONAL,	-- Need R
}			
SL-PSCCH-Config-r16 ::=	SEQUENCE {		
sl-TimeResourcePSCCH-r16	ENUMERATED {n2, n3}	OPTIONAL,	-- Need M
sl-FreqResourcePSCCH-r16	ENUMERATED {n10,n12, n15, n20, n25}	OPTIONAL,	-- Need M
sl-DMRS-ScrambleID-r16	INTEGER (0..65535)	OPTIONAL,	-- Need M
sl-NumReservedBits-r16	INTEGER (2..4)	OPTIONAL,	-- Need M
...			
}			
SL-PSSCH-Config-r16 ::=	SEQUENCE {		
sl-PSSCH-DMRS-TimePatternList-r16	SEQUENCE (SIZE (1..3)) OF INTEGER (2..4)	OPTIONAL,	-- Need M
sl-BetaOffsets2ndSCI-r16	SEQUENCE (SIZE (4)) OF SL-BetaOffsets-r16	OPTIONAL,	-- Need M
sl-Scaling-r16	ENUMERATED {f0p5, f0p65, f0p8, f1}	OPTIONAL,	-- Need M
...			
}			
SL-PSFCH-Config-r16 ::=	SEQUENCE {		
sl-PSFCH-Period-r16	ENUMERATED {s10, s11, s12, s14}	OPTIONAL,	-- Need M
sl-PSFCH-RB-Set-r16	BIT STRING (SIZE (10..275))	OPTIONAL,	-- Need M

```

sl-NumMuxCS-Pair-r16          ENUMERATED {n1, n2, n3, n6}          OPTIONAL, -- Need M
sl-MinTimeGapPSFCH-r16       ENUMERATED {s12, s13}          OPTIONAL, -- Need M
sl-PSFCH-HopID-r16           INTEGER (0..1023)              OPTIONAL, -- Need M
sl-PSFCH-CandidateResourceType-r16 ENUMERATED {startSubCH, allocSubCH} OPTIONAL, -- Need M
...
}
SL-PTRS-Config-r16 ::=
  sl-PTRS-FreqDensity-r16     SEQUENCE (SIZE (2)) OF INTEGER (1..276)    OPTIONAL, -- Need M
  sl-PTRS-TimeDensity-r16     SEQUENCE (SIZE (3)) OF INTEGER (0..29)    OPTIONAL, -- Need M
  sl-PTRS-RE-Offset-r16       ENUMERATED {offset01, offset10, offset11}  OPTIONAL, -- Need M
  ...
}

SL-UE-SelectedConfigRP-r16 ::=
  sl-CBR-PriorityTxConfigList-r16 SL-CBR-PriorityTxConfigList-r16    OPTIONAL, -- Need M
  sl-ThresPSSCH-RSRP-List-r16     SL-ThresPSSCH-RSRP-List-r16          OPTIONAL, -- Need M
  sl-MultiReserveResource-r16     ENUMERATED {enabled}                OPTIONAL, -- Need M
  sl-MaxNumPerReserve-r16         ENUMERATED {n2, n3}                  OPTIONAL, -- Need M
  sl-SensingWindow-r16           ENUMERATED {ms100, ms1100}           OPTIONAL, -- Need M
  sl-SelectionWindowList-r16      SL-SelectionWindowList-r16         OPTIONAL, -- Need M
  sl-ResourceReservePeriodList-r16 SEQUENCE (SIZE (1..16)) OF SL-ResourceReservePeriod-r16 OPTIONAL, -- Need M
  sl-RS-ForSensing-r16           ENUMERATED {pscch, pssch},
  ...
}

SL-ResourceReservePeriod-r16 ::=
  sl-ResourceReservePeriod1-r16   ENUMERATED {ms0, ms100, ms200, ms300, ms400, ms500, ms600, ms700, ms800, ms900, ms1000},
  sl-ResourceReservePeriod2-r16   INTEGER (1..99)
}

SL-SelectionWindowList-r16 ::=
  SEQUENCE (SIZE (8)) OF SL-SelectionWindowConfig-r16

SL-SelectionWindowConfig-r16 ::=
  sl-Priority-r16                 INTEGER (1..8),
  sl-SelectionWindow-r16          ENUMERATED {n1, n5, n10, n20}
}

SL-TxPercentageList-r16 ::=
  SEQUENCE (SIZE (8)) OF SL-TxPercentageConfig-r16

SL-TxPercentageConfig-r16 ::=
  sl-Priority-r16                 INTEGER (1..8),
  sl-TxPercentage-r16             ENUMERATED {p20, p35, p50}
}

SL-MinMaxMCS-List-r16 ::=
  SEQUENCE (SIZE (1..3)) OF SL-MinMaxMCS-Config-r16

SL-MinMaxMCS-Config-r16 ::=
  sl-MCS-Table-r16               ENUMERATED {qam64, qam256, qam64LowSE},
  sl-MinMCS-PSSCH-r16            INTEGER (0..27),
  sl-MaxMCS-PSSCH-r16            INTEGER (0..31)
}

SL-BetaOffsets-r16 ::=
  INTEGER (0..31)

```

```

SL-PowerControl-r16 ::= SEQUENCE {
  sl-MaxTransPower-r16      INTEGER (-30..33),
  sl-Alpha-PSSCH-PSCCH-r16  ENUMERATED {alpha0, alpha04, alpha05, alpha06, alpha07, alpha08, alpha09, alpha1} OPTIONAL, -- Need M
  dl-Alpha-PSSCH-PSCCH-r16  ENUMERATED {alpha0, alpha04, alpha05, alpha06, alpha07, alpha08, alpha09, alpha1} OPTIONAL, -- Need S
  sl-P0-PSSCH-PSCCH-r16     INTEGER (-16..15)    OPTIONAL, -- Need S
  dl-P0-PSSCH-PSCCH-r16     INTEGER (-16..15)    OPTIONAL, -- Need M
  dl-Alpha-PSFCH-r16        ENUMERATED {alpha0, alpha04, alpha05, alpha06, alpha07, alpha08, alpha09, alpha1} OPTIONAL, -- Need S
  dl-P0-PSFCH-r16          INTEGER (-16..15)    OPTIONAL, -- Need M
  ...
}

-- TAG-SL-RESOURCEPOOL-STOP
-- ASN1STOP

```

<b><i>SL-ZoneConfigMCR</i> field descriptions</b>
<b><i>sl-TransRange</i></b> Indicates the communication range requirement for the corresponding <i>sl-ZoneConfigMCR-Index</i> .
<b><i>sl-ZoneConfig</i></b> Indicates the zone configuration for the corresponding <i>sl-ZoneConfigMCR-Index</i> .
<b><i>sl-ZoneConfigMCR-Index</i></b> Indicates the codepoint of the communication range requirement field in SCI.

<b>SL-ResourcePool field descriptions</b>	
<b>sl-FilterCoefficient</b>	This field indicates the filtering coefficient for long-term measurement and reference signal power derivation used for sidelink open-loop power control.
<b>sl-Additional-MCS-Table</b>	Indicates the MCS table(s) additionally used in the resource pool. 64QAM table is (pre-)configured as default. Zero, one or two can be additionally (pre-)configured using the 256QAM and/or low-SE MCS tables
<b>sl-NumSubchannel</b>	Indicates the number of subchannels in the corresponding resource pool, which consists of contiguous PRBs only.
<b>sl-PreemptionEnable</b>	Indicates whether pre-emption is disabled or enabled in a resource pool. If enabled, a priority level <i>p_preemption</i> can be optionally configured. If the pre-emption is enabled but <i>p_preemption</i> is not configured, pre-emption is applicable to all levels.
<b>sl-PriorityThreshold-UL-URLLC</b>	Indicates the threshold used to determine whether NR sidelink transmission or PUCCH transmission carrying SL HARQ is prioritized over uplink transmission of priority index 1 if they overlap in time.
<b>sl-PriorityThreshold</b>	Indicates the threshold used to determine whether NR sidelink transmission or PUCCH transmission carrying SL HARQ is prioritized over uplink transmission of priority index 0 if they overlap in time.
<b>sl-RB-Number</b>	Indicates the number of PRBs in the corresponding resource pool, which consists of contiguous PRBs only. The remaining RB cannot be used (See TS 38.214[19], clause 8).
<b>sl-StartRB-Subchannel</b>	Indicates the lowest RB index of the subchannel with the lowest index in the resource pool with respect to the lowest RB index of a SL BWP.
<b>sl-SubchannelSize</b>	Indicates the minimum granularity in frequency domain for the sensing for PSSCH resource selection in the unit of PRB.
<b>sl-SyncAllowed</b>	Indicates the allowed synchronization reference(s) which is (are) allowed to use the configured resource pool.
<b>sl-SyncConfigIndex</b>	Indicates the synchronisation configuration that is associated with a reception pool, by means of an index to the corresponding entry <i>SL-SyncConfigList</i> of in <i>SIB12</i> for NR sidelink communication.
<b>sl-TDD-Configuration</b>	Indicates the TDD configuration associated with the reception pool of the cell indicated by <i>sl-SyncConfigIndex</i> .
<b>sl-ThreshS-RSSI-CBR</b>	Indicates the S-RSSI threshold for determining the contribution of a sub-channel to the CBR measurement. Value 0 corresponds to -112 dBm, value 1 to -110 dBm, value <i>n</i> to $(-112 + n \cdot 2)$ dBm, and so on.
<b>sl-TimeResource</b>	Indicates the bitmap of the resource pool, which is defined by repeating the bitmap with a periodicity during a SFN or DFN cycle.
<b>sl-TimeWindowSizeCBR</b>	Indicates the time window size for CBR measurement.
<b>sl-TimeWindowSizeCR</b>	Indicates the time window size for CR evaluation.
<b>sl-TxPercentageList</b>	Indicates the portion of candidate single-slot PSSCH resources over the total resources. Value <i>p20</i> corresponds to 20%, and so on.
<b>sl-X-Overhead</b>	Accounts for overhead from CSI-RS, PT-RS. If the field is absent, the UE applies value <i>n0</i> (see TS 38.214 [19], clause 5.1.3.2).

**SL-SyncAllowed field descriptions****gnbEnb-Sync**

If configured, the (pre-) configured resources can be used if the UE is directly or indirectly synchronized to eNB or gNB (i.e., synchronized to a reference UE which is directly synchronized to eNB or gNB).

**gnss-Sync**

If configured, the (pre-) configured resources can be used if the UE is directly or indirectly synchronized to GNSS (i.e., synchronized to a reference UE which is directly synchronized to GNSS).

**ue-Sync**

If configured, the (pre-) configured resources can be used if the UE is synchronized to a reference UE which is not synchronized to eNB, gNB and GNSS directly or indirectly.

**SL-PSCCH field descriptions****sl-FreqResourcePSCCH**

Indicates the number of PRBs for PSCCH in a resource pool where it is not greater than the number PRBs of the subchannel.

**sl-DMRS-ScrambleID**

Indicates the initialization value for PSCCH DMRS scrambling.

**sl-NumReservedBits**

Indicates the number of reserved bits in first stage SCI.

**sl-TimeResourcePSCCH**

Indicates the number of symbols of PSCCH in a resource pool.

**SL-PSSCH field descriptions****sl-BetaOffsets2ndSCI**

Indicates candidates of beta-offset values to determine the number of coded modulation symbols for second stage SCI. The value indicates the index of Table 9.3-2 of TS 38.213

**sl-PSSCH-DMRS-TimePatternList**

Indicates the set of PSSCH DMRS time domain patterns in terms of PSSCH DMRS symbols in a slot that can be used in the resource pool.

**sl-Scaling**

Indicates a scaling factor to limit the number of resource elements assigned to the second stage SCI on PSSCH. Value  $f0p5$  corresponds to 0.5, value  $f0p65$  corresponds to 0.65, and so on.

**SL-PSFCH field descriptions****sl-PSFCH-CandidateResourceType**

Indicates the number of PSFCH resources available for multiplexing HARQ-ACK information in a PSFCH transmission (see TS 38.213 clause 16.3)

**sl-PSFCH-Period**

Indicates the period of PSFCH resource in the unit of slots within this resource pool. If set to  $s/0$ , no resource for PSFCH, and HARQ feedback for all transmissions in the resource pool is disabled.

**sl-PSFCH-RB-Set**

Indicates the set of PRBs that are actually used for PSFCH transmission and reception. The leftmost bit of the bitmap refers to the lowest RB index in the resource pool, and so on

**SL-UE-SelectedConfigRP field descriptions****sl-MaxNumPerReserve**

Indicates the maximum number of reserved PSCCH/PSSCH resources that can be indicated by an SCI.

**sl-MultiReserveResource**

Indicates if it is allowed to reserve a sidelink resource for an initial transmission of a TB by an SCI associated with a different TB, based on sensing and resource selection procedure.

**sl-ResourceReservePeriodList**

Set of possible resource reservation period allowed in the resource pool in the unit of ms. Up to 16 values can be configured per resource pool.

**sl-RS-ForSensing**

Indicates whether DMRS of PSCCH or PSSCH is used for L1 RSRP measurement in the sensing operation.

**sl-SensingWindow**

Parameter that indicates the start of the sensing window.

**sl-SelectionWindowList**

Parameter that determines the end of the selection window in the resource selection for a TB with respect to priority indicated in SCI. Value n1 corresponds to  $1 \cdot 2^\mu$ , value n5 corresponds to  $5 \cdot 2^\mu$ , and so on, where  $\mu = 0, 1, 2, 3$  for SCS 15, 30, 60, 120 kHz respectively.

**sl-ThresPSSCH-RSRP-List**

Indicates a list of 64 thresholds, and the threshold should be selected based on the priority in the decoded SCI and the priority in the SCI to be transmitted. A resource is excluded if it is indicated or reserved by a decoded SCI and PSSCH RSRP in the associated data resource is above a threshold.

**SL-PowerControl field descriptions****sl-MaxTransPower**

Indicates the maximum value of the UE's sidelink transmission power on this resource pool. The unit is dBm.

**sl-Alpha-PSSCH-PSCCH**

Indicates alpha value for sidelink pathloss based power control for PSCCH/PSSCH when sl-P0-PSSCH is configured. When the field is absent the UE applies the value 1.

**sl-P0-PSSCH-PSCCH**

Indicates P0 value for sidelink pathloss based power control for PSCCH/PSSCH. If not configured, sidelink pathloss based power control is disabled for PSCCH/PSSCH.

**dl-Alpha-PSSCH-PSCCH**

Indicates alpha value for downlink pathloss based power control for PSCCH/PSSCH when dl-P0-PSSCH is configured. When the field is absent the UE applies the value 1.

**dl-P0-PSSCH-PSCCH**

Indicates P0 value for downlink pathloss based power control for PSCCH/PSSCH. If not configured, downlink pathloss based power control is disabled for PSCCH/PSSCH.

**dl-Alpha-PSFCH**

Indicates alpha value for downlink pathloss based power control for PSFCH when dl-P0-PSFCH is configured. When the field is absent the UE applies the value 1.

**dl-P0-PSFCH**

Indicates P0 value for downlink pathloss based power control for PSFCH. If not configured, downlink pathloss based power control is disabled for PSFCH.

**SL-MinMaxMCS-Config field descriptions****sl-MaxMCS-PSSCH**

Indicates the maximum MCS value used for Mode 1 configured and dynamic grants when using the associated MCS table. If no MCS is configured, UE autonomously selects MCS from the full range of values.

**sl-MinMCS-PSSCH**

Indicates the minimum MCS value for Mode 1 configured and dynamic grants when using the associated MCS table. If no MCS is configured, UE autonomously selects MCS from the full range of values.

– *SL-RLC-BearerConfig*

The IE *SL-RLC-BearerConfig* specifies the SL RLC bearer configuration information for NR sidelink communication.

***SL-RLC-BearerConfig* information element**

```
-- ASN1START
-- TAG-SL-RLC-BEARERCONFIG-START

SL-RLC-BearerConfig-r16 ::=
    sl-RLC-BearerConfigIndex-r16          SEQUENCE {
    sl-ServedRadioBearer-r16              SL-RLC-BearerConfigIndex-r16,
    sl-RLC-Config-r16                     SLRB-Uu-ConfigIndex-r16          OPTIONAL, -- Cond LCH-SetupOnly
    sl-MAC-LogicalChannelConfig-r16       SL-RLC-Config-r16          OPTIONAL, -- Cond LCH-Setup
    ...
    }
-- TAG-SL-RLC-BEARERCONFIG-STOP
-- ASN1STOP
```

<b><i>SL-RLC-BearerCoonfig</i> field descriptions</b>	
<b><i>sl-MAC-LogicalChannelConfig</i></b>	The field is used to configure MAC SL logical channel paramenters.
<b><i>sl-RLC-BearerConfigIndex</i></b>	The index of the RLC bearer configuration.
<b><i>sl-RLC-Config</i></b>	Determines the RLC mode (UM, AM) and provides corresponding parameters.
<b><i>sl-ServedRadioBearer</i></b>	Associates the sidelink RLC Bearer with a sidelink DRB. It indicates the index of SL radio bearer configuration, which is corresponding to the RLC bearer configuration.

<b>Conditional Presence</b>	<b>Explanation</b>
<i>LCH-Setup</i>	The field is mandatory present upon creation of a new sidelink logical channel via the dedicated signalling and in case of sidelink DRB configuration via system information and pre-configuration; otherwise the field is optionally present, Need M.
<i>LCH-SetupOnly</i>	This field is mandatory present upon creation of a new sidelink logical channel via the dedicated signalling and in case of sidelink DRB configuration via system information and pre-configuration. Otherwise, it is absent, Need M.

– *SL-RLC-BearerConfigIndex*

The IE *SL-RadioBearerConfigIndex* is used to identify a SL RLC bearer configuration.

***SL-RadioBearerConfigIndex* information element**

```
-- ASN1START
-- TAG-SL-RLC-BEARERCONFIGINDEX-START
```



```
SL-RLC-BearerConfigIndex-r16 ::=
    INTEGER (1..maxSL-LCID-r16)

-- TAG-RLC-BEARERCONFIGINDEX-STOP
-- ASN1STOP
```

– **SL-RLC-Config**

The IE *SL-RLC-Config* is used to specify the RLC configuration of sidelink DRB. RLC AM configuration is only applicable to the unicast NR sidelink communication.

**SL-RLC-Config information element**

```
-- ASN1START
-- TAG-SL-RLC-CONFIG-START

SL-RLC-Config-r16 ::=
    CHOICE {
        sl-AM-RLC-r16
            SEQUENCE {
                sl-SN-FieldLengthAM-r16
                    SN-FieldLengthAM
                    OPTIONAL, -- Cond SLRBSetup
                sl-T-PollRetransmit-r16
                    T-PollRetransmit,
                sl-PollPDU-r16
                    PollPDU,
                sl-PollByte-r16
                    PollByte,
                sl-MaxRetxThreshold-r16
                    ENUMERATED { t1, t2, t3, t4, t6, t8, t16, t32 },
                ...
            },
        sl-UM-RLC-r16
            SEQUENCE {
                sl-SN-FieldLengthUM-r16
                    SN-FieldLengthUM
                    OPTIONAL, -- Cond SLRBSetup
                ...
            },
        ...
    }

-- TAG-SL-RLC-CONFIG-STOP
-- ASN1STOP
```

**SL-RLC-Config field descriptions**

**sl-SN-FieldLengthUM**

For groupcast and broadcast, only 6 bits SN length is supported.

Conditional Presence	Explanation
SLRBSetup	The field is mandatory present in case of sidelink DRB setup via the dedicated signalling and in case of sidelink DRB configuration via system information and pre-configuration; otherwise the field is optionally present, need M.

– **SL-ScheduledConfig**

The IE *SL-ScheduledConfig* specifies sidelink communication configurations used for network scheduled NR sidelink communication.

**SL-ScheduledConfig** information element

```

-- ASN1START
-- TAG-SL-SCHEDULEDCONFIG-START

SL-ScheduledConfig-r16 ::=
    sl-RNTI-r16                SEQUENCE {
        mac-MainConfigSL-r16  MAC-MainConfigSL-r16                OPTIONAL, -- Need M
        sl-CS-RNTI-r16        RNTI-Value                        OPTIONAL, -- Need M
        sl-PSFCH-ToPUCCH-r16  SEQUENCE (SIZE (1..8)) OF INTEGER (0..15)  OPTIONAL, -- Need M
        sl-ConfiguredGrantConfigList-r16  SL-ConfiguredGrantConfigList-r16  OPTIONAL, -- Need M
        ...
    }

MAC-MainConfigSL-r16 ::=
    sl-BSR-Config-r16         BSR-Config                OPTIONAL, -- Need M
    ul-PrioritizationThres-r16  INTEGER (1..16)                OPTIONAL, -- Cond SLThreshold
    sl-PrioritizationThres-r16  INTEGER (1..8)                OPTIONAL, -- Cond ULThreshold
    ...
}

SL-ConfiguredGrantConfigList-r16 ::=
    sl-ConfiguredGrantConfigToReleaseList-r16  SEQUENCE (SIZE (1..maxNrofCG-SL-r16)) OF SL-ConfigIndexCG-r16  OPTIONAL, -- Need N
    sl-ConfiguredGrantConfigToAddModList-r16   SEQUENCE (SIZE (1..maxNrofCG-SL-r16)) OF SL-ConfiguredGrantConfig-r16  OPTIONAL, -- Need N
}

-- TAG-SL-SCHEDULEDCONFIG-STOP
-- ASN1STOP

```

**SL-ScheduledConfig** field descriptions**sl-CS-RNTI**

Indicate the RNTI used to scramble CRC of DCI format 3\_0, see TS 38.321 [3].

**sl-PSFCH-ToPUCCH**

For dynamic grant and configured grant type 2, configure the values of the PSFCH to PUCCH gap. The field PSFCH-to-HARQ\_feedback timing indicator in DCI format 3\_0 selects one of the configured values of the PSFCH to PUCCH gap.

**sl-RNTI**

Indicate the C-RNTI used for monitoring the network scheduling to transmit NR sidelink communication (i.e. the mode 1).

**MAC-MainConfigSL** field descriptions**sl-BSR-Config**

This field is to configure the sidelink buffer status report.

**sl-PrioritizationThres**

Indicates the SL priority threshold, which is used to determine whether SL TX is prioritized over UL TX, as specified in TS 38.321 [3].

**ul-PrioritizationThres**

Indicates the UL priority threshold, which is used to determine whether SL TX is prioritized over UL TX, as specified in TS 38.321 [3].

Conditional Presence	Explanation
<i>SLThreshold</i>	The field is mandatory present if the field <i>sl-PrioritizationThres</i> is configured; otherwise it is absent, Need M.
<i>ULThreshold</i>	The field is mandatory present if the field <i>ul-PrioritizationThres</i> is configured; otherwise it is absent, Need M.

## – *SL-SDAP-Config*

The IE *SL-SDAP-Config* is used to set the configurable SDAP parameters for a Sidelink DRB.

### *SL-SDAP-Config* information element

```
-- ASN1START
-- TAG-SL-SDAP-CONFIG-START

SL-SDAP-Config-r16 ::=
    SEQUENCE {
        sl-SDAP-Header-r16          ENUMERATED {present, absent},
        sl-DefaultRB-r16           BOOLEAN,
        sl-MappedQoS-Flows-r16     CHOICE {
            sl-MappedQoS-FlowsList-r16    SEQUENCE (SIZE (1..maxNrofSL-QFIs-r16)) OF SL-QoS-Profile-r16,
            sl-MappedQoS-FlowsListDedicated-r16  SL-MappedQoS-FlowsListDedicated-r16
        } OPTIONAL, -- Need M
        sl-CastType-r16           ENUMERATED {broadcast, groupcast, unicast, spare1} OPTIONAL, -- Need M
        ...
    }

SL-MappedQoS-FlowsListDedicated-r16 ::= SEQUENCE {
    sl-MappedQoS-FlowsToAddList-r16    SEQUENCE (SIZE (1..maxNrofSL-QFIs-r16)) OF SL-QoS-FlowIdentity-r16 OPTIONAL, -- Need N
    sl-MappedQoS-FlowsToReleaseList-r16 SEQUENCE (SIZE (1..maxNrofSL-QFIs-r16)) OF SL-QoS-FlowIdentity-r16 OPTIONAL, -- Need N
}

-- TAG-SL-SDAP-CONFIG-STOP
-- ASN1STOP
```

<b>SL-SDAP-Config field descriptions</b>
<p><b>sl-DefaultRB</b> Indicates whether or not this is the default sidelink DRB for this NR sidelink communication transmission destination. Among all configured instances of <i>SL-SDAP-Config</i> with the same value of <i>sl-DestinationIdentity</i>, this field shall be set to <i>true</i> in at most one instance of <i>SL-SDAP-Config</i> and to <i>false</i> in all other instances.</p>
<p><b>sl-MappedQoS-Flows</b> Indicates QoS flows to be mapped to the sidelink DRB. If the field is included in dedicated signalling, it is set to <i>sl-MappedQoS-FlowsListDedicated</i>; otherwise, it is set to <i>sl-MappedQoS-FlowsList</i>.</p>
<p><b>sl-MappedQoS-FlowsList</b> Indicates the list of SL QoS flows ID of the NR sidelink communication transmission destination mapped to this sidelink DRB.</p>
<p><b>sl-MappedQoS-FlowsToAddList</b> Indicates the list of SL QoS flows ID of the NR sidelink communication transmission destination to be additionally mapped to this sidelink DRB.</p>
<p><b>sl-MappedQoS-FlowsToReleaseList</b> Indicates the list of SL QoS flows ID of the NR sidelink communication transmission destination to be released from existing QoS flow to SLRB mapping of this sidelink DRB.</p>
<p><b>sl-SDAP-Header</b> Indicates whether or not a SDAP header is present on this sidelink DRB. The field cannot be changed after a sidelink DRB is established. This field is set to present if the field <i>sl-DefaultRB</i> is set to <i>true</i>.</p>

## – SL-SyncConfig

The IE *SL-SyncConfig* specifies the configuration information concerning reception of synchronisation signals from neighbouring cells as well as concerning the transmission of synchronisation signals for sidelink communication.

### SL-SyncConfig information element

```

-- ASN1START
-- TAG-SL-SYNCCONFIG-START

SL-SyncConfigList-r16 ::=          SEQUENCE (SIZE (1..maxSL-SyncConfig-r16)) OF SL-SyncConfig-r16

SL-SyncConfig-r16 ::=             SEQUENCE {
    sl-SyncRefMinHyst-r16          ENUMERATED {dB0, dB3, dB6, dB9, dB12}                OPTIONAL,    -- Need R
    sl-SyncRefDiffHyst-r16        ENUMERATED {dB0, dB3, dB6, dB9, dB12, dBInf}        OPTIONAL,    -- Need R
    sl-filterCoefficient-r16      FilterCoefficient                                OPTIONAL,    -- Need R
    sl-SSB-TimeAllocation1-r16    SL-SSB-TimeAllocation-r16                        OPTIONAL,    -- Need R
    sl-SSB-TimeAllocation2-r16    SL-SSB-TimeAllocation-r16                        OPTIONAL,    -- Need R
    sl-SSB-TimeAllocation3-r16    SL-SSB-TimeAllocation-r16                        OPTIONAL,    -- Need R
    sl-SSID-r16                   INTEGER (0..671)                                  OPTIONAL,    -- Need R
    txParameters-r16              SEQUENCE {
        syncTxThreshIC-r16        SL-RSRP-Range-r16                                OPTIONAL,    -- Need R
        syncTxThreshOoC-r16      SL-RSRP-Range-r16                                OPTIONAL,    -- Need R
        syncInfoReserved-r16     BIT STRING (SIZE (2))                            OPTIONAL,    -- Need R
    },
    gnss-Sync-r16                 ENUMERATED {true}                                OPTIONAL,    -- Need R
    ...
}

SL-RSRP-Range-r16 ::=             INTEGER (0..13)

```

```

SL-SSB-TimeAllocation-r16 ::= SEQUENCE {
    sl-NumSSB-WithinPeriod-r16    ENUMERATED {n1, n2, n4, n8, n16, n32, n64}    OPTIONAL,    -- Need R
    sl-TimeOffsetSSB-r16         INTEGER (0..1279)                            OPTIONAL,    -- Need R
    sl-TimeInterval-r16          INTEGER (0..639)                            OPTIONAL,    -- Need R
}

-- TAG-SL-SYNCCONFIG-STOP
-- ASN1STOP

```

#### **SL-SyncConfig field descriptions**

<p><b>gnss-Sync</b> if configured, the synchronization configuration is used for SLSS transmission/reception when the UE is synchronized to GNSS. If not configured, the synchronization configuration is used for SLSS transmission/reception when the UE is synchronized to eNB/gNB.</p>
<p><b>sl-SyncRefMinHyst</b> Hysteresis when evaluating a SyncRef UE using absolute comparison.</p>
<p><b>sl-SyncRefDiffHyst</b> Hysteresis when evaluating a SyncRef UE using relative comparison.</p>
<p><b>sl-NumSSB-WithinPeriod</b> Indicates the number of sidelink SSB transmissions within one sidelink SSB period. The applicable values are related to the subcarrier spacing and frequency as follows: FR1, SCS = 15 kHz: 1, 2 FR1, SCS = 30 kHz: 1, 2, 4 FR1, SCS = 60 kHz: 1, 2, 4, 8 FR2, SCS = 60 kHz: 1, 2, 4, 8, 16, 32 FR2, SCS = 120 kHz: 1, 2, 4, 8, 16, 32, 64</p>
<p><b>sl-TimeOffsetSSB</b> Indicates the slot offset from the start of sidelink SSB period to the first sidelink SSB.</p>
<p><b>sl-TimeInterval</b> Indicates the slot interval between neighboring sidelink SSBs. This value is applicable when there are more than one sidelink SSBs within one sidelink SSB period.</p>
<p><b>sl-SSID</b> Indicates the ID of sidelink synchronization signal associated with different synchronization priorities.</p>
<p><b>SL-RSRP-Range</b> Value 0 corresponds to -infinity, value 1 to -115dBm, value 2 to -110dBm, and so on (i.e. in steps of 5dBm) until value 12, which corresponds to -60dBm, while value 13 corresponds to +infinity.</p>
<p><b>syncInfoReserved</b> Reserved for future use.</p>

#### – *SL-ThresPSSCH-RSRP-List*

IE *SL-ThresPSSCH-RSRP-List* indicates a threshold used for sensing based UE autonomous resource selection (see TS 38.215 [9]). A resource is excluded if it is indicated or reserved by a decoded SCI and PSSCH RSRP in the associated data resource is above the threshold defined by IE *SL-ThresPSSCH-RSRP-List*.

#### **SL-ThresPSSCH-RSRP-List information element**

```

-- ASN1START
-- TAG-SL-THRESPSSCH-RSRP-LIST-START

```

```

SL-ThresPSSCH-RSRP-List-r16 ::= SEQUENCE (SIZE (64)) OF SL-ThresPSSCH-RSRP-r16
SL-ThresPSSCH-RSRP-r16 ::= INTEGER (0..66)

-- TAG-SL-THRESPSSCH-RSRP-LIST-STOP
-- ASN1STOP

```

<i>SL-ThresPSSCH-RSRP-List</i> field descriptions
---

<p><b><i>SL-ThresPSSCH-RSRP</i></b>  Value 0 corresponds to minus infinity dBm, value 1 corresponds to -128dBm, value 2 corresponds to -126dBm, value n corresponds to <math>(-128 + (n-1)*2)</math> dBm and so on, value 66 corresponds to infinity dBm.</p>
---

## – *SL-TxPower*

The IE *SL-TxPower* is used to limit the UE's sidelink transmission power on a carrier frequency. The unit is dBm. Value minusinfinity corresponds to –infinity.

### *SL-TxPower* information element

```

-- ASN1START
-- TAG-SL-TXPOWER-START

SL-TxPower-r16 ::= CHOICE{
    minusinfinity-r16
    txPower-r16
}

-- TAG-SL-TXPOWER-STOP
-- ASN1STOP

```

## – *SL-TypeTxSync*

The IE *SL-TypeTxSync* indicates the synchronization reference type.

### *SL-TypeTxSync* information element

```

-- ASN1START
-- TAG-SL-TYPETXSYNC-START

SL-TypeTxSync-r16 ::= ENUMERATED {gnss, gnbEnb, ue}

-- TAG-SL-TYPETXSYNC-STOP
-- ASN1STOP

```

– *SL-UE-SelectedConfig*

IE *SL-UE-SelectedConfig* specifies sidelink communication configurations used for UE autonomous resource selection.

***SL-UE-SelectedConfig* information element**

```
-- ASN1START
-- TAG-SL-UE-SELECTEDCONFIG-START

SL-UE-SelectedConfig-r16 ::=
    SL-PSSCH-TxConfigList-r16          SEQUENCE {
    sl-ProbResourceKeep-r16            SL-PSSCH-TxConfigList-r16          OPTIONAL, -- Need R
    sl-ReselectAfter-r16               ENUMERATED {v0, v0dot2, v0dot4, v0dot6, v0dot8}  OPTIONAL, -- Need R
    sl-CBR-CommonTxConfigList-r16     ENUMERATED {n1, n2, n3, n4, n5, n6, n7, n8, n9}  OPTIONAL, -- Need R
    ul-PrioritizationThres-r16        SL-CBR-CommonTxConfigList-r16  OPTIONAL, -- Need R
    sl-PrioritizationThres-r16        INTEGER (1..16)                       OPTIONAL, -- Need R
    ...
}

-- TAG-SL-UE-SELECTEDCONFIG-STOP
-- ASN1STOP
```

***SL-UE-SelectedConfig* field descriptions**

<b><i>sl-PrioritizationThres</i></b>
Indicates the SL priority threshold, which is used to determine whether SL TX is prioritized over UL TX, as specified in TS 38.321 [3].
<b><i>sl-ProbResourceKeep</i></b>
Indicates the probability with which the UE keeps the current resource when the resource reselection counter reaches zero for sensing based UE autonomous resource selection (see TS 38.321 [3]).
<b><i>sl-PSSCH-TxConfigList</i></b>
Indicates PSSCH TX parameters such as MCS, sub-channel number, retransmission number, associated to different UE absolute speeds and different synchronization reference types for UE autonomous resource selection.
<b><i>sl-ReselectAfter</i></b>
Indicates the number of consecutive skipped transmissions before triggering resource reselection for sidelink communication (see TS 38.321 [3]).
<b><i>ul-PrioritizationThres</i></b>
Indicates the UL priority threshold, which is used to determine whether SL TX is prioritized over UL TX, as specified in TS 38.321 [3].

– *SL-ZoneConfig*

The IE *SL-ZoneConfig* is used to configure the zone ID related parameters.

***SL-ZoneConfig* information element**

```
-- ASN1START
-- TAG-SL-ZONECONFIG-START

SL-ZoneConfig-r16 ::=
    SEQUENCE {
```

```

    sl-ZoneLength-r16          ENUMERATED { m5, m10, m20, m30, m40, m50, spare2, spare1},
    ...
}
-- TAG-SL-ZONECONFIG-STOP
-- ASN1STOP

```

<b><i>SL-ZoneConfig</i> field descriptions</b>
--

<b><i>sl-ZoneLength</i></b>
-----------------------------

Indicates the length of each geographic zone.
---

## – *SLRB-Uu-ConfigIndex*

The IE *SLRB-Uu-ConfigIndex* is used to identify a sidelink DRB configuration from the network side.

### ***SLRB-Uu-ConfigIndex* information element**

```

-- ASN1START
-- TAG-SLRB-UU-CONFIGINDEX-START

SLRB-Uu-ConfigIndex-r16 ::=
    INTEGER (1..maxNrofSLRB-r16)

-- TAG-SLRB-UU-CONFIGINDEX-STOP
-- ASN1STOP

```

## 6.4 RRC multiplicity and type constraint values

### – Multiplicity and type constraint definitions

```

-- ASN1START
-- TAG-MULTIPLICITY-AND-TYPE-CONSTRAINT-DEFINITIONS-START

maxAI-DCI-PayloadSize-r16          INTEGER ::= 128      --Maximum size of the DCI payload scrambled with ai-RNTI
maxAI-DCI-PayloadSize-r16-1        INTEGER ::= 127      --Maximum size of the DCI payload scrambled with ai-RNTI minus 1
maxBandComb                         INTEGER ::= 65536     -- Maximum number of DL band combinations
maxBandsUTRA-FDD-r16               INTEGER ::= 64        -- Maximum number of bands listed in UTRA-FDD UE caps
maxBH-RLC-ChannelID-r16            INTEGER ::= 65536     -- Maximum value of BH RLC Channel ID
maxBT-IdReport-r16                 INTEGER ::= 32        -- Maximum number of Bluetooth IDs to report
maxBT-Name-r16                     INTEGER ::= 4         -- Maximum number of Bluetooth name
maxCAG-Cell-r16                    INTEGER ::= 16        -- Maximum number of NR CAG cell ranges in SIB3, SIB4
maxCBR-Config-r16                  INTEGER ::= 8         -- Maximum number of CBR range configurations for sidelink communication
-- congestion control
maxCBR-Config-1-r16                INTEGER ::= 7         -- Maximum number of CBR range configurations for sidelink communication
-- congestion control minus 1

```



maxCBR-Level-r16	INTEGER ::= 16	-- Maximum number of CBR levels
maxCBR-Level-1-r16	INTEGER ::= 15	-- Maximum number of CBR levels minus 1
maxCellBlack	INTEGER ::= 16	-- Maximum number of NR blacklisted cell ranges in SIB3, SIB4
maxCellHistory-r16	INTEGER ::= 16	-- Maximum number of visited cells reported
maxCellInter	INTEGER ::= 16	-- Maximum number of inter-Freq cells listed in SIB4
maxCellIntra	INTEGER ::= 16	-- Maximum number of intra-Freq cells listed in SIB3
maxCellMeasEUTRA	INTEGER ::= 32	-- Maximum number of cells in E-UTRAN
maxCellMeasIdle-r16	INTEGER ::= 8	-- Maximum number of cells per carrier for idle/inactive measurements
maxCellMeasUTRA-FDD-r16	INTEGER ::= 32	-- Maximum number of cells in FDD UTRAN
maxCellWhite	INTEGER ::= 16	-- Maximum number of NR whitelisted cell ranges in SIB3, SIB4
maxEARFCN	INTEGER ::= 262143	-- Maximum value of E-UTRA carrier frequency
maxEUTRA-CellBlack	INTEGER ::= 16	-- Maximum number of E-UTRA blacklisted physical cell identity ranges -- in SIB5
maxEUTRA-NS-Pmax	INTEGER ::= 8	-- Maximum number of NS and P-Max values per band
maxLogMeasReport-r16	INTEGER ::= 520	-- Maximum number of entries for logged measurements
maxMultiBands	INTEGER ::= 8	-- Maximum number of additional frequency bands that a cell belongs to
maxNARFCN	INTEGER ::= 3279165	-- Maximum value of NR carrier frequency
maxNR-NS-Pmax	INTEGER ::= 8	-- Maximum number of NS and P-Max values per band
maxFreqIdle-r16	INTEGER ::= 8	-- Maximum number of carrier frequencies for idle/inactive measurements
maxNrofServingCells	INTEGER ::= 32	-- Max number of serving cells (SpCells + SCells)
maxNrofServingCells-1	INTEGER ::= 31	-- Max number of serving cells (SpCell + SCells) per cell group
maxNrofAggregatedCellsPerCellGroup	INTEGER ::= 16	
maxNrofDUCells-r16	INTEGER ::= 512	-- Max number of cells configured on the collocated IAB-DU
maxNrofAssociatedDUCellsPerMT-r16	INTEGER ::= 65535	
maxNrofAvailabilityCombinationsPerSet-r16	INTEGER ::= 512	-- Max number of AvailabilityCombinationId used in the DCI format 2_5
maxNrofAvailabilityCombinationsPerSet-r16-1	INTEGER ::= 511	-- Max number of AvailabilityCombinationId used in the DCI format 2_5 minus 1
maxNrofSCells	INTEGER ::= 31	-- Max number of secondary serving cells per cell group
maxNrofCellMeas	INTEGER ::= 32	-- Maximum number of entries in each of the cell lists in a measurement object
maxNrofCG-SL-r16	INTEGER ::= 8	-- Max number of sidelink configured grant
maxNrofCG-SL-r16-1	INTEGER ::= 7	-- Max number of sidelink configured grant minus 1
maxNrofSS-BlocksToAverage measurement	INTEGER ::= 16	-- Max number for the (max) number of SS blocks to average to determine cell measurement
maxNrofCondCells-r16	INTEGER ::= 8	-- Max number of conditional candidate SpCells
maxNrofCSI-RS-ResourcesToAverage	INTEGER ::= 16	-- Max number for the (max) number of CSI-RS to average to determine cell measurement
maxNrofDL-Allocations	INTEGER ::= 16	-- Maximum number of PDSCH time domain resource allocations
maxNrofSR-ConfigPerCellGroup	INTEGER ::= 8	-- Maximum number of SR configurations per cell group
maxLCG-ID	INTEGER ::= 7	-- Maximum value of LCG ID
maxLC-ID	INTEGER ::= 32	-- Maximum value of Logical Channel ID
maxLC-ID-Iab-r16	INTEGER ::= 65855	-- Maximum value of BH Logical Channel ID extension
maxLTE-CRS-Patterns-r16	INTEGER ::= 3	-- Maximum number of additional LTE CRS rate matching patterns
maxNrofTAGs	INTEGER ::= 4	-- Maximum number of Timing Advance Groups
maxNrofTAGs-1	INTEGER ::= 3	-- Maximum number of Timing Advance Groups minus 1
maxNrofBWPs	INTEGER ::= 4	-- Maximum number of BWPs per serving cell
maxNrofCombIDC	INTEGER ::= 128	-- Maximum number of reported MR-DC combinations for IDC
maxNrofSymbols-1	INTEGER ::= 13	-- Maximum index identifying a symbol within a slot (14 symbols, indexed from 0..13)
maxNrofSlots	INTEGER ::= 320	-- Maximum number of slots in a 10 ms period
maxNrofSlots-1	INTEGER ::= 319	-- Maximum number of slots in a 10 ms period minus 1
maxNrofPhysicalResourceBlocks	INTEGER ::= 275	-- Maximum number of PRBs
maxNrofPhysicalResourceBlocks-1	INTEGER ::= 274	-- Maximum number of PRBs minus 1
maxNrofPhysicalResourceBlocksPlus1	INTEGER ::= 276	-- Maximum number of PRBs plus 1
maxNrofControlResourceSets	INTEGER ::= 12	-- Max number of CoReSets configurable on a serving cell
maxNrofControlResourceSets-1	INTEGER ::= 11	-- Max number of CoReSets configurable on a serving cell minus 1
maxNrofControlResourceSets-1-r16	INTEGER ::= 15	-- Max number of CoReSets configurable on a serving cell extended in minus 1
maxNrofCoresetPools-r16	INTEGER ::= 2	-- Maximum number of CORESET pools

maxCoReSetDuration	INTEGER	::= 3	-- Max number of OFDM symbols in a control resource set
maxNrofSearchSpaces-1	INTEGER	::= 39	-- Max number of Search Spaces minus 1
maxSFI-DCI-PayloadSize	INTEGER	::= 128	-- Max number payload of a DCI scrambled with SFI-RNTI
maxSFI-DCI-PayloadSize-1	INTEGER	::= 127	-- Max number payload of a DCI scrambled with SFI-RNTI minus 1
maxIAB-IP-Address-r16	INTEGER	::= 32	-- Max number of assigned IP addresses
maxINT-DCI-PayloadSize	INTEGER	::= 126	-- Max number payload of a DCI scrambled with INT-RNTI
maxINT-DCI-PayloadSize-1	INTEGER	::= 125	-- Max number payload of a DCI scrambled with INT-RNTI minus 1
maxNrofRateMatchPatterns	INTEGER	::= 4	-- Max number of rate matching patterns that may be configured
maxNrofRateMatchPatterns-1	INTEGER	::= 3	-- Max number of rate matching patterns that may be configured minus 1
maxNrofRateMatchPatternsPerGroup	INTEGER	::= 8	-- Max number of rate matching patterns that may be configured in one group
maxNrofCSI-ReportConfigurations	INTEGER	::= 48	-- Maximum number of report configurations
maxNrofCSI-ReportConfigurations-1	INTEGER	::= 47	-- Maximum number of report configurations minus 1
maxNrofCSI-ResourceConfigurations	INTEGER	::= 112	-- Maximum number of resource configurations
maxNrofCSI-ResourceConfigurations-1	INTEGER	::= 111	-- Maximum number of resource configurations minus 1
maxNrofAP-CSI-RS-ResourcesPerSet	INTEGER	::= 16	
maxNrOfCSI-AperiodicTriggers	INTEGER	::= 128	-- Maximum number of triggers for aperiodic CSI reporting
maxNrofReportConfigPerAperiodicTrigger	INTEGER	::= 16	-- Maximum number of report configurations per trigger state for aperiodic reporting
maxNrofNZP-CSI-RS-Resources	INTEGER	::= 192	-- Maximum number of Non-Zero-Power (NZP) CSI-RS resources
maxNrofNZP-CSI-RS-Resources-1	INTEGER	::= 191	-- Maximum number of Non-Zero-Power (NZP) CSI-RS resources minus 1
maxNrofNZP-CSI-RS-ResourcesPerSet	INTEGER	::= 64	-- Maximum number of NZP CSI-RS resources per resource set
maxNrofNZP-CSI-RS-ResourceSets	INTEGER	::= 64	-- Maximum number of NZP CSI-RS resources per cell
maxNrofNZP-CSI-RS-ResourceSets-1	INTEGER	::= 63	-- Maximum number of NZP CSI-RS resources per cell minus 1
maxNrofNZP-CSI-RS-ResourceSetsPerConfig	INTEGER	::= 16	-- Maximum number of resource sets per resource configuration
maxNrofNZP-CSI-RS-ResourcesPerConfig	INTEGER	::= 128	-- Maximum number of resources per resource configuration
maxNrofZP-CSI-RS-Resources	INTEGER	::= 32	-- Maximum number of Zero-Power (ZP) CSI-RS resources
maxNrofZP-CSI-RS-Resources-1	INTEGER	::= 31	-- Maximum number of Zero-Power (ZP) CSI-RS resources minus 1
maxNrofZP-CSI-RS-ResourceSets-1	INTEGER	::= 15	
maxNrofZP-CSI-RS-ResourcesPerSet	INTEGER	::= 16	
maxNrofZP-CSI-RS-ResourceSets	INTEGER	::= 16	
maxNrofCSI-IM-Resources	INTEGER	::= 32	-- Maximum number of CSI-IM resources. See CSI-IM-ResourceMax in 38.214.
maxNrofCSI-IM-Resources-1	INTEGER	::= 31	-- Maximum number of CSI-IM resources minus 1. See CSI-IM-ResourceMax in 38.214.
maxNrofCSI-IM-ResourcesPerSet	INTEGER	::= 8	-- Maximum number of CSI-IM resources per set. See CSI-IM-ResourcePerSetMax in 38.214
maxNrofCSI-IM-ResourceSets	INTEGER	::= 64	-- Maximum number of NZP CSI-IM resources per cell
maxNrofCSI-IM-ResourceSets-1	INTEGER	::= 63	-- Maximum number of NZP CSI-IM resources per cell minus 1
maxNrofCSI-IM-ResourceSetsPerConfig	INTEGER	::= 16	-- Maximum number of CSI IM resource sets per resource configuration
maxNrofCSI-SSB-ResourcePerSet	INTEGER	::= 64	-- Maximum number of SSB resources in a resource set
maxNrofCSI-SSB-ResourceSets	INTEGER	::= 64	-- Maximum number of CSI SSB resource sets per cell
maxNrofCSI-SSB-ResourceSets-1	INTEGER	::= 63	-- Maximum number of CSI SSB resource sets per cell minus 1
maxNrofCSI-SSB-ResourceSetsPerConfig	INTEGER	::= 1	-- Maximum number of CSI SSB resource sets per resource configuration
maxNrofFailureDetectionResources	INTEGER	::= 10	-- Maximum number of failure detection resources
maxNrofFailureDetectionResources-1	INTEGER	::= 9	-- Maximum number of failure detection resources minus 1
maxNrofFreqSL-r16	INTEGER	::= 8	-- Maximum number of carrier frequency for for NR sidelink communication
maxNrofSL-BWPs-r16	INTEGER	::= 4	-- Maximum number of BWP for for NR sidelink communication
maxFreqSL-EUTRA-r16	INTEGER	::= 8	-- Maximum number of EUTRA anchor carrier frequency for NR sidelink communication
maxNrofSL-MeasId-r16	INTEGER	::= 64	-- Maximum number of sidelink measurement identity (RSRP) per destination
maxNrofSL-ObjectId-r16	INTEGER	::= 64	-- Maximum number of sidelink measurement objects (RSRP) per destination
maxNrofSL-ReportConfigId-r16	INTEGER	::= 64	-- Maximum number of sidelink measurement reporting configuration(RSRP) per destination
maxNrofSL-PoolToMeasureNR-r16	INTEGER	::= 8	-- Maximum number of resource pool for NR sidelink measurement to measure for each measurement object (for CBR)
maxFreqSL-NR-r16	INTEGER	::= 8	-- Maximum number of NR anchor carrier frequency for NR sidelink communication
maxNrofSL-QFIs-r16	INTEGER	::= 2048	-- Maximum number of QoS flow for NR sidelink communication per UE
maxNrofSL-QFIsPerDest-r16	INTEGER	::= 64	-- Maximum number of QoS flow per destination for NR sidelink communication
maxNrofObjectId	INTEGER	::= 64	-- Maximum number of measurement objects
maxNrofPageRec	INTEGER	::= 32	-- Maximum number of page records

maxNrofPCI-Ranges	INTEGER ::= 8	-- Maximum number of PCI ranges
maxPLMN	INTEGER ::= 12	-- Maximum number of PLMNs broadcast and reported by UE at establishment
maxNrofCSI-RS-ResourcesRRM	INTEGER ::= 96	-- Maximum number of CSI-RS resources for an RRM measurement object
maxNrofCSI-RS-ResourcesRRM-1	INTEGER ::= 95	-- Maximum number of CSI-RS resources for an RRM measurement object minus 1
maxNrofMeasId	INTEGER ::= 64	-- Maximum number of configured measurements
maxNrofQuantityConfig	INTEGER ::= 2	-- Maximum number of quantity configurations
maxNrofCSI-RS-CellsRRM	INTEGER ::= 96	-- Maximum number of cells with CSI-RS resources for an RRM measurement object
maxNrofSL-Dest-r16	INTEGER ::= 32	-- Maximum number of destination for NR sidelink communication
maxNrofSL-Dest-1-r16	INTEGER ::= 31	-- Highest index of destination for NR sidelink communication
maxNrofSLRB-r16	INTEGER ::= 512	-- Maximum number of radio bearer for NR sidelink communication per UE
maxSL-LCID-r16	INTEGER ::= 512	-- Maximum number of RLC bearer for NR sidelink communication per UE
maxSL-SyncConfig-r16	INTEGER ::= 16	-- Maximum number of sidelink Sync configurations
maxNrofRXPool-r16	INTEGER ::= 16	-- Maximum number of Rx resource pool for NR sidelink communication
maxNrofTXPool-r16	INTEGER ::= 8	-- Maximum number of Tx resource pool for NR sidelink communication
maxNrofPoolID-r16	INTEGER ::= 16	-- Maximum index of resource pool for NR sidelink communication
maxNrofSRS-PathlossReferenceRS-r16	INTEGER ::= 64	-- Maximum number of RSs used as pathloss reference for SRS power control.
maxNrofSRS-PathlossReferenceRS-1-r16	INTEGER ::= 63	-- Maximum number of RSs used as pathloss reference for SRS power control-1.
maxNrofSRS-ResourceSets	INTEGER ::= 16	-- Maximum number of SRS resource sets in a BWP.
maxNrofSRS-ResourceSets-1	INTEGER ::= 15	-- Maximum number of SRS resource sets in a BWP minus 1.
maxNrofSRS-PosResourceSets-r16	INTEGER ::= 16	-- Maximum number of SRS Positioning resource sets in a BWP.
maxNrofSRS-PosResourceSets-1-r16	INTEGER ::= 15	-- Maximum number of SRS Positioning resource sets in a BWP minus 1.
maxNrofSRS-Resources	INTEGER ::= 64	-- Maximum number of SRS resources.
maxNrofSRS-Resources-1	INTEGER ::= 63	-- Maximum number of SRS resources in an SRS resource set minus 1.
maxNrofSRS-PosResources-r16	INTEGER ::= 64	-- Maximum number of SRS Positioning resources.
maxNrofSRS-PosResources-1-r16	INTEGER ::= 63	-- Maximum number of SRS Positioning resources in an SRS Positioning resource set minus 1.
maxNrofSRS-ResourcesPerSet	INTEGER ::= 16	-- Maximum number of SRS resources in an SRS resource set
maxNrofSRS-TriggerStates-1	INTEGER ::= 3	-- Maximum number of SRS trigger states minus 1, i.e., the largest code point.
maxNrofSRS-TriggerStates-2	INTEGER ::= 2	-- Maximum number of SRS trigger states minus 2.
maxRAT-CapabilityContainers	INTEGER ::= 8	-- Maximum number of interworking RAT containers (incl NR and MRDC)
maxSimultaneousBands	INTEGER ::= 32	-- Maximum number of simultaneously aggregated bands
maxULTxSwitchingBandPairs combination	INTEGER ::= 32	-- Maximum number of band pairs supporting dynamic UL Tx switching in a band combination
maxNrofSlotFormatCombinationsPerSet	INTEGER ::= 512	-- Maximum number of Slot Format Combinations in a SF-Set.
maxNrofSlotFormatCombinationsPerSet-1	INTEGER ::= 511	-- Maximum number of Slot Format Combinations in a SF-Set minus 1.
maxNrofTrafficPattern-r16	INTEGER ::= 8	-- Maximum number of Traffic Pattern for NR sidelink communication.
maxNrofPUCCH-Resources	INTEGER ::= 128	
maxNrofPUCCH-Resources-1	INTEGER ::= 127	
maxNrofPUCCH-ResourceSets	INTEGER ::= 4	-- Maximum number of PUCCH Resource Sets
maxNrofPUCCH-ResourceSets-1	INTEGER ::= 3	-- Maximum number of PUCCH Resource Sets minus 1.
maxNrofPUCCH-ResourcesPerSet	INTEGER ::= 32	-- Maximum number of PUCCH Resources per PUCCH-ResourceSet
maxNrofPUCCH-P0-PerSet	INTEGER ::= 8	-- Maximum number of P0-pucch present in a p0-pucch set
maxNrofPUCCH-PathlossReferenceRSs	INTEGER ::= 4	-- Maximum number of RSs used as pathloss reference for PUCCH power control.
maxNrofPUCCH-PathlossReferenceRSs-1	INTEGER ::= 3	-- Maximum number of RSs used as pathloss reference for PUCCH power control minus 1.
maxNrofPUCCH-PathlossReferenceRSs-r16	INTEGER ::= 64	-- Maximum number of RSs used as pathloss reference for PUCCH power control extended.
maxNrofPUCCH-PathlossReferenceRSs-1-r16	INTEGER ::= 63	-- Maximum number of RSs used as pathloss reference for PUCCH power control minus 1 extended.
maxNrofPUCCH-PathlossReferenceRSsDiff-r16	INTEGER ::= 60	-- Difference between the extended maximum and the non-extended maximum
maxNrofPUCCH-ResourceGroups-r16	INTEGER ::= 4	-- Maximum number of PUCCH resources groups.
maxNrofPUCCH-ResourcesPerGroup-r16	INTEGER ::= 128	-- Maximum number of PUCCH resources in a PUCCH group.
maxNrofMultiplePUSCHs-r16	INTEGER ::= 8	-- Maximum number of multiple PUSCHs in PUSCH TDRA list
maxNrofP0-PUSCH-AlphaSets	INTEGER ::= 30	-- Maximum number of P0-pusch-alpha-sets (see 38,213, clause 7.1)
maxNrofP0-PUSCH-AlphaSets-1	INTEGER ::= 29	-- Maximum number of P0-pusch-alpha-sets minus 1 (see 38,213, clause 7.1)
maxNrofPUSCH-PathlossReferenceRSs	INTEGER ::= 4	-- Maximum number of RSs used as pathloss reference for PUSCH power control.

maxNrofPUSCH-PathlossReferenceRSs-1	INTEGER ::= 3	-- Maximum number of RSs used as pathloss reference for PUSCH power control minus 1.
maxNrofPUSCH-PathlossReferenceRSs-r16	INTEGER ::= 64	-- Maximum number of RSs used as pathloss reference for PUSCH power control extended
maxNrofPUSCH-PathlossReferenceRSs-1-r16	INTEGER ::= 63	-- Maximum number of RSs used as pathloss reference for PUSCH power control minus 1
maxNrofPUSCH-PathlossReferenceRSsDiff-r16	INTEGER ::= 60	-- Difference between maxNrofPUSCH-PathlossReferenceRSs-r16 and -- maxNrofPUSCH-PathlossReferenceRSs
maxNrofNAICS-Entries	INTEGER ::= 8	-- Maximum number of supported NAICS capability set
maxBands	INTEGER ::= 1024	-- Maximum number of supported bands in UE capability.
maxBandsMRDC	INTEGER ::= 1280	
maxBandsEUTRA	INTEGER ::= 256	
maxCellReport	INTEGER ::= 8	
maxDRB	INTEGER ::= 29	-- Maximum number of DRBs (that can be added in DRB-ToAddModList).
maxFreq	INTEGER ::= 8	-- Max number of frequencies.
maxFreqLayers	INTEGER ::= 4	-- Max number of frequency layers.
maxFreqIDC-r16	INTEGER ::= 128	-- Max number of frequencies for IDC indication.
maxCombIDC-r16	INTEGER ::= 128	-- Max number of reported UL CA for IDC indication.
maxFreqIDC-MRDC	INTEGER ::= 32	-- Maximum number of candidate NR frequencies for MR-DC IDC indication
maxNrofCandidateBeams	INTEGER ::= 16	-- Max number of PRACH-ResourceDedicatedBFR that in BFR config.
maxNrofCandidateBeams-r16	INTEGER ::= 64	-- Max number of candidate beam resources in BFR config.
maxNrofCandidateBeamsExt-r16	INTEGER ::= 48	-- Max number of PRACH-ResourceDedicatedBFR in the CandidateBeamRSLListExt
maxNrofPCIsPerSMTC	INTEGER ::= 64	-- Maximum number of PCIs per SMTC.
maxNrofQFIs	INTEGER ::= 64	
maxNrofResourceAvailabilityPerCombination-r16	INTEGER ::= 256	
maxNrOfSemiPersistentPUSCH-Triggers	INTEGER ::= 64	-- Maximum number of triggers for semi persistent reporting on PUSCH
maxNrofSR-Resources	INTEGER ::= 8	-- Maximum number of SR resources per BWP in a cell.
maxNrofSlotFormatsPerCombination	INTEGER ::= 256	
maxNrofSpatialRelationInfos	INTEGER ::= 8	
maxNrofSpatialRelationInfos-plus-1	INTEGER ::= 9	
maxNrofSpatialRelationInfos-r16	INTEGER ::= 64	
maxNrofSpatialRelationInfosDiff-r16	INTEGER ::= 56	-- Difference between maxNrofSpatialRelationInfos-r16 and maxNrofSpatialRelationInfos
maxNrofIndexesToReport	INTEGER ::= 32	
maxNrofIndexesToReport2	INTEGER ::= 64	
maxNrofSSBs-r16	INTEGER ::= 64	-- Maximum number of SSB resources in a resource set.
maxNrofSSBs-1	INTEGER ::= 63	-- Maximum number of SSB resources in a resource set minus 1.
maxNrofS-NSSAI	INTEGER ::= 8	-- Maximum number of S-NSSAI.
maxNrofTCI-StatesPDCCH	INTEGER ::= 64	
maxNrofTCI-States	INTEGER ::= 128	-- Maximum number of TCI states.
maxNrofTCI-States-1	INTEGER ::= 127	-- Maximum number of TCI states minus 1.
maxNrofUL-Allocations	INTEGER ::= 16	-- Maximum number of PUSCH time domain resource allocations.
maxQFI	INTEGER ::= 63	
maxRA-CSIRS-Resources	INTEGER ::= 96	
maxRA-OccasionsPerCSIRS	INTEGER ::= 64	-- Maximum number of RA occasions for one CSI-RS
maxRA-Occasions-1	INTEGER ::= 511	-- Maximum number of RA occasions in the system
maxRA-SSB-Resources	INTEGER ::= 64	
maxSCSs	INTEGER ::= 5	
maxSecondaryCellGroups	INTEGER ::= 3	
maxNrofServingCellsEUTRA	INTEGER ::= 32	
maxMBSFN-Allocations	INTEGER ::= 8	
maxNrofMultiBands	INTEGER ::= 8	
maxCellSFTD	INTEGER ::= 3	-- Maximum number of cells for SFTD reporting
maxReportConfigId	INTEGER ::= 64	
maxNrofCodebooks	INTEGER ::= 16	-- Maximum number of codebooks supported by the UE
maxNrofCSI-RS-ResourcesExt-r16	INTEGER ::= 16	-- Maximum number of codebook resources supported by the UE for eType2/Codebook combo
maxNrofCSI-RS-Resources	INTEGER ::= 7	-- Maximum number of codebook resources supported by the UE
maxNrofCSI-RS-ResourcesAlt-r16	INTEGER ::= 512	-- Maximum number of alternative codebook resources supported by the UE

maxNrofCSI-RS-ResourcesAlt-1-r16	INTEGER ::= 511	-- Maximum number of alternative codebook resources supported by the UE minus 1
maxNrofSRI-PUSCH-Mappings	INTEGER ::= 16	
maxNrofSRI-PUSCH-Mappings-1	INTEGER ::= 15	
maxSIB	INTEGER ::= 32	-- Maximum number of SIBs
maxSI-Message	INTEGER ::= 32	-- Maximum number of SI messages
maxPO-perPF	INTEGER ::= 4	-- Maximum number of paging occasion per paging frame
maxAccessCat-1	INTEGER ::= 63	-- Maximum number of Access Categories minus 1
maxBarringInfoSet	INTEGER ::= 8	-- Maximum number of Access Categories
maxCelleUTRA	INTEGER ::= 8	-- Maximum number of E-UTRA cells in SIB list
maxEUTRA-Carrier	INTEGER ::= 8	-- Maximum number of E-UTRA carriers in SIB list
maxPLMNIdentities	INTEGER ::= 8	-- Maximum number of PLMN identities in RAN area configurations
maxDownlinkFeatureSets	INTEGER ::= 1024	-- (for NR DL) Total number of FeatureSets (size of the pool)
maxUplinkFeatureSets	INTEGER ::= 1024	-- (for NR UL) Total number of FeatureSets (size of the pool)
maxEUTRA-DL-FeatureSets	INTEGER ::= 256	-- (for E-UTRA) Total number of FeatureSets (size of the pool)
maxEUTRA-UL-FeatureSets	INTEGER ::= 256	-- (for E-UTRA) Total number of FeatureSets (size of the pool)
maxFeatureSetsPerBand	INTEGER ::= 128	-- (for NR) The number of feature sets associated with one band.
maxPerCC-FeatureSets	INTEGER ::= 1024	-- (for NR) Total number of CC-specific FeatureSets (size of the pool)
maxFeatureSetCombinations	INTEGER ::= 1024	-- (for MR-DC/NR) Total number of Feature set combinations (size of the pool)
maxInterRAT-RSTD-Freq	INTEGER ::= 3	
maxHRNN-Len-r16	INTEGER ::= 48	-- Maximum length of HRNNs
maxNPN-r16	INTEGER ::= 12	-- Maximum number of NPNs broadcast and reported by UE at establishment
maxNrofMinSchedulingOffsetValues-r16	INTEGER ::= 2	-- Maximum number of min. scheduling offset (K0/K2) configurations
maxK0-SchedulingOffset-r16	INTEGER ::= 16	-- Maximum number of slots configured as min. scheduling offset (K0)
maxK2-SchedulingOffset-r16	INTEGER ::= 16	-- Maximum number of slots configured as min. scheduling offset (K2)
maxDCI-2-6-Size-r16	INTEGER ::= 140	-- Maximum size of DCI format 2-6
maxDCI-2-6-Size-1-r16	INTEGER ::= 139	-- Maximum DCI format 2-6 size minus 1
maxNrofUL-Allocations-r16	INTEGER ::= 64	-- Maximum number of PUSCH time domain resource allocations
maxNrofP0-PUSCH-Set-r16	INTEGER ::= 2	-- Maximum number of P0 PUSCH set(s)
maxOnDemandSIB-r16	INTEGER ::= 8	-- Maximum number of SIB(s) that can be requested on-demand
maxOnDemandPosSIB-r16	INTEGER ::= 32	-- Maximum number of posSIB(s) that can be requested on-demand
maxCI-DCI-PayloadSize-r16	INTEGER ::= 126	-- Maximum number of the DCI size for CI
maxCI-DCI-PayloadSize-r16-1	INTEGER ::= 125	-- Maximum number of the DCI size for CI minus 1
maxWLAN-Id-Report-r16	INTEGER ::= 32	-- Maximum number of WLAN IDs to report
maxWLAN-Name-r16	INTEGER ::= 4	-- Maximum number of WLAN name
maxRARReport-r16	INTEGER ::= 8	-- Maximum number of RA procedures information to be included in the RA report
maxTxConfig-r16	INTEGER ::= 64	-- Maximum number of sidelink transmission parameters configurations
maxTxConfig-1-r16	INTEGER ::= 63	-- Maximum number of sidelink transmission parameters configurations minus 1
maxPSSCH-TxConfig-r16	INTEGER ::= 16	-- Maximum number of PSSCH TX configurations
maxNrofCLI-RSSI-Resources-r16	INTEGER ::= 64	-- Maximum number of CLI-RSSI resources for UE
maxNrofCLI-RSSI-Resources-r16-1	INTEGER ::= 63	-- Maximum number of CLI-RSSI resources for UE minus 1
maxNrofCLI-SRS-Resources-r16	INTEGER ::= 32	-- Maximum number of SRS resources for CLI measurement for UE
maxCLI-Report-r16	INTEGER ::= 8	
maxNrofConfiguredGrantConfig-r16	INTEGER ::= 12	-- Maximum number of configured grant configurations per BWP
maxNrofConfiguredGrantConfig-r16-1	INTEGER ::= 11	-- Maximum number of configured grant configurations per BWP minus 1
maxNrofCG-Type2DeactivationState	INTEGER ::= 16	-- Maximum number of deactivation state for type 2 configured grants per BWP
maxNrofConfiguredGrantConfigMAC-r16	INTEGER ::= 32	-- Maximum number of configured grant configurations per MAC entity
maxNrofConfiguredGrantConfigMAC-r16-1	INTEGER ::= 31	-- Maximum number of configured grant configurations per MAC entity minus 1
maxNrofSPS-Config-r16	INTEGER ::= 8	-- Maximum number of SPS configurations per BWP
maxNrofSPS-Config-r16-1	INTEGER ::= 7	-- Maximum number of SPS configurations per BWP minus 1
maxNrofSPS-DeactivationState	INTEGER ::= 16	-- Maximum number of deactivation state for SPS per BWP
maxNrofDormancyGroups	INTEGER ::= 5	--
maxNrofPUCCH-ResourceGroups-1-r16	INTEGER ::= 3	--
maxNrofServingCellsTCI-r16	INTEGER ::= 32	-- Maximum number of serving cells in simultaneousTCI-UpdateList

```
-- TAG-MULTIPLICITY-AND-TYPE-CONSTRAINT-DEFINITIONS-STOP
-- ASN1STOP
```

## – End of NR-RRC-Definitions

```
-- ASN1START
END
-- ASN1STOP
```

## 6.5 Short Message

Short Messages can be transmitted on PDCCH using P-RNTI with or without associated *Paging* message using Short Message field in DCI format 1\_0 (see TS 38.212 [17], clause 7.3.1.2.1).

Table 6.5-1 defines Short Messages. Bit 1 is the most significant bit.

**Table 6.5-1: Short Messages**

Bit	Short Message
1	<b>systemInfoModification</b> If set to 1: indication of a BCCH modification other than SIB6, SIB7 and SIB8.
2	<b>etwsAndCmasIndication</b> If set to 1: indication of an ETWS primary notification and/or an ETWS secondary notification and/or a CMAS notification.
3	<b>stopPagingMonitoring</b> This bit can be used for only operation with shared spectrum channel access and if <i>nrofPDCCH-MonitoringOccasionPerSSB-InPO</i> is present. If set to 1: indication that the UE may stop monitoring PDCCH occasion(s) for paging in this Paging Occasion as specified in TS 38.304 [20], clause 7.1.
4 – 8	Not used in this release of the specification, and shall be ignored by UE if received.

## 6.6 PC5 RRC messages

### 6.6.1 General message structure

#### – *PC5-RRC-Definitions*

This ASN.1 segment is the start of the PC5 RRC PDU definitions.

```
-- ASN1START
```

```

-- TAG-PC5-RRC-DEFINITIONS-START

PC5-RRC-Definitions DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    SetupRelease,
    RRC-TransactionIdentifier,
    SN-FieldLengthAM,
    SN-FieldLengthUM,
    LogicalChannelIdentity,
    maxNrofSLRB-r16,
    maxNrofSL-QFIs-r16,
    maxNrofSL-QFIsPerDest-r16,
    RSRP-Range,
    SL-MeasConfig-r16,
    SL-MeasId-r16,
    FreqBandList,
    FreqBandIndicatorNR,
    maxSimultaneousBands,
    maxBandComb,
    maxBands,
    BandParametersSidelink-r16

FROM NR-RRC-Definitions;

-- TAG-PC5-RRC-DEFINITIONS-STOP
-- ASN1STOP

```

## — SBCCH-SL-BCH-Message

The *SBCCH-SL-BCH-Message* class is the set of RRC messages that may be sent from the UE to the UE via SL-BCH on the SBCCH logical channel.

```

-- ASN1START
-- TAG-SBCCH-SL-BCH-MESSAGE-START

SBCCH-SL-BCH-Message ::= SEQUENCE {
    message SBCCH-SL-BCH-MessageType
}

SBCCH-SL-BCH-MessageType ::= CHOICE {
    c1 CHOICE {
        masterInformationBlockSidelink MasterInformationBlockSidelink,
        spare1 NULL
    },
    messageClassExtension SEQUENCE {}
}

-- TAG-SBCCH-SL-BCH-MESSAGE-STOP
-- ASN1STOP

```

## – SCCH-Message

The *SCCH-Message* class is the set of RRC messages that may be sent from the UE to the UE for unicast of NR sidelink communication on SCCH logical channel.

```
-- ASN1START
-- TAG-SCCH-MESSAGE-START

SCCH-Message ::=
    SEQUENCE {
        message SCCH-MessageType
    }

SCCH-MessageType ::=
    CHOICE {
        c1 CHOICE {
            measurementReportSidelink MeasurementReportSidelink,
            rrcReconfigurationSidelink RRCReconfigurationSidelink,
            rrcReconfigurationCompleteSidelink RRCReconfigurationCompleteSidelink,
            rrcReconfigurationFailureSidelink RRCReconfigurationFailureSidelink,
            ueCapabilityEnquirySidelink UECapabilityEnquirySidelink,
            ueCapabilityInformationSidelink UECapabilityInformationSidelink,
            spare2 NULL, spare1 NULL
        },
        messageClassExtension SEQUENCE {}
    }

-- TAG-SCCH-MESSAGE-STOP
-- ASN1STOP
```

## 6.6.2 Message definitions

### – MasterInformationBlockSidelink

The *MasterInformationBlockSidelink* includes the system information transmitted by a UE via SL-BCH.

Signalling radio bearer: N/A

RLC-SAP: TM

Logical channel: SBCCH

Direction: UE to UE

### **MasterInformationBlockSidelink**

```
-- ASN1START
-- TAG-MASTERINFORMATIONBLOCKSIDELINK-START
```



```

MasterInformationBlockSidelink ::=
    sl-TDD-Config-r16
    inCoverage-r16
    directFrameNumber-r16
    slotIndex-r16
    reservedBits-r16
}

-- TAG-MASTERINFORMATIONBLOCKSIDELINK-STOP
-- ASN1STOP

```

#### **MasterInformationBlockSidelink field descriptions**

**directFrameNumber**

Indicates the frame number in which S-SSB transmitted.

**inCoverage**

Value true indicates that the UE transmitting the *MasterInformationBlockSidelink* is in network coverage, or UE selects GNSS timing as the synchronization reference source.

**slotIndex**

Indicates the slot index in which S-SSB transmitted.

### – *MeasurementReportSidelink*

The *MeasurementReportSidelink* message is used for the indication of measurement results of NR sidelink.

Signalling radio bearer: SL-SRB3

RLC-SAP: AM

Logical channel: SCCH

Direction: UE to UE

#### **MeasurementReportSidelink message**

```

-- ASN1START
-- TAG-MEASUREMENTREPORTSIDELINK-START

MeasurementReportSidelink ::=
    criticalExtensions
        measurementReportSidelink-r16
        criticalExtensionsFuture
    }
}

MeasurementReportSidelink-IEs-r16 ::=
    sl-measResults-r16
    lateNonCriticalExtension
}

SEQUENCE {
    CHOICE {
        MeasurementReportSidelink-IEs-r16,
        SEQUENCE {}
    }
}

SEQUENCE {
    SL-MeasResults-r16,
    OCTET STRING
}
OPTIONAL,

```

```

    nonCriticalExtension          SEQUENCE{}                                OPTIONAL
}

SL-MeasResults-r16 ::=
    sl-MeasId-r16                SEQUENCE {
        sl-MeasResult-r16        SL-MeasId-r16,
        ...                      SL-MeasResult-r16,
    }

SL-MeasResult-r16 ::=
    sl-ResultDMRS-r16           SEQUENCE {
        ...                      SL-MeasQuantityResult-r16                                OPTIONAL,
    }

SL-MeasQuantityResult-r16 ::=
    sl-RSRP-r16                 SEQUENCE {
        ...                      RSRP-Range                                            OPTIONAL,
    }

-- TAG-MEASUREMENTREPORTSIDELINK-STOP
-- ASN1STOP

```

<i>MeasurementReportSidelink</i> field descriptions
<b><i>sl-MeasId</i></b> Identifies the sidelink measurement identity for which the reporting is being performed.
<b><i>sl-MeasResult</i></b> Measured RSRP results of a unicast destination.

## – *RRCReconfigurationSidelink*

The *RRCReconfigurationSidelink* message is the command to AS configuration of the PC5 RRC connection. It is only applied to unicast of NR sidelink communication.

Signalling radio bearer: SL-SRB3

RLC-SAP: AM

Logical channel: SCCH

Direction: UE to UE

### *RRCReconfigurationSidelink* message

```

-- ASN1START
-- TAG-RRCRECONFIGURATIONSIDELINK-START

RRCReconfigurationSidelink ::=
    rrc-TransactionIdentifier-r16 SEQUENCE {
        criticalExtensions        RRC-TransactionIdentifier,
                                CHOICE {

```

```

rrcReconfigurationSidelink-r16          RRCReconfigurationSidelink-IEs-r16,
criticalExtensionsFuture                SEQUENCE {}
}
}

RRCReconfigurationSidelink-IEs-r16 ::= SEQUENCE {
  slrb-ConfigToAddModList-r16          SEQUENCE (SIZE (1..maxNrofSLRB-r16)) OF SLRB-Config-r16          OPTIONAL, -- Need N
  slrb-ConfigToReleaseList-r16        SEQUENCE (SIZE (1..maxNrofSLRB-r16)) OF SLRB-PC5-ConfigIndex-r16    OPTIONAL, -- Need N
  sl-MeasConfig-r16                   SetupRelease {SL-MeasConfig-r16}          OPTIONAL, -- Need M
  sl-CSI-RS-Config-r16                SetupRelease {SL-CSI-RS-Config-r16}      OPTIONAL, -- Need M
  sl-ResetConfig-r16                  ENUMERATED {true}                          OPTIONAL, -- Need N
  sl-LatencyBoundCSI-Report-r16       INTEGER (3..160)                            OPTIONAL, -- Need M
  lateNonCriticalExtension             OCTET STRING                                OPTIONAL,
  nonCriticalExtension                 SEQUENCE {}                                  OPTIONAL
}

SLRB-Config-r16 ::= SEQUENCE {
  slrb-PC5-ConfigIndex-r16            SLRB-PC5-ConfigIndex-r16,
  sl-SDAP-ConfigPC5-r16               SL-SDAP-ConfigPC5-r16                      OPTIONAL, -- Need M
  sl-PDCP-ConfigPC5-r16               SL-PDCP-ConfigPC5-r16                      OPTIONAL, -- Need M
  sl-RLC-ConfigPC5-r16                SL-RLC-ConfigPC5-r16                       OPTIONAL, -- Need M
  sl-MAC-LogicalChannelConfigPC5-r16 SL-LogicalChannelConfigPC5-r16             OPTIONAL, -- Need M
  ...
}

SLRB-PC5-ConfigIndex-r16 ::= INTEGER (1..maxNrofSLRB-r16)

SL-SDAP-ConfigPC5-r16 ::= SEQUENCE {
  sl-MappedQoS-FlowsToAddList-r16     SEQUENCE (SIZE (1.. maxNrofSL-QFIsPerDest-r16)) OF SL-PQFI-r16          OPTIONAL, -- Need N
  sl-MappedQoS-FlowsToReleaseList-r16 SEQUENCE (SIZE (1.. maxNrofSL-QFIsPerDest-r16)) OF SL-PQFI-r16          OPTIONAL, -- Need N
  sl-SDAP-Header-r16                 ENUMERATED {present, absent},
  ...
}

SL-PDCP-ConfigPC5-r16 ::= SEQUENCE {
  sl-PDCP-SN-Size-r16                 ENUMERATED {len12bits, len18bits}          OPTIONAL, -- Need M
  sl-OutOfOrderDelivery-r16           ENUMERATED { true }                        OPTIONAL, -- Need R
  ...
}

SL-RLC-ConfigPC5-r16 ::= CHOICE {
  sl-AM-RLC-r16                       SEQUENCE {
    sl-SN-FieldLengthAM-r16            SN-FieldLengthAM                          OPTIONAL, -- Need M
    ...
  },
  sl-UM-Bi-Directional-RLC-r16        SEQUENCE {
    sl-SN-FieldLengthUM-r16            SN-FieldLengthUM                          OPTIONAL, -- Need M
    ...
  },
  sl-UM-Uni-Directional-RLC-r16       SEQUENCE {
    sl-SN-FieldLengthUM-r16            SN-FieldLengthUM                          OPTIONAL, -- Need M
    ...
  }
}
}

```

```

SL-LogicalChannelConfigPC5-r16 ::= SEQUENCE {
    sl-LogicalChannelIdentity-r16
    ...
}

SL-PQFI-r16 ::= INTEGER (1..64)

SL-CSI-RS-Config-r16 ::= SEQUENCE {
    sl-CSI-RS-FreqAllocation-r16 CHOICE {
        sl-OneAntennaPort-r16 BIT STRING (SIZE (12)),
        sl-TwoAntennaPort-r16 BIT STRING (SIZE (6))
    }
    sl-CSI-RS-FirstSymbol-r16 INTEGER (3..12)
    ...
}

-- TAG-RRCRECONFIGURATIONSIDELINK-STOP
-- ASN1STOP

```

OPTIONAL, -- Need M  
OPTIONAL, -- Need M

#### ***RRCReconfigurationSidelink* field descriptions**

<b><i>sl-CSI-RS-FreqAllocation</i></b>
Indicates the frequency domain position for sidelink CSI-RS.
<b><i>sl-CSI-RS-FirstSymbol</i></b>
Indicates the position of first symbol of sidelink CSI-RS.
<b><i>sl-Resetconfig</i></b>
Indicates that the full configuration should be applicable for the <i>RRCReconfigurationSidelink</i> message.
<b><i>sl-LatencyBoundCSI-Report</i></b>
Indicate the latency bound of SL CSI report from the associated SL CSI triggering in terms of number of slots.
<b><i>sl-LogicalChannelIdentity</i></b>
Indicates the identity of the sidelink logical channel.
<b><i>sl-MappedQoS-FlowsToAddList</i></b>
Indicate the QoS flows to be mapped to the configured sidelink DRB. Each entry is indicated by the SL-PQFI, which is used between UEs, as defined in TS 23.287 [55].
<b><i>sl-MappedQoS-FlowsToReleaseList</i></b>
Indicate the QoS flows to be released from the configured sidelink DRB. Each entry is indicated by the SL-PQFI, which is used between UEs, as defined in TS 23.287 [55].
<b><i>sl-MeasConfig</i></b>
Indicates the sidelink measurement configuration for the unicast destination.
<b><i>sl-OutOfOrderDelivery</i></b>
Indicates whether or not outOfOrderDelivery specified in TS 38.323 [5] is configured. This field should be either always present or always absent, after the sidelink radio bearer is established.
<b><i>sl-PDCP-SN-Size</i></b>
Indicates the PDCP SN size of the configured sidelink DRB.
<b><i>sl-SDAP-Header</i></b>
Indicates whether or not a SDAP header is present on this sidelink DRB.

– *RRCReconfigurationCompleteSidelink*

The *RRCReconfigurationCompleteSidelink* message is used to confirm the successful completion of a PC5 RRC AS reconfiguration. It is only applied to unicast of NR sidelink communication.

Signalling radio bearer: SL-SRB3

RLC-SAP: AM

Logical channel: SCCH

Direction: UE to UE

***RRCReconfigurationCompleteSidelink* message**

```
-- ASN1START
-- TAG-RRCRECONFIGURATIONCOMPLETESIDELINK-START

RRCReconfigurationCompleteSidelink ::= SEQUENCE {
    rrc-TransactionIdentifier-r16          RRC-TransactionIdentifier,
    criticalExtensions                     CHOICE {
        rrcReconfigurationCompleteSidelink-r16  RRCReconfigurationCompleteSidelink-IEs-r16,
        criticalExtensionsFuture                SEQUENCE {}
    }
}

RRCReconfigurationCompleteSidelink-IEs-r16 ::= SEQUENCE {
    lateNonCriticalExtension              OCTET STRING OPTIONAL,
    nonCriticalExtension                  SEQUENCE {} OPTIONAL
}

-- TAG-RRCRECONFIGURATIONCOMPLETESIDELINK-STOP
-- ASN1STOP
```

– *RRCReconfigurationFailureSidelink*

The *RRCReconfigurationFailureSidelink* message is used to indicate the failure of a PC5 RRC AS reconfiguration. It is only applied to unicast of NR sidelink communication.

Signalling radio bearer: SL-SRB3

RLC-SAP: AM

Logical channel: SCCH

Direction: UE to UE

**RRCReconfigurationFailureSidelink message**

```

-- ASN1START
-- TAG-RRCRECONFIGURATIONFAILURESIDELINK-START

RRCReconfigurationFailureSidelink ::= SEQUENCE {
    rrc-TransactionIdentifier-r16      RRC-TransactionIdentifier,
    criticalExtensions                 CHOICE {
        rrcReconfigurationFailureSidelink-r16  RRCReconfigurationFailureSidelink-IEs-r16,
        criticalExtensionsFuture              SEQUENCE {}
    }
}

RRCReconfigurationFailureSidelink-IEs-r16 ::= SEQUENCE {
    lateNonCriticalExtension          OCTET STRING OPTIONAL,
    nonCriticalExtension              SEQUENCE {}          OPTIONAL
}

-- TAG-RRCRECONFIGURATIONFAILURESIDELINK-STOP
-- ASN1STOP

```

**UECapabilityEnquirySidelink**

The *UECapabilityEnquirySidelink* message is used to request UE sidelink capabilities. It is only applied to unicast of NR sidelink communication.

Signalling radio bearer: SL-SRB3

RLC-SAP: AM

Logical channel: SCCH

Direction: UE to UE

**UECapabilityEnquirySidelink information element**

```

-- ASN1START
-- TAG-UECAPABILITYENQUIRYSIDELINK-START

UECapabilityEnquirySidelink ::= SEQUENCE {
    rrc-TransactionIdentifier-r16      RRC-TransactionIdentifier,
    criticalExtensions                 CHOICE {
        ueCapabilityEnquirySidelink-r16  UECapabilityEnquirySidelink-IEs-r16,
        criticalExtensionsFuture          SEQUENCE {}
    }
}

UECapabilityEnquirySidelink-IEs-r16 ::= SEQUENCE {
    frequencyBandListFilterSidelink-r16  FreqBandList          OPTIONAL, -- Need N
    ue-CapabilityInformationSidelink-r16  OCTET STRING          OPTIONAL,
}

```

```

    lateNonCriticalExtension      OCTET STRING
    nonCriticalExtension          SEQUENCE{}
}
-- TAG-UECAPABILITYENQUIRYSIDELINK-STOP
-- ASN1STOP

```

### ***UECapabilityEnquirySidelink-IEs field descriptions***

#### ***ue-CapabilityInformationSidelink***

This field indicates the *UECapabilityInformationSidelink* message to provide the UE sidelink capability, which can be optionally sent together with *UECapabilityEnquirySidelink*.

#### – ***UECapabilityInformationSidelink***

The IE *UECapabilityInformationSidelink* message is used to transfer UE radio access capabilities. It is only applied to unicast of NR sidelink communication.

Signalling radio bearer: SL-SRB3

RLC-SAP: AM

Logical channel: SCCH

Direction: UE to UE

#### ***UECapabilityInformationSidelink* information element**

```

-- ASN1START
-- TAG-UECAPABILITYINFORMATIONSIDELINK-START

UECapabilityInformationSidelink ::= SEQUENCE {
    rrc-TransactionIdentifier-r16      RRC-TransactionIdentifier,
    criticalExtensions                 CHOICE {
        ueCapabilityInformationSidelink-r16  UECapabilityInformationSidelink-IEs-r16,
        criticalExtensionsFuture           SEQUENCE {}
    }
}

UECapabilityInformationSidelink-IEs-r16 ::= SEQUENCE {
    accessStratumReleaseSidelink-r16    AccessStratumReleaseSidelink-r16,
    pdcp-ParametersSidelink-r16        PDCP-ParametersSidelink-r16 OPTIONAL,
    rlc-ParametersSidelink-r16         RLC-ParametersSidelink-r16 OPTIONAL,
    supportedBandCombinationListSidelinkNR-r16 BandCombinationListSidelinkNR-r16 OPTIONAL,
    supportedBandListSidelink-r16      SEQUENCE (SIZE (1..maxBands)) OF BandSidelink-r16 OPTIONAL,
    appliedFreqBandListFilter-r16      FreqBandList OPTIONAL,
    lateNonCriticalExtension           OCTET STRING OPTIONAL,
    nonCriticalExtension                SEQUENCE{} OPTIONAL
}

AccessStratumReleaseSidelink-r16 ::= ENUMERATED { rel16, spare7, spare6, spare5, spare4, spare3, spare2, spare1, ... }

```

```

PCDP-ParametersSidelink-r16 ::= SEQUENCE {
    outOfOrderDeliverySidelink-r16      ENUMERATED {supported}      OPTIONAL,
    ...
}

RLC-ParametersSidelink-r16 ::= SEQUENCE {
    am-WithLongSN-Sidelink-r16          ENUMERATED {supported}      OPTIONAL,
    um-WithLongSN-Sidelink-r16          ENUMERATED {supported}      OPTIONAL,
    ...
}

BandCombinationListSidelinkNR-r16 ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombinationParametersSidelinkNR-r16

BandCombinationParametersSidelinkNR-r16 ::= SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BandParametersSidelink-r16

BandSidelink-r16 ::=
    SEQUENCE {
        freqBandSidelink-r16             FreqBandIndicatorNR,
        --15-1
        sl-Reception-r16                 SEQUENCE {
            harq-RxProcessSidelink-r16   ENUMERATED {n16, n24, n32, n64},
            pscch-RxSidelink-r16         ENUMERATED {value1, value2},
            scs-CP-PatternRxSidelink-r16 CHOICE {
                fr1-r16                  SEQUENCE {
                    scs-15kHz-r16         BIT STRING (SIZE (16))      OPTIONAL,
                    scs-30kHz-r16         BIT STRING (SIZE (16))      OPTIONAL,
                    scs-60kHz-r16         BIT STRING (SIZE (16))      OPTIONAL,
                },
                fr2-r16                  SEQUENCE {
                    scs-60kHz-r16         BIT STRING (SIZE (16))      OPTIONAL,
                    scs-120kHz-r16        BIT STRING (SIZE (16))      OPTIONAL,
                }
            }
            extendedCP-RxSidelink-r16     ENUMERATED {supported}      OPTIONAL,
            OPTIONAL,
            OPTIONAL,
        }
        --15-10
        sl-Tx-256QAM-r16                 ENUMERATED {supported}      OPTIONAL,
        --15-12
        lowSE-64QAM-MCS-TableSidelink-r16 ENUMERATED {supported}      OPTIONAL,
        ...
    }

-- TAG-UECAPABILITYINFORMATIONSIDELINK-STOP
-- ASN1STOP

```

— *End of PC5-RRC-Definitions*

```
-- ASN1START
```

```
END
```

```
-- ASN1STOP
```





## 7 Variables and constants

### 7.1 Timers

#### 7.1.1 Timers (Informative)

Timer	Start	Stop	At expiry
T300	Upon transmission of <i>RRCSetupRequest</i> .	Upon reception of <i>RRCSetup</i> or <i>RRCReject</i> message, cell re-selection and upon abortion of connection establishment by upper layers.	Perform the actions as specified in 5.3.3.7.
T301	Upon transmission of <i>RRCReestablishmentRequest</i>	Upon reception of <i>RRCReestablishment</i> or <i>RRCSetup</i> message as well as when the selected cell becomes unsuitable	Go to RRC_IDLE
T302	Upon reception of <i>RRCReject</i> while performing RRC connection establishment or resume, upon reception of <i>RRCRelease</i> with <i>waitTime</i> .	Upon entering RRC_CONNECTED or RRC_IDLE, upon cell re-selection and upon reception of <i>RRCReject</i> message.	Inform upper layers about barring alleviation as specified in 5.3.14.4
T304	Upon reception of <i>RRCReconfiguration</i> message including <i>reconfigurationWithSync</i> or upon conditional reconfiguration execution i.e. when applying a stored <i>RRCReconfiguration</i> message including <i>reconfigurationWithSync</i> .	Upon successful completion of random access on the corresponding SpCell For T304 of SCG, upon SCG release	For T304 of MCG, in case of the handover from NR or intra-NR handover, initiate the RRC re-establishment procedure; In case of handover to NR, perform the actions defined in the specifications applicable for the source RAT. If any DAPS bearer is configured and if there is no RLF in source PCell, initiate the failure information procedure.  For T304 of SCG, inform network about the reconfiguration with sync failure by initiating the SCG failure information procedure as specified in 5.7.3.

Timer	Start	Stop	At expiry
T310	Upon detecting physical layer problems for the SpCell 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 SpCell, upon receiving RRCReconfiguration with <i>reconfigurationWithSync</i> for that cell group, upon reception of <i>MobilityFromNRCommand</i> , upon the reconfiguration of <i>rlf-TimersAndConstant</i> , upon initiating the connection re-establishment procedure, upon conditional reconfiguration execution i.e. when applying a stored RRCReconfiguration message including <i>reconfigurationWithSync</i> for that cell group, and upon initiating the MCG failure information procedure. Upon SCG release, if the T310 is kept in SCG.	If the T310 is kept in MCG: If AS security is not activated: go to RRC_IDLE else: initiate the MCG failure information procedure as specified in 5.7.3b or the connection re-establishment procedure as specified in 5.3.7 or the procedure as specified in 5.3.10.3 if any DAPS bearer is configured. If the T310 is kept in SCG, Inform E-UTRAN/NR about the SCG radio link failure by initiating the SCG failure information procedure as specified in 5.7.3.
T311	Upon initiating the RRC connection re-establishment procedure	Upon selection of a suitable NR cell or a cell using another RAT.	Enter RRC_IDLE

Timer	Start	Stop	At expiry
T312	<p>If T312 is configured in MCG: Upon triggering a measurement report for a measurement identity for which T312 has been configured and <i>useT312</i> has been set to true, while T310 in PCell is running.</p> <p>If T312 is configured in SCG and <i>useT312</i> has been set to true: Upon triggering a measurement report for a measurement identity for which T312 has been configured, while T310 in PSCell is running.</p>	<p>Upon receiving N311 consecutive in-sync indications from lower layers for the SpCell, receiving <i>RRCReconfiguration with reconfigurationWithSync</i> for that cell group, upon reception of <i>MobilityFromNRCommand</i>, upon initiating the connection re-establishment procedure, upon the reconfiguration of <i>rfl-TimersAndConstant</i>, upon initiating the MCG failure information procedure, upon conditional reconfiguration execution i.e. when applying a stored RRCReconfiguration message including <i>reconfigurationWithSync</i> for that cell group, and upon the expiry of T310 in corresponding SpCell.</p> <p>Upon SCG release, if the T312 is kept in SCG</p>	<p>If the T312 is kept in MCG initiate the MCG failure information procedure as specified in 5.7.3b or the connection re-establishment procedure.</p> <p>If the T312 is kept in SCG, Inform E-UTRAN/NR about the SCG radio link failure by initiating the SCG failure information procedure.as specified in 5.7.3.</p>
T316	Upon transmission of the <i>MCGFailureInformation</i> message	Upon receiving <i>RRCRelease</i> , <i>RRCReconfiguration with reconfigurationwithSync</i> for the PCell, <i>MobilityFromNRCommand</i> , or upon initiating the re-establishment procedure	Perform the actions as specified in 5.7.3b.5.
T319	Upon transmission of <i>RRCResumeRequest</i> or <i>RRCResumeRequest1</i> .	Upon reception of <i>RRCResume</i> , <i>RRCSetup</i> , <i>RRCRelease</i> , <i>RRCRelease with suspendConfig</i> or <i>RRCReject</i> message, cell re-selection and upon abortion of connection establishment by upper layers.	Perform the actions as specified in 5.3.13.5.

Timer	Start	Stop	At expiry
T320	Upon reception of <i>t320</i> or upon cell (re)selection to NR from another RAT with validity time configured for dedicated priorities (in which case the remaining validity time is applied).	Upon entering RRC_CONNECTED, upon reception of <i>RRCRelease</i> , 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).	Discard the cell reselection priority information provided by dedicated signalling.
T321	Upon receiving <i>measConfig</i> including a <i>reportConfig</i> with the purpose set to <i>reportCGI</i>	Upon acquiring the information needed to set all fields of <i>cgi-info</i> , upon receiving <i>measConfig</i> that includes removal of the <i>reportConfig</i> with the purpose set to <i>reportCGI</i> and upon detecting that a cell is not broadcasting SIB1.	Initiate the measurement reporting procedure, stop performing the related measurements.
T322	Upon receiving <i>measConfig</i> including <i>reportConfigNR</i> with the purpose set to <i>reportSFTD</i> and <i>drx-SFTD-NeighMeas</i> is set to <i>true</i> .	Upon acquiring the SFTD measurement results, upon receiving <i>measConfig</i> that includes removal of the <i>reportConfig</i> with the purpose set to <i>reportSFTD</i> .	Initiate the measurement reporting procedure, stop performing the related measurements.
T325	Upon reception of <i>RRCRelease</i> message with <i>deprioritisationTimer</i> .		Stop deprioritisation of all frequencies or NR signalled by <i>RRCRelease</i> .
T330	Upon receiving <i>LoggedMeasurementConfiguration</i> message	Upon log volume exceeding the suitable UE memory, upon initiating the release of <i>LoggedMeasurementConfiguration</i> procedure	Perform the actions specified in 5.5a.1.4
T331	Upon receiving <i>RRCRelease</i> message with <i>measIdleDuration</i>	Upon receiving <i>RRCSetup</i> , <i>RRCResume</i> , <i>RRCRelease</i> with idle/inactive measurement configuration, upon cell selection/reselection to a cell that does not belong to the <i>validityArea</i> (if configured), or upon cell re-selection to another RAT.	Perform the actions as specified in 5.7.8.3.

Timer	Start	Stop	At expiry
T342	Upon transmitting <i>UEAssistanceInformation</i> message with <i>DelayBudgetReport</i> .	Upon releasing <i>delayBudgetReportingConfig</i> during the connection re-establishment/resume procedures, and upon receiving <i>delayBudgetReportingConfig</i> set to <i>release</i> .	No action.
T345	Upon transmitting <i>UEAssistanceInformation</i> message with <i>overheatingAssistance</i>	Upon releasing <i>overheatingAssistance</i> during the connection re-establishment procedure, upon initiating the connection resumption procedure, and upon receiving <i>overheatingAssistanceConfig</i> set to <i>release</i> .	No action.
T346a (The UE maintains one instance of this timer per cell group)	Upon transmitting <i>UEAssistanceInformation</i> message with <i>drx-Preference</i> .	Upon releasing <i>drx-PreferenceConfig</i> during the connection re-establishment/resume procedures, upon receiving <i>drx-PreferenceConfig</i> set to <i>release</i> , or upon performing MR-DC release.	No action.
T346b (The UE maintains one instance of this timer per cell group)	Upon transmitting <i>UEAssistanceInformation</i> message with <i>maxBW-Preference</i> .	Upon releasing <i>maxBW-PreferenceConfig</i> during the connection re-establishment/resume procedures, upon receiving <i>maxBW-PreferenceConfig</i> set to <i>release</i> , or upon performing MR-DC release.	No action.
T346c (The UE maintains one instance of this timer per cell group)	Upon transmitting <i>UEAssistanceInformation</i> message with <i>maxCC-Preference</i> .	Upon releasing <i>maxCC-PreferenceConfig</i> during the connection re-establishment/resume procedures, upon receiving <i>maxCC-PreferenceConfig</i> set to <i>release</i> , or upon performing MR-DC release.	No action.

Timer	Start	Stop	At expiry
T346d (The UE maintains one instance of this timer per cell group)	Upon transmitting <i>UEAssistanceInformation</i> message with <i>maxMIMO-LayerPreference</i> .	Upon releasing <i>maxMIMO-LayerPreferenceConfig</i> during the connection re-establishment/resume procedures, upon receiving <i>maxMIMO-LayerPreferenceConfig</i> set to <i>release</i> , or upon performing MR-DC release.	No action.
T346e (The UE maintains one instance of this timer per cell group)	Upon transmitting <i>UEAssistanceInformation</i> message with <i>minSchedulingOffsetPreference</i> .	Upon releasing <i>minSchedulingOffsetPreferenceConfig</i> during the connection re-establishment/resume procedures, upon receiving <i>minSchedulingOffsetPreferenceConfig</i> set to <i>release</i> , or upon performing MR-DC release.	No action.
T346f	Upon transmitting <i>UEAssistanceInformation</i> message with <i>releasePreference</i> .	Upon releasing <i>releasePreferenceConfig</i> during the connection re-establishment/resume procedures, or upon receiving <i>releasePreferenceConfig</i> set to <i>release</i> .	No action.
T350	Upon transmitting <i>DedicatedSIBRequest</i> message with <i>requestedSIB-List</i> and/or <i>requestedPosSIB-List</i> .	Upon acquiring the requested SIB(s) or posSIB(s), upon releasing <i>onDemandSIB-Request</i> during the connection re-establishment procedures, upon receiving <i>onDemandSIB-Request</i> set to <i>release</i> , or upon successful change of PCell while in RRC_CONNECTED.	No action
T380	Upon reception of t380 in <i>RRCRelease</i> .	Upon reception of <i>RRCResume</i> , <i>RRCSetup</i> or <i>RRCRelease</i> .	Perform the actions as specified in 5.3.13.
T390	When access attempt is barred at access barring check for an Access Category. The UE maintains one instance of this timer per Access Category.	Upon cell (re)selection, upon entering RRC_CONNECTED, upon reception of <i>RRCReconfiguration</i> including <i>reconfigurationWithSync</i> , upon change of PCell while in RRC_CONNECTED, upon reception of <i>MobilityFromNRCommand</i> , or upon reception of <i>RRCRelease</i> .	Perform the actions as specified in 5.3.14.4.



Timer	Start	Stop	At expiry
T400	Upon transmission of <i>RRCReconfigurationSidelink</i>	Upon reception of <i>RRCReconfigurationFailureSidelink</i> or <i>RRCReconfigurationCompleteSidelink</i>	Perform the sidelink RRC reconfiguration failure procedure as specified in 5.8.9.1.8

## 7.1.2 Timer handling

When the UE applies zero value for a timer, the timer shall be started and immediately expire unless explicitly stated otherwise.

## 7.2 Counters

Counter	Reset	Incremented	When reaching max value
N310	Upon reception of "in-sync" indication from lower layers; upon receiving <i>RRCReconfiguration</i> with <i>reconfigurationWithSync</i> for that cell group; upon initiating the connection re-establishment procedure.	Upon reception of "out-of-sync" from lower layer while the timer T310 is stopped.	Start timer T310
N311	Upon reception of "out-of-sync" indication from lower layers; upon receiving <i>RRCReconfiguration</i> with <i>reconfigurationWithSync</i> for that cell group; upon initiating the connection re-establishment procedure.	Upon reception of the "in-sync" from lower layer while the timer T310 is running.	Stop the timer T310.

## 7.3 Constants

Constant	Usage
N310	Maximum number of consecutive "out-of-sync" indications for the SpCell received from lower layers
N311	Maximum number of consecutive "in-sync" indications for the SpCell received from lower layers

## 7.4 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.

### – *NR-UE-Variables*

This ASN.1 segment is the start of the NR UE variable definitions.

```
-- ASN1START
-- NR-UE-VARIABLES-START

NR-UE-Variables DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
  ARFCN-ValueNR,
  CellIdentity,
  EUTRA-PhysCellId,
  MeasId,
  MeasIdToAddModList,
  MeasIdleCarrierEUTRA-r16,
  MeasIdleCarrierNR-r16,
  MeasResultIdleEUTRA-r16,
  MeasResultIdleNR-r16,
  MeasObjectToAddModList,
  PhysCellId,
  RNTI-Value,
  ReportConfigToAddModList,
  RSRP-Range,
  SL-MeasId-r16,
  SL-MeasIdList-r16,
  SL-MeasObjectList-r16,
  SL-ReportConfigList-r16,
  SL-QuantityConfig-r16,
  Tx-PoolMeasList-r16,
  QuantityConfig,
  maxNrofCellMeas,
```

```

maxNrofMeasId,
maxFreqIdle-r16,
PhysCellIdUTRA-FDD-r16,
ValidityAreaList-r16,
CondReconfigToAddModList-r16,
ConnEstFailReport-r16,
LoggingDuration-r16,
LoggingInterval-r16,
LogMeasInfoList-r16,
LogMeasInfo-r16,
RA-Report-r16,
RLF-Report-r16,
TraceReference-r16,
WLAN-Identifiers-r16,
WLAN-NameList-r16,
BT-NameList-r16,
PLMN-Identity,
maxPLMN,
RA-ReportList-r16,
VisitedCellInfoList-r16,
AbsoluteTimeInfo-r16,
LoggedEventTriggerConfig-r16,
LoggedPeriodicalReportConfig-r16,
Sensor-NameList-r16,
PLMN-IdentityList2-r16,
AreaConfiguration-r16,
maxNrofSL-MeasId-r16,
maxNrofFreqSL-r16,
maxNrofCLI-RSSI-Resources-r16,
maxNrofCLI-SRS-Resources-r16,
RSSI-ResourceId-r16,
SRS-ResourceId
FROM NR-RRC-Definitions;

-- NR-UE-VARIABLES-STOP
-- ASN1STOP

```

## – *VarConditionalReconfig*

The UE variable *VarConditionalReconfig* includes the accumulated configuration of the conditional handover or conditional PSCell change configurations including the pointers to conditional handover or conditional PSCell change execution condition (associated *measId(s)*) and the stored target candidate SpCell *RRCReconfiguration*.

### ***VarConditionalReconfig UE variable***

```

-- ASN1START
-- TAG-VARCONDITIONALRECONFIG-START

VarConditionalReconfig ::= SEQUENCE {
    condReconfigList          CondReconfigToAddModList-r16    OPTIONAL
}

```

```
-- TAG-VARCONDITIONALRECONFIG-STOP
-- ASN1STOP
```

## – *VarConnEstFailReport*

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

### *VarConnEstFailReport* UE variable

```
-- ASN1START
-- TAG-VARCONNЕСТFAILLREPORT-START

VarConnEstFailReport-r16 ::= SEQUENCE {
    connEstFailReport-r16      ConnEstFailReport-r16,
    plmn-Identity-r16          PLMN-Identity
}

-- TAG-VARCONNЕСТFAILLREPORT-STOP
-- ASN1STOP
```

## – *VarLogMeasConfig*

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

### *VarLogMeasConfig* UE variable

```
-- ASN1START
-- TAG-VARLOGMEASCONFIG-START

VarLogMeasConfig-r16-IEs ::= SEQUENCE {
    areaConfiguration-r16      AreaConfiguration-r16          OPTIONAL,
    bt-NameList-r16            BT-NameList-r16                OPTIONAL,
    wlan-NameList-r16          WLAN-NameList-r16              OPTIONAL,
    sensor-NameList-r16        Sensor-NameList-r16            OPTIONAL,
    loggingDuration-r16        LoggingDuration-r16,
    reportType                  CHOICE {
        periodical              LoggedPeriodicalReportConfig-r16,
        eventTriggered          LoggedEventTriggerConfig-r16
    }
}

-- TAG-VARLOGMEASCONFIG-STOP
-- ASN1STOP
```

## – *VarLogMeasReport*

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

### *VarLogMeasReport* UE variable

```
-- ASN1START
-- TAG-VARLOGMEAREPORT-START

VarLogMeasReport-r16 ::= SEQUENCE {
    absoluteTimeInfo-r16      AbsoluteTimeInfo-r16,
    traceReference-r16        TraceReference-r16,
    traceRecordingSessionRef-r16 OCTET STRING (SIZE (2)),
    tce-Id-r16                 OCTET STRING (SIZE (1)),
    logMeasInfoList-r16       LogMeasInfoList-r16,
    plmn-IdentityList-r16     PLMN-IdentityList2-r16
}

-- TAG-VARLOGMEAREPORT-STOP
-- 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.

### *VarMeasConfig* UE variable

```
-- ASN1START
-- TAG-VARMEASCONFIG-START

VarMeasConfig ::= SEQUENCE {
    -- Measurement identities
    measIdList                MeasIdToAddModList           OPTIONAL,
    -- Measurement objects
    measObjectList            MeasObjectToAddModList        OPTIONAL,
    -- Reporting configurations
    reportConfigList          ReportConfigToAddModList      OPTIONAL,
    -- Other parameters
    quantityConfig            QuantityConfig                OPTIONAL,
    s-MeasureConfig           CHOICE {
        ssb-RSRP              RSRP-Range,
        csi-RSRP               RSRP-Range
    } OPTIONAL
}

-- TAG-VARMEASCONFIG-STOP
-- ASN1STOP
```

## – *VarMeasConfigSL*

The UE variable *VarMeasConfigSL* includes the accumulated configuration of the NR sidelink measurements to be performed by the UE of unicast destination.

### *VarMeasConfigSL* UE variable

```
-- ASN1START
-- TAG-VARMEASCONFIGSL-START

VarMeasConfigSL-r16 ::=                               SEQUENCE {
  -- NR sidelink measurement identities
  sl-MeasIdList-r16                                  OPTIONAL,
  -- NR sidelink measurement objects
  sl-MeasObjectList-r16                             OPTIONAL,
  -- NR sidelink reporting configurations
  sl-reportConfigList-r16                           OPTIONAL,
  -- Other parameters
  sl-QuantityConfig-r16                             OPTIONAL
}

-- TAG-VARMEASCONFIGSL-STOP
-- ASN1STOP
```

## – *VarMeasIdleConfig*

The UE variable *VarMeasIdleConfig* includes the configuration of the measurements to be performed by the UE while in RRC\_IDLE or RRC\_INACTIVE for NR inter-frequency and inter-RAT (i.e. EUTRA) measurements.

### *VarMeasIdleConfig* UE variable

```
-- ASN1START
-- TAG-VARMEASIDLECONFIG-START

VarMeasIdleConfig-r16 ::= SEQUENCE {
  measIdleCarrierListNR-r16 SEQUENCE (SIZE (1..maxFreqIdle-r16)) OF MeasIdleCarrierNR-r16 OPTIONAL,
  measIdleCarrierListEUTRA-r16 SEQUENCE (SIZE (1..maxFreqIdle-r16)) OF MeasIdleCarrierEUTRA-r16 OPTIONAL,
  measIdleDuration-r16 ENUMERATED {sec10, sec30, sec60, sec120, sec180, sec240, sec300, spare},
  validityAreaList-r16 ValidityAreaList-r16 OPTIONAL
}

-- TAG-VARMEASIDLECONFIG-STOP
-- ASN1STOP
```

## – *VarMeasIdleReport*

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

### *VarMeasIdleReport UE variable*

```
-- ASN1START
-- TAG-VARMEASIDLEREPORT-START

VarMeasIdleReport-r16 ::= SEQUENCE {
    measReportIdleNR-r16      MeasResultIdleNR-r16      OPTIONAL,
    measReportIdleEUTRA-r16   MeasResultIdleEUTRA-r16   OPTIONAL
}

-- TAG-VARMEASIDLEREPORT-STOP
-- ASN1STOP
```

## – *VarMeasReportList*

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

### *VarMeasReportList UE variable*

```
-- ASN1START
-- TAG-VARMEASREPORTLIST-START

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

VarMeasReport ::= SEQUENCE {
    -- List of measurement that have been triggered
    measId                MeasId,
    cellsTriggeredList    CellsTriggeredList          OPTIONAL,
    numberOfReportsSent   INTEGER,
    cli-TriggeredList-r16 CLI-TriggeredList-r16       OPTIONAL,
    tx-PoolMeasToAddModListNR-r16 Tx-PoolMeasList-r16  OPTIONAL
}

CellsTriggeredList ::= SEQUENCE (SIZE (1..maxNrofCellMeas)) OF CHOICE {
    physCellId            PhysCellId,
    physCellIdEUTRA       EUTRA-PhysCellId,
    physCellIdUTRA-FDD-r16 PhysCellIdUTRA-FDD-r16
}

CLI-TriggeredList-r16 ::= CHOICE {
    srs-RSRP-TriggeredList-r16 SRS-RSRP-TriggeredList-r16,
    cli-RSSI-TriggeredList-r16 CLI-RSSI-TriggeredList-r16
}

SRS-RSRP-TriggeredList-r16 ::= SEQUENCE (SIZE (1.. maxNrofCLI-SRS-Resources-r16)) OF SRS-ResourceId
```

```

CLI-RSSI-TriggeredList-r16 ::= SEQUENCE (SIZE (1.. maxNrofCLI-RSSI-Resources-r16)) OF RSSI-ResourceId-r16

-- TAG-VARMEASREPORTLIST-STOP
-- ASN1STOP

```

### – *VarMeasReportListSL*

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

#### ***VarMeasReportListSL UE variable***

```

-- ASN1START
-- TAG-VARMEASREPORTLISTSL-START

VarMeasReportListSL-r16 ::= SEQUENCE (SIZE (1..maxNrofSL-MeasId-r16)) OF VarMeasReportSL-r16

VarMeasReportSL-r16 ::= SEQUENCE {
  -- List of NR sidelink measurement that have been triggered
  sl-MeasId-r16 SL-MeasId-r16,
  sl-FrequencyTriggeredList-r16 SEQUENCE (SIZE (1..maxNrofFreqSL-r16)) OF ARFCN-ValueNR OPTIONAL,
  sl-NumberOfReportsSent-r16 INTEGER
}

-- TAG-VARMEASREPORTLISTSL-STOP
-- ASN1STOP

```

### – *VarMobilityHistoryReport*

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

#### ***VarMobilityHistoryReport UE variable***

```

-- ASN1START
-- TAG-VARMOBILITYHISTORYREPORT-START

VarMobilityHistoryReport-r16 ::= VisitedCellInfoList-r16

-- TAG-VARMOBILITYHISTORYREPORT-STOP
-- ASN1STOP

```

### – *VarPendingRNA-Update*

The UE variable *VarPendingRNA-Update* indicates whether there is a pending RNA update procedure or not. The setting of this BOOLEAN variable to *true* means that there is a pending RNA Update procedure.



**VarPendingRNA-Update UE variable**

```

-- ASN1START
-- TAG-VARPENDINGRNA-UPDATE-START

VarPendingRNA-Update ::=
    pendingRNA-Update          SEQUENCE {
                                BOOLEAN          OPTIONAL
    }

-- TAG-VARPENDINGRNA-UPDATE-STOP
-- ASN1STOP

```

– **VarRA-Report**

The UE variable *VarRA-Report* includes the random-access related information.

**VarRA-Report UE variable**

```

-- ASN1START
-- TAG-VARRA-REPORT-START

VarRA-Report-r16 ::= SEQUENCE {
    ra-ReportList-r16      RA-ReportList-r16,
    plmn-IdentityList-r16  PLMN-IdentityList-r16
}

PLMN-IdentityList-r16 ::= SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity

-- TAG-VARRA-REPORT-STOP
-- ASN1STOP

```

– **VarResumeMAC-Input**

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

**VarResumeMAC-Input variable**

```

-- ASN1START
-- TAG-VARRESUMEMAC-INPUT-START

VarResumeMAC-Input ::= SEQUENCE {
    sourcePhysCellId      PhysCellId,
    targetCellIdentity    CellIdentity,
    source-c-RNTI         RNTI-Value
}

```

```
-- TAG-VARRESUMEMAC-INPUT-STOP
-- ASN1STOP
```

#### **VarResumeMAC-Input field descriptions**

##### **targetCellIdentity**

An input variable used to calculate the *resumeMAC-I*. Set to the *cellIdentity* of the first *PLMN-Identity* included in the *PLMN-IdentityInfoList* broadcasted in *SIB1* of the target cell i.e. the cell the UE is trying to resume.

##### **source-c-RNTI**

Set to C-RNTI that the UE had in the PCell it was connected to prior to suspension of the RRC connection.

##### **sourcePhysCellId**

Set to the physical cell identity of the PCell the UE was connected to prior to suspension of the RRC connection.

## – **VarRLF-Report**

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

#### **VarRLF-Report UE variable**

```
-- ASN1START
-- TAG-VARRLF-REPORT-START

VarRLF-Report-r16 ::= SEQUENCE {
    rlf-Report-r16          RLF-Report-r16,
    plmn-IdentityList-r16  PLMN-IdentityList2-r16
}

-- TAG-VARRLF-REPORT-STOP
-- ASN1STOP
```

## – **VarShortMAC-Input**

The UE variable *VarShortMAC-Input* specifies the input used to generate the *shortMAC-I* during RRC Connection Reestablishment procedure.

#### **VarShortMAC-Input variable**

```
-- ASN1START
-- TAG-VARSHORTMAC-INPUT-START

VarShortMAC-Input ::= SEQUENCE {
    sourcePhysCellId      PhysCellId,
    targetCellIdentity    CellIdentity,
    source-c-RNTI         RNTI-Value
}

-- TAG-VARSHORTMAC-INPUT-STOP
```

```
-- ASN1STOP
```

<i>VarShortMAC-Input</i> field descriptions
---

<b><i>targetCellIdentity</i></b>
----------------------------------

An input variable used to calculate the <i>shortMAC-I</i> . Set to the <i>cellIdentity</i> of the first <i>PLMN-Identity</i> in the <i>PLMN-IdentityInfoList</i> broadcasted in <i>SIB1</i> of the target cell i.e. the cell the UE is trying to reestablish the connection.
--

<b><i>source-c-RNTI</i></b>
-----------------------------

Set to C-RNTI that the UE had in the PCell it was connected to prior to the reestablishment.
--

<b><i>sourcePhysCellId</i></b>
--------------------------------

Set to the physical cell identity of the PCell the UE was connected to prior to the reestablishment.
--

— End of *NR-UE-Variables*

```
-- ASN1START
```

```
END
```

```
-- ASN1STOP
```

---

## 8 Protocol data unit abstract syntax

### 8.1 General

The RRC PDU contents in clause 6 and clause 10 are described using abstract syntax notation one (ASN.1) as specified in ITU-T Rec. X.680 [6] and X.681 [7]. Transfer syntax for RRC PDUs is derived from their ASN.1 definitions by use of Packed Encoding Rules, unaligned as specified in ITU-T Rec. X.691 [8].

The following encoding rules apply in addition to what has been specified in X.691:

- When a bit string value is placed in a bit-field as specified in 15.6 to 15.11 in X.691, the leading bit of the bit string value shall be placed in the leading bit of the bit-field, and the trailing bit of the bit string value shall be placed in the trailing bit of the bit-field;

NOTE: The terms 'leading bit' and 'trailing bit' are defined in ITU-T Rec. X.680. When using the 'bstring' notation, the leading bit of the bit string value is on the left, and the trailing bit of the bit string value is on the right.

- When decoding types constrained with the ASN.1 Contents Constraint ("CONTAINING"), automatic decoding of the contained type should not be performed because errors in the decoding of the contained type should not cause the decoding of the entire RRC message PDU to fail. It is recommended that the decoder first decodes the outer PDU type that contains the OCTET STRING or BIT STRING with the Contents Constraint, and then decodes the contained type that is nested within the OCTET STRING or BIT STRING as a separate step;
- When decoding a) RRC message PDUs, b) BIT STRING constrained with a Contents Constraint, or c) OCTET STRING constrained with a Contents Constraint, PER decoders are required to never report an error if there are extraneous zero or non-zero bits at the end of the encoded RRC message PDU, BIT STRING or OCTET STRING.

### 8.2 Structure of encoded RRC messages

An RRC PDU, which is the bit string that is exchanged between peer entities/across the radio interface contains the basic production as defined in X.691.

RRC PDUs shall be mapped to and from PDCP SDUs (in case of DCCH) or RLC SDUs (in case of PCCH, BCCH or CCCH) upon transmission and reception as follows:

- when delivering an RRC PDU as an PDCP SDU to the PDCP layer for transmission, the first bit of the RRC PDU shall be represented as the first bit in the PDCP SDU and onwards; and
- when delivering an RRC PDU as an RLC SDU to the RLC layer for transmission, the first bit of the RRC PDU shall be represented as the first bit in the RLC SDU and onwards; and
- upon reception of an PDCP SDU from the PDCP layer, the first bit of the PDCP SDU shall represent the first bit of the RRC PDU and onwards; and
- upon reception of an RLC SDU from the RLC layer, the first bit of the RLC SDU shall represent the first bit of the RRC PDU and onwards.

### 8.3 Basic production

The 'basic production' is obtained by applying UNALIGNED PER to the abstract syntax value (the ASN.1 description) as specified in X.691. It always contains a multiple of 8 bits.

### 8.4 Extension

The following rules apply with respect to the use of protocol extensions:

- A transmitter compliant with this version of the specification shall, unless explicitly indicated otherwise on a PDU type basis, set the extension part empty. Transmitters compliant with a later version may send non-empty extensions;
- A transmitter compliant with this version of the specification shall set spare bits to zero.

## 8.5 Padding

If the encoded RRC message does not fill a transport block, the RRC layer shall add padding bits. This applies to PCCH and BCCH.

Padding bits shall be set to 0 and the number of padding bits is a multiple of 8.

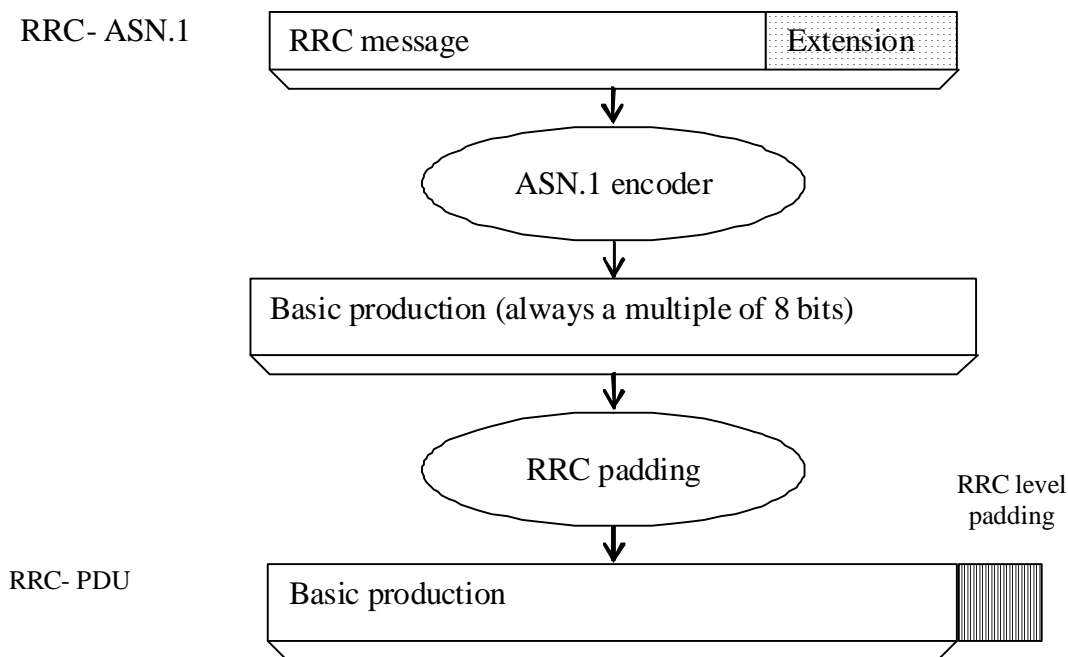


Figure 8.5-1: RRC level padding

## 9 Specified and default radio configurations

Specified and default configurations are configurations of which the details are specified in the standard. Specified configurations are fixed while default configurations can be modified using dedicated signalling. The default value for the parameters not listed in following subclauses shall be set such as the corresponding features are not configured, i.e. *release* or *false* unless explicitly stated otherwise.

NOTE: The UE applies the default values specified in the field description of ASN.1 parameters only when the parent IE is present. Hence, the UE does not apply all default values in field descriptions when it applies the "default radio configuration" in accordance with this clause.

### 9.1 Specified configurations

#### 9.1.1 Logical channel configurations

##### 9.1.1.1 BCCH configuration

Parameters

Name	Value	Semantics description	Ver
SDAP configuration	Not used		
PDCP configuration	Not used		
RLC configuration	TM		
Logical channel configuration	Not used		

NOTE: RRC will perform padding, if required due to the granularity of the TF signalling, as defined in 8.5.

### 9.1.1.2 CCCH configuration

Parameters

Name	Value	Semantics description	Ver
SDAP configuration	Not used		
PDCP configuration	Not used		
RLC configuration	TM		
Logical channel configuration			
>priority	1	Highest priority	
>prioritisedBitRate	infinity		
>bucketSizeDuration	ms1000		
>logicalChannelGroup	0		

### 9.1.1.3 PCCH configuration

Parameters

Name	Value	Semantics description	Ver
SDAP configuration	Not used		
PDCP configuration	Not used		
RLC configuration	TM		
Logical channel configuration	Not used		

NOTE: RRC will perform padding, if required due to the granularity of the TF signalling, as defined in 8.5.

### 9.1.1.4 SCCH configuration

Parameters that are specified for unicast of NR sidelink communication, which is used for the sidelink signalling radio bearer of PC5-RRC message. The SL-SRB using this SCCH configuration is named as SL-SRB3.

Name	Value	Semantics description	Ver
PDCP configuration			
>t-Reordering	Undefined	Selected by the receiving UE, up to UE implementation	
>pdcp-SN-Size	12		
RLC configuration		AM RLC	
>sn-FieldLength	12		
>t-Reassembly	Undefined	Selected by the receiving UE, up to UE implementation	
>logicalChannelIdentity	3		
MAC configuration			
>priority	1		
>prioritisedBitRate	infinity		
>logicalChannelGroup	0		
>schedulingRequestId	0	The scheduling request configuration with this value is applicable for this SCCH if configured by the network.	

Parameters that are specified of NR sidelink communication, which is used for the sidelink signalling radio bearer of unprotected PC5-S message (e.g. Direct Communication Request, TS 23.287 [55]). The SL-SRB using this SCCH configuration is named as SL-SRB0.

Name	Value	Semantics description	Ver
PDCP configuration			
>t-Reordering	Undefined	Selected by the receiving UE, up to UE implementation	
>pdcp-SN-Size	12		
RLC configuration		UM RLC	
>sn-FieldLength	6		
>t-Reassembly	Undefined	Selected by the receiving UE, up to UE implementation	
>logicalChannelIdentity	0		
MAC configuration			
>priority	1		
>prioritisedBitRate	infinity		
>logicalChannelGroup	0		
>schedulingRequestId	0	The scheduling request configuration with this value is applicable for this SCCH if configured by the network.	

Parameters that are specified for unicast of NR sidelink communication, which is used for the sidelink signalling radio bearer of PC5-S message establishing PC5-S security (e.g. Direct Security Mode Command and Direct Security Mode Complete). The SL-SRB using this SCCH configuration is named as SL-SRB1.

Name	Value	Semantics description	Ver
PDCP configuration			
>t-Reordering	Undefined	Selected by the receiving UE, up to UE implementation	
>pdcp-SN-Size	12		
RLC configuration		AM RLC	
>sn-FieldLength	12		
>t-Reassembly	Undefined	Selected by the receiving UE, up to UE implementation	
>logicalChannelIdentity	1		
MAC configuration			
>priority	1		
>prioritisedBitRate	infinity		
>logicalChannelGroup	0		
>schedulingRequestId	0	The scheduling request configuration with this value is applicable for this SCCH if configured by the network.	

Parameters that are specified for unicast of NR sidelink communication, which is used for the sidelink signalling radio bearer of protected PC5-S message. The SL-SRB using this SCCH configuration is named as SL-SRB2.

Name	Value	Semantics description	Ver
PDCP configuration			
>t-Reordering	Undefined	Selected by the receiving UE, up to UE implementation	
>pdcp-SN-Size	12		
RLC configuration		AM RLC	
>sn-FieldLength	12		
>t-Reassembly	Undefined	Selected by the receiving UE, up to UE implementation	
>logicalChannelIdentity	2		
MAC configuration			
>priority	1		
>prioritisedBitRate	infinity		
>logicalChannelGroup	0		
>schedulingRequestId	0	The scheduling request configuration with this value is applicable for this SCCH if configured by the network.	

### 9.1.1.5 STCH configuration

Parameters that are specified for NR sidelink communication, which is used for the sidelink data radio bearer.

Name	Value	Semantics description	Ver
PDCP configuration			
>t-Reordering	Undefined	Selected by the receiving UE, up to UE implementation	
>pdcp-SN-Size	12	For broadcast and groupcast of NR sidelink communication	
>maxCID	15	For broadcast and groupcast of NR sidelink communication	
>profiles			
RLC configuration		For broadcast and groupcast of NR sidelink communication, uni-directional UM RLC UM window size is set to 32	
>t-Reassembly	Undefined	Selected by the receiving UE, up to Up to UE implementation	
>sn-FieldLength	6	For broadcast and groupcast of NR sidelink communication	
>logicalChannelIdentity	Undefined	Selected by the transmitting UE, up to UE implementation	
MAC configuration			
>priority			

### 9.1.2 Void

## 9.2 Default radio configurations

The following clauses only list default values for REL-15 parameters included in protocol version v15.3.0. For all fields introduced in a later protocol version, the default value is "released" or "false" unless explicitly specified otherwise. If the UE is to apply default configuration while it is configured with some critically extended fields, the UE shall apply the original version of those fields with only default values.

NOTE 1: In general, the signalling should preferably support a "release" option for fields introduced after v15.3.0. The "value not applicable" should be used restrictively, mainly limited to for fields which value is relevant only if another field is set to a value other than its default.

NOTE 2: For parameters in *ServingCellConfig*, the default values are specified in the corresponding specification.



## 9.2.1 Default SRB configurations

Parameters

Name	Value			Semantics description	Ver
	SRB1	SRB2	SRB3		
<i>PDCP-Config</i> > <i>t-Reordering</i>	infinity				
<i>RLC-Config CHOICE</i>	Am				
<i>ul-AM-RLC</i> > <i>sn-FieldLength</i> > <i>t-PollRetransmit</i> > <i>pollPDU</i> > <i>pollByte</i> > <i>maxRetxThreshold</i>	size12 ms45 infinity infinity t8				
<i>dl-AM-RLC</i> > <i>sn-FieldLength</i> > <i>t-Reassembly</i> > <i>t-StatusProhibit</i>	size12 ms35 ms0				
<i>logicalChannelIdentity</i>	1	2	3		
<i>LogicalChannelConfig</i> > <i>priority</i> > <i>prioritisedBitRate</i> > <i>logicalChannelGroup</i>	1	3	1		
	infinity				
	0				

## 9.2.2 Default MAC Cell Group configuration

Parameters

Name	Value	Semantics description	Ver
MAC Cell Group configuration			
<i>bsr-Config</i> > <i>periodicBSR-Timer</i> > <i>retxBSR-Timer</i>	sf10 sf80		
<i>phr-Config</i> > <i>phr-PeriodicTimer</i> > <i>phr-ProhibitTimer</i> > <i>phr-Tx-PowerFactorChange</i>	sf10 sf10 dB1		

## 9.2.3 Default values timers and constants

Parameters

Name	Value	Semantics description	Ver
t310	ms1000		
n310	n1		
t311	ms30000		
n311	n1		

## 9.3 Sidelink pre-configured parameters

This ASN.1 segment is the start of the NR definitions of pre-configured sidelink parameters.

### – *NR-Sidelink-Preconf*

```
-- ASN1START
-- TAG-NR-SIDELINK-PRECONF-DEFINITIONS-START

NR-Sidelink-Preconf DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
SL-CBR-CommonTxConfigList-r16,
SL-FreqConfigCommon-r16,
SL-RadioBearerConfig-r16,
SL-RLC-BearerConfig-r16,
SL-EUTRA-AnchorCarrierFreqList-r16,
SL-NR-AnchorCarrierFreqList-r16,
SL-MeasConfigCommon-r16,
SL-UE-SelectedConfig-r16,
TDD-UL-DL-ConfigCommon,
maxNrofFreqSL-r16,
maxNrofSLRB-r16,
maxSL-LCID-r16
FROM NR-RRC-Definitions;

-- TAG-NR-SIDELINK-PRECONF-DEFINITIONS-STOP
-- ASN1STOP
```

### – *SL-PreconfigurationNR*

The IE *SL-PreconfigurationNR* includes the sidelink pre-configured parameters used for NR sidelink communication. Any field with need code in pre-configuration does not apply.

#### ***SL-PreconfigurationNR* information elements**

```
-- ASN1START
-- TAG-SL-PRECONFIGURATIONNR-START

SL-PreconfigurationNR-r16 ::=
    sidelinkPreconfigNR-r16
    ...
SEQUENCE {
    SidelinkPreconfigNR-r16,
}
```

```

SidelinkPreconfigNR-r16 ::=
    sl-PreconfigFreqInfoList-r16          SEQUENCE (SIZE (1..maxNrofFreqSL-r16)) OF SL-FreqConfigCommon-r16  OPTIONAL,
    sl-PreconfigNR-AnchorCarrierFreqList-r16  SL-NR-AnchorCarrierFreqList-r16  OPTIONAL,
    sl-PreconfigEUTRA-AnchorCarrierFreqList-r16  SL-EUTRA-AnchorCarrierFreqList-r16  OPTIONAL,
    sl-RadioBearerPreConfigList-r16          SEQUENCE (SIZE (1..maxNrofSLRB-r16)) OF SL-RadioBearerConfig-r16  OPTIONAL,
    sl-RLC-BearerPreConfigList-r16          SEQUENCE (SIZE (1..maxSL-LCID-r16)) OF SL-RLC-BearerConfig-r16  OPTIONAL,
    sl-MeasPreConfig-r16                    SL-MeasConfigCommon-r16  OPTIONAL,
    sl-OffsetDFN-r16                        INTEGER (1..1000)  OPTIONAL,
    t400-r16                                ENUMERATED {ms100, ms200, ms300, ms400, ms600, ms1000, ms1500, ms2000}  OPTIONAL,
    sl-MaxNumConsecutiveDTX-r16              ENUMERATED {n1, n2, n3, n4, n6, n8, n16, n32}  OPTIONAL,
    sl-SSB-PriorityNR-r16                    INTEGER (1..8)  OPTIONAL,
    sl-PreconfigGeneral-r16                  SL-PreconfigGeneral-r16  OPTIONAL,
    sl-UE-SelectedPreConfig-r16              SL-UE-SelectedConfig-r16  OPTIONAL,
    sl-CSI-Acquisition-r16                  ENUMERATED {enabled}  OPTIONAL,
    sl-RoHC-Profiles-r16                     SL-RoHC-Profiles-r16  OPTIONAL,
    sl-MaxCID-r16                             INTEGER (1..16383)  DEFAULT 15,
    ...
}

SL-PreconfigGeneral-r16 ::=
    sl-TDD-Configuration-r16                TDD-UL-DL-ConfigCommon  OPTIONAL,
    reservedBits-r16                         BIT STRING (SIZE (2))  OPTIONAL,
    ...
}

SL-RoHC-Profiles-r16 ::=
    profile0x0001-r16                        BOOLEAN,
    profile0x0002-r16                        BOOLEAN,
    profile0x0003-r16                        BOOLEAN,
    profile0x0004-r16                        BOOLEAN,
    profile0x0006-r16                        BOOLEAN,
    profile0x0101-r16                        BOOLEAN,
    profile0x0102-r16                        BOOLEAN,
    profile0x0103-r16                        BOOLEAN,
    profile0x0104-r16                        BOOLEAN
}

-- TAG-SL-PRECONFIGURATIONNR-STOP
-- ASN1STOP

```

<b><i>SL-PreconfigurationNR</i></b> field descriptions
<p><b><i>sl-OffsetDFN</i></b> Indicates the timing offset for the UE to determine DFN timing when GNSS is used for timing reference. Value 1 corresponds to 0.001 milliseconds, value 2 corresponds to 0.002 milliseconds, and so on. If the field is absent, no offset is applied.</p>
<p><b><i>sl-PreconfigEUTRA-AnchorCarrierFreqList</i></b> This field indicates the EUTRA anchor carrier frequency list, which can provide the NR sidelink communication configuration.</p>
<p><b><i>sl-PreconfigFreqInfoList</i></b> This field indicates the NR sidelink communication configuration some carrier frequency(ies). In this release, only one SL-FreqConfig can be configured in the list.</p>
<p><b><i>sl-PreconfigNR-AnchorCarrierFreqList</i></b> This field indicates the NR anchor carrier frequency list, which can provide the NR sidelink communication configuration.</p>
<p><b><i>sl-RadioBearerPreConfigList</i></b> This field indicates one or multiple sidelink radio bearer configurations.</p>
<p><b><i>sl-RLC-BearerPreConfigList</i></b> This field indicates one or multiple sidelink RLC bearer configurations.</p>
<p><b><i>sl-RoHC-Profiles</i></b> This field indicates the supported RoHC profiles for NR sidelink communications.</p>
<p><b><i>sl-SSB-PriorityNR</i></b> This field indicates the priority of NR sidelink SSB transmission and reception.</p>

— *End of NR-Sidelink-Preconf*

-- ASN1START

END

-- ASN1STOP

---

## 10 Generic error handling

### 10.1 General

The generic error handling defined in the subsequent sub-clauses applies unless explicitly specified otherwise e.g. within the procedure specific error handling.

The UE shall consider a value as not comprehended when it is set:

- to an extended value that is not defined in the version of the transfer syntax supported by the UE;
- to a spare or reserved value unless the specification defines specific behaviour that the UE shall apply upon receiving the concerned spare/reserved value.

The UE shall consider a field as not comprehended when it is defined:

- as spare or reserved unless the specification defines specific behaviour that the UE shall apply upon receiving the concerned spare/reserved field.

### 10.2 ASN.1 violation or encoding error

The UE shall:

- 1> when receiving an RRC message on the BCCH, CCCH or PCCH for which the abstract syntax is invalid [6]:
  - 2> ignore the message.

NOTE: This clause applies in case one or more fields is set to a value, other than a spare, reserved or extended value, not defined in this version of the transfer syntax. E.g. in the case the UE receives value 12 for a field defined as INTEGER (1..11). In cases like this, it may not be possible to reliably detect which field is in the error hence the error handling is at the message level.

### 10.3 Field set to a not comprehended value

The UE shall, when receiving an RRC message on any logical channel:

- 1> if the message includes a field that has a value that the UE does not comprehend:
  - 2> if a default value is defined for this field:
    - 3> treat the message while using the default value defined for this field;
  - 2> else if the concerned field is optional:
    - 3> treat the message as if the field were absent and in accordance with the need code for absence of the concerned field;
  - 2> else:
    - 3> treat the message as if the field were absent and in accordance with sub-clause 10.4.

### 10.4 Mandatory field missing

The UE shall:

- 1> if the message includes a field that is mandatory to include in the message (e.g. because conditions for mandatory presence are fulfilled) and that field is absent or treated as absent:
  - 2> if the RRC message was not received on DCCH or CCCH:

- 3> if the field concerns a (sub-field of) an entry of a list (i.e. a SEQUENCE OF):
- 4> treat the list as if the entry including the missing or not comprehended field was absent;
- 3> else if the field concerns a sub-field of another field, referred to as the 'parent' field i.e. the field that is one nesting level up compared to the erroneous field:
- 4> consider the 'parent' field to be set to a not comprehended value;
- 4> apply the generic error handling to the subsequent 'parent' field(s), until reaching the top nesting level i.e. the message level;
- 3> else (field at message level):
- 4> ignore the message.

NOTE 1: The error handling defined in these sub-clauses implies that the UE ignores a message with the message type or version set to a not comprehended value.

NOTE 2: The nested error handling for messages received on logical channels other than DCCH and CCCH applies for errors in extensions also, even for errors that can be regarded as invalid network operation e.g. the network not observing conditional presence.

NOTE 3: UE behaviour on receipt of an RRC message on DCCH or CCCH that does not include a field that is mandatory (e.g. because conditions for mandatory presence are fulfilled) is unspecified.

The following ASN.1 further clarifies the levels applicable in case of nested error handling for errors in extension fields.

```
-- /example/ ASN1START
-- Example with extension addition group
ItemInfoList ::=
    SEQUENCE (SIZE (1..max)) OF ItemInfo
ItemInfo ::=
    SEQUENCE {
        itemIdentity      INTEGER (1..max),
        field1            Field1,
        field2            Field2                OPTIONAL,          -- Need N
        ...
        [[
            field3-r9     Field3-r9            OPTIONAL,          -- Cond Cond1
            field4-r9     Field4-r9            OPTIONAL,          -- Need N
        ]]
    }
-- Example with traditional non-critical extension (empty sequence)
BroadcastInfoBlock1 ::=
    SEQUENCE {
        itemIdentity      INTEGER (1..max),
        field1            Field1,
        field2            Field2                OPTIONAL,          -- Need N
        nonCriticalExtension
            BroadcastInfoBlock1-v940-IEs     OPTIONAL
    }
BroadcastInfoBlock1-v940-IEs ::= SEQUENCE {
        field3-r9         Field3-r9            OPTIONAL,          -- Cond Cond1
        field4-r9         Field4-r9            OPTIONAL,          -- Need N
        nonCriticalExtension
            SEQUENCE {}                OPTIONAL,          -- Need S
    }
-- ASN1STOP
```

The UE shall, apply the following principles regarding the levels applicable in case of nested error handling:

- an extension addition group is not regarded as a level on its own. E.g. in the ASN.1 extract in the previous, a error regarding the conditionality of *field3* would result in the entire *itemInfo* entry to be ignored (rather than just the extension addition group containing *field3* and *field4*);

- a traditional *nonCriticalExtension* is not regarded as a level on its own. E.g. in the ASN.1 extract in the previous, an error regarding the conditionality of *field3* would result in the entire *BroadcastInfoBlock1* to be ignored (rather than just the non-critical extension containing *field3* and *field4*).

## 10.5 Not comprehended field

The UE shall, when receiving an RRC message on any logical channel:

- 1> if the message includes a field that the UE does not comprehend:
- 2> treat the rest of the message as if the field was absent.

NOTE: This clause does not apply to the case of an extension to the value range of a field. Such cases are addressed instead by the requirements in clause 10.3.

---

# 11 Radio information related interactions between network nodes

## 11.1 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 NR radio interface, i.e. the same transfer syntax and protocol extension mechanisms apply.

## 11.2 Inter-node RRC messages

### 11.2.1 General

This clause specifies RRC messages that are sent either across the X2-, Xn- or the NG-interface, either to or from the gNB, 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.

```
-- ASN1START
-- TAG-NR-INTER-NODE-DEFINITIONS-START
```

```
NR-InterNodeDefinitions DEFINITIONS AUTOMATIC TAGS ::=
```

```
BEGIN
```

```
IMPORTS
```

```
ARFCN-ValueNR,
ARFCN-ValueEUTRA,
CellIdentity,
CGI-InfoEUTRA,
CGI-InfoNR,
CSI-RS-Index,
CSI-RS-CellMobility,
DRX-Config,
EUTRA-PhysCellId,
FreqBandIndicatorNR,
GapConfig,
maxBandComb,
maxBands,
maxCellSFTD,
maxFeatureSetsPerBand,
maxFreqIDC-MRDC,
maxNrofCombIDC,
maxNrofSCells,
maxNrofServingCells,
maxNrofServingCells-1,
maxNrofServingCellsEUTRA,
```



```

maxNrofIndexesToReport,
maxSimultaneousBands,
MeasQuantityResults,
MeasResultCellListSFTD-EUTRA,
MeasResultCellListSFTD-NR,
MeasResultList2NR,
MeasResultSCG-Failure,
MeasResultServFreqListEUTRA-SCG,
NeedForGapsInfoNR-r16,
OverheatingAssistance,
P-Max,
PhysCellId,
RadioBearerConfig,
RAN-NotificationAreaInfo,
RRCReconfiguration,
ServCellIndex,
SetupRelease,
SSB-Index,
SSB-MTC,
SSB-ToMeasure,
SS-RSSI-Measurement,
ShortMAC-I,
SubcarrierSpacing,
UEAssistanceInformation,
UE-CapabilityRAT-ContainerList,
maxNrofCLI-RSSI-Resources-r16,
maxNrofCLI-SRS-Resources-r16,
RSSI-ResourceId-r16,
SidelinkUEInformationNR-r16,
SRS-ResourceId
FROM NR-RRC-Definitions;

-- TAG-NR-INTER-NODE-DEFINITIONS-STOP
-- ASN1STOP

```

## 11.2.2 Message definitions

### – *HandoverCommand*

This message is used to transfer the handover command as generated by the target gNB.

Direction: target gNB to source gNB/source RAN.

#### ***HandoverCommand* message**

```

-- ASN1START
-- TAG-HANDOVER-COMMAND-START

HandoverCommand ::= SEQUENCE {

```

```

criticalExtensions          CHOICE {
  c1                        CHOICE {
    handoverCommand        HandoverCommand-IEs,
    spare3 NULL, spare2 NULL, spare1 NULL
  },
  criticalExtensionsFuture SEQUENCE {}
}
}

HandoverCommand-IEs ::= SEQUENCE {
  handoverCommandMessage OCTET STRING (CONTAINING RRCReconfiguration),
  nonCriticalExtension    SEQUENCE {} OPTIONAL
}

-- TAG-HANDOVER-COMMAND-STOP
-- ASN1STOP

```

<i>HandoverCommand</i> field descriptions
---

<b><i>handoverCommandMessage</i></b>
--------------------------------------

Contains the <i>RRCReconfiguration</i> message used to perform handover within NR or handover to NR, as generated (entirely) by the target gNB.
---

## – *HandoverPreparationInformation*

This message is used to transfer the NR RRC information used by the target gNB during handover preparation or UE context retrieval, e.g. in case of resume or re-establishment, including UE capability information. This message is also used for transferring the information between the CU and DU.

Direction: source gNB/source RAN to target gNB or CU to DU.

### *HandoverPreparationInformation* message

```

-- ASN1START
-- TAG-HANDOVER-PREPARATION-INFORMATION-START

HandoverPreparationInformation ::= SEQUENCE {
  criticalExtensions          CHOICE {
    c1                        CHOICE {
      handoverPreparationInformation HandoverPreparationInformation-IEs,
      spare3 NULL, spare2 NULL, spare1 NULL
    },
    criticalExtensionsFuture SEQUENCE {}
  }
}

HandoverPreparationInformation-IEs ::= SEQUENCE {
  ue-CapabilityRAT-List      UE-CapabilityRAT-ContainerList,
  sourceConfig                AS-Config OPTIONAL, -- Cond HO
  rrm-Config                  RRM-Config OPTIONAL,
  as-Context                  AS-Context OPTIONAL,
  nonCriticalExtension        SEQUENCE {} OPTIONAL
}

```

```

}
AS-Config ::=
  rrcReconfiguration
  ...
  [[
    sourceRB-SN-Config
    sourceSCG-NR-Config
    sourceSCG-EUTRA-Config
  ]],
  [[
    sourceSCG-Configured
  ]]
}

AS-Context ::=
  reestablishmentInfo
  configRestrictInfo
  ...
  [[ ran-NotificationAreaInfo
  ]],
  [[ ueAssistanceInformation
  ]],
  [[
    selectedBandCombinationSN
  ]],
  [[
    configRestrictInfoDAPS-r16
    sidelinkUEInformationNR-r16
    sidelinkUEInformationEUTRA-r16
    ueAssistanceInformationEUTRA-r16
    ueAssistanceInformationSCG-r16
    needForGapsInfoNR-r16
  ]]
}

ConfigRestrictInfoDAPS-r16 ::=
  powerCoordination-r16
  p-DAPS-Source-r16
  p-DAPS-Target-r16
  uplinkPowerSharingDAPS-Mode-r16
}

ReestablishmentInfo ::=
  sourcePhysCellId
  targetCellShortMAC-I
  additionalReestabInfoList
}

ReestabNCellInfoList ::=
  SEQUENCE ( SIZE (1..maxCellPrep) ) OF ReestabNCellInfo

ReestabNCellInfo ::= SEQUENCE {

```

```

    cellIdentity          CellIdentity,
    key-gNodeB-Star      BIT STRING (SIZE (256)),
    shortMAC-I           ShortMAC-I
}

RRM-Config ::=
  ue-InactiveTime       SEQUENCE {
    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}
    candidateCellInfoList MeasResultList2NR
    ...
    [[
      candidateCellInfoListSN-EUTRA MeasResultServFreqListEUTRA-SCG
    ]]
  }

-- TAG-HANDOVER-PREPARATION-INFORMATION-STOP
-- ASN1STOP

```

<b>HandoverPreparationInformation field descriptions</b>	
<b>as-Context</b>	Local RAN context required by the target gNB or DU.
<b>configRestrictInfoDAPS</b>	Includes fields for which source cell explicitly indicates the restriction to be observed by target cell during DAPS handover.
<b>rrm-Config</b>	Local RAN context used mainly for RRM purposes.
<b>sourceConfig</b>	The radio resource configuration as used in the source cell.
<b>ue-CapabilityRAT-List</b>	The UE radio access related capabilities concerning RATs supported by the UE. A gNB that retrieves MRDC related capability containers ensures that the set of included MRDC containers is consistent w.r.t. the feature set related information.
<b>ue-InactiveTime</b>	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 <i>s1</i> corresponds to 1 second, <i>s2</i> corresponds to 2 seconds and so on. Value <i>min1</i> corresponds to 1 minute, value <i>min1s20</i> corresponds to 1 minute and 20 seconds, value <i>min1s40</i> corresponds to 1 minute and 40 seconds and so on. Value <i>hr1</i> corresponds to 1 hour, <i>hr1min30</i> corresponds to 1 hour and 30 minutes and so on.

<b>AS-Config field descriptions</b>
<p><b>rrcReconfiguration</b> Contains the <i>RRCReconfiguration</i> configuration as generated entirely by the MN.</p>
<p><b>sourceRB-SN-Config</b> Contains the IE <i>RadioBearerConfig</i> as generated entirely by the SN. This field is only used when the UE is configured with SN terminated RB(s).</p>
<p><b>sourceSCG-Configured</b> Value <i>true</i> indicates that the UE is configured with NR or EUTRA SCG in source configuration. The field is only used in NR-DC and NE-DC and is included only if the fields <i>sourceSCG-NR-Config</i> and <i>sourceSCG-EUTRA-Config</i> are absent.</p>
<p><b>sourceSCG-EUTRA-Config</b> Contains the current dedicated SCG configuration in <i>RRCConnectionReconfiguration</i> message as specified in TS 36.331 [10] and generated entirely by the SN. In this version of the specification, the E-UTRA <i>RRCConnectionReconfiguration</i> message can only include the field <i>scg-Configuration</i>. This field is only used in NE-DC.</p>
<p><b>sourceSCG-NR-Config</b> Contains the current dedicated SCG configuration in <i>RRCReconfiguration</i> message as generated entirely by the SN. In this version of the specification, the <i>RRCReconfiguration</i> message can only include fields <i>secondaryCellGroup</i> and <i>measConfig</i>. This field is only used in NR-DC.</p>

<b>AS-Context field descriptions</b>
<p><b>needForGapsInfoNR</b> Includes measurement gap requirement information of the UE for NR target bands.</p>
<p><b>selectedBandCombinationSN</b> Indicates the band combination selected by SN in (NG)EN-DC, NE-DC, and NR-DC.</p>
<p><b>sidelinkUEInformationEUTRA</b> This field includes <i>SidelinkUEInformation</i> IE as specified in TS 36.331 [10].</p>
<p><b>sidelinkUEInformationNR</b> This field includes <i>SidelinkUEInformationNR</i> IE.</p>
<p><b>ueAssistanceInformation</b> Includes for each UE assistance feature the information last reported by the UE, if any.</p>
<p><b>ueAssistanceInformationSCG</b> Includes for each UE assistance feature associated with the SCG, the information last reported by the UE in the NR <i>UEAssistanceInformation</i> message for the SCG, if any.</p>

<b>RRM-Config field descriptions</b>
<p><b>candidateCellInfoList</b> A list of the best cells on each frequency for which measurement information was available</p>
<p><b>candidateCellInfoListSN-EUTRA</b> A list of EUTRA cells including serving cells and best neighbour cells on each serving frequency, for which measurement results were available. This field is only used in NE-DC.</p>

<b>Conditional Presence</b>	<b>Explanation</b>
<i>HO</i>	The field is mandatory present in case of handover within NR or UE context retrieval, e.g. in case of resume or re-establishment. The field is optionally present in case of handover from E-UTRA/5GC. Otherwise the field is absent.
<i>HO2</i>	The field is optionally present in case of handover within NR; otherwise the field is absent.

NOTE 1: The following table indicates per source RAT whether RAT capabilities are included or not.

Source RAT	NR capabilities	E-UTRA capabilities	MR-DC capabilities
NR	May be included if UE Radio Capability ID as specified in 23.502 [43] is used for the UE. Included otherwise.	May be included	May be included
E-UTRAN	May be included if UE Radio Capability ID as specified in 23.502 [43] is used for the UE. Included otherwise.	May be included	May be included

NOTE 2: The following table indicates, in case of inter-RAT handover from E-UTRA, which additional IEs are included or not:

Source system	sourceConfig	rrm-Config	as-Context
E-UTRA/EPC	Not included	May be included	Not included
E-UTRA/5GC	May be included, but only <i>radioBearerConfig</i> is included in the <i>RRCReconfiguration</i> .	May be included	Not included

## – CG-Config

This message is used to transfer the SCG radio configuration as generated by the SgNB or SeNB. It can also be used by a CU to request a DU to perform certain actions, e.g. to request the DU to perform a new lower layer configuration.

Direction: Secondary gNB or eNB to master gNB or eNB, alternatively CU to DU.

### CG-Config message

```
-- ASN1START
-- TAG-CG-CONFIG-START

CG-Config ::=
    criticalExtensions
        c1
            cg-Config
            spare3 NULL, spare2 NULL, spare1 NULL
        },
    criticalExtensionsFuture
        SEQUENCE {}
    }

CG-Config-IEs ::=
    SEQUENCE {
        scg-CellGroupConfig OCTET STRING (CONTAINING RRCReconfiguration) OPTIONAL,
        scg-RB-Config OCTET STRING (CONTAINING RadioBearerConfig) OPTIONAL,
        configRestrictModReq ConfigRestrictModReqSCG OPTIONAL,
        drx-InfoSCG DRX-Info OPTIONAL,
        candidateCellInfoListSN OCTET STRING (CONTAINING MeasResultList2NR) OPTIONAL,
        measConfigSN MeasConfigSN OPTIONAL,
        selectedBandCombination BandCombinationInfoSN OPTIONAL,
        fr-InfoListSCG FR-InfoList OPTIONAL,
    }
```

```

candidateServingFreqListNR      CandidateServingFreqListNR      OPTIONAL,
nonCriticalExtension              CG-Config-v1540-IEs            OPTIONAL,
}

CG-Config-v1540-IEs ::=
  pSCellFrequency                SEQUENCE {                      OPTIONAL,
  reportCGI-RequestNR            SEQUENCE {
    requestedCellInfo            SEQUENCE {
      ssbFrequency              ARFCN-ValueNR,
      cellForWhichToReportCGI   PhysCellId
    }
  }
  ph-InfoSCG                     PH-TypeListSCG                 OPTIONAL,
  nonCriticalExtension           CG-Config-v1560-IEs            OPTIONAL,
}

CG-Config-v1560-IEs ::=
  pSCellFrequencyEUTRA          ARFCN-ValueEUTRA              OPTIONAL,
  scg-CellGroupConfigEUTRA      OCTET STRING                  OPTIONAL,
  candidateCellInfoListSN-EUTRA  OCTET STRING                  OPTIONAL,
  candidateServingFreqListEUTRA  CandidateServingFreqListEUTRA OPTIONAL,
  needForGaps                    ENUMERATED {true}             OPTIONAL,
  drx-ConfigSCG                 DRX-Config                    OPTIONAL,
  reportCGI-RequestEUTRA        SEQUENCE {
    requestedCellInfoEUTRA      SEQUENCE {
      eutraFrequency            ARFCN-ValueEUTRA,
      cellForWhichToReportCGI-EUTRA EUTRA-PhysCellId
    }
  }
  nonCriticalExtension           CG-Config-v1590-IEs            OPTIONAL,
}

CG-Config-v1590-IEs ::=
  scellFrequenciesSN-NR         SEQUENCE (SIZE (1.. maxNrofServingCells-1)) OF ARFCN-ValueNR  OPTIONAL,
  scellFrequenciesSN-EUTRA      SEQUENCE (SIZE (1.. maxNrofServingCells-1)) OF ARFCN-ValueEUTRA  OPTIONAL,
  nonCriticalExtension           CG-Config-v1610-IEs            OPTIONAL,
}

CG-Config-v1610-IEs ::=
  drx-InfoSCG2                  DRX-Info2                     OPTIONAL,
  nonCriticalExtension           CG-Config-v1620-IEs            OPTIONAL,
}

CG-Config-v1620-IEs ::=
  ueAssistanceInformationSCG-r16 OCTET STRING (CONTAINING UEAssistanceInformation) OPTIONAL,
  nonCriticalExtension           SEQUENCE {}                    OPTIONAL,
}

PH-TypeListSCG ::=
  SEQUENCE (SIZE (1..maxNrofServingCells)) OF PH-InfoSCG

PH-InfoSCG ::=
  servCellIndex                 ServCellIndex,
  ph-Uplink                     PH-UplinkCarrierSCG,
  ph-SupplementaryUplink        PH-UplinkCarrierSCG           OPTIONAL,

```

```

}
...
}
PH-UplinkCarrierSCG ::= SEQUENCE {
  ph-Type1or3      ENUMERATED {type1, type3},
  ...
}
MeasConfigSN ::= SEQUENCE {
  measuredFrequenciesSN SEQUENCE (SIZE (1..maxMeasFreqsSN)) OF NR-FreqInfo OPTIONAL,
  ...
}
NR-FreqInfo ::= SEQUENCE {
  measuredFrequency ARFCN-ValueNR OPTIONAL,
  ...
}
ConfigRestrictModReqSCG ::= SEQUENCE {
  requestedBC-MRDC      BandCombinationInfoSN OPTIONAL,
  requestedP-MaxFR1     P-Max OPTIONAL,
  ...,
  [[
  requestedPDCCH-BlindDetectionSCG INTEGER (1..15) OPTIONAL,
  requestedP-MaxEUTRA     P-Max OPTIONAL
  ]],
  [[
  requestedP-MaxFR2-r16    P-Max OPTIONAL,
  requestedMaxInterFreqMeasIdSCG-r16 INTEGER(1..maxMeasIdentitiesMN) OPTIONAL,
  requestedMaxIntraFreqMeasIdSCG-r16 INTEGER(1..maxMeasIdentitiesMN) OPTIONAL,
  requestedToffset-r16    T-Offset-r16 OPTIONAL
  ]]
}
BandCombinationIndex ::= INTEGER (1..maxBandComb)
BandCombinationInfoSN ::= SEQUENCE {
  bandCombinationIndex BandCombinationIndex,
  requestedFeatureSets  FeatureSetEntryIndex
}
FR-InfoList ::= SEQUENCE (SIZE (1..maxNrofServingCells-1)) OF FR-Info
FR-Info ::= SEQUENCE {
  servCellIndex ServCellIndex,
  fr-Type       ENUMERATED {fr1, fr2}
}
CandidateServingFreqListNR ::= SEQUENCE (SIZE (1.. maxFreqIDC-MRDC)) OF ARFCN-ValueNR
CandidateServingFreqListEUTRA ::= SEQUENCE (SIZE (1.. maxFreqIDC-MRDC)) OF ARFCN-ValueEUTRA
T-Offset-r16 ::= ENUMERATED {ms0dot5, ms0dot75, ms1, ms1dot5, ms2, ms2dot5, ms3, spare1}

```



```
-- TAG-CG-CONFIG-STOP  
-- ASN1STOP
```

<b>CG-Config field descriptions</b>
<p><b>candidateCellInfoListSN</b> Contains information regarding cells that the source secondary node suggests the target secondary gNB to consider configuring.</p>
<p><b>candidateCellInfoListSN-EUTRA</b> Includes the <i>MeasResultList3EUTRA</i> as specified in TS 36.331 [10]. Contains information regarding cells that the source secondary node suggests the target secondary eNB to consider configuring. This field is only used in NE-DC.</p>
<p><b>candidateServingFreqListNR, candidateServingFreqListEUTRA</b> Indicates frequencies of candidate serving cells for In-Device Co-existence Indication (see TS 36.331 [10]).</p>
<p><b>configRestrictModReq</b> Used by SN to request changes to SCG configuration restrictions previously set by MN to ensure UE capabilities are respected. E.g. can be used to request configuring an NR band combination whose use MN has previously forbidden.</p>
<p><b>drx-ConfigSCG</b> This field contains the complete DRX configuration of the SCG. This field is only used in NR-DC.</p>
<p><b>drx-InfoSCG</b> This field contains the DRX long and short cycle configuration of the SCG. This field is used in (NG)EN-DC and NE-DC.</p>
<p><b>drx-InfoSCG2</b> This field contains the drx-onDurationTimer configuration of the SCG. This field is only used in (NG)EN-DC.</p>
<p><b>fr-InfoListSCG</b> Contains information of FR information of serving cells that include PSCell and SCells configured in SCG.</p>
<p><b>measuredFrequenciesSN</b> Used by SN to indicate a list of frequencies measured by the UE.</p>
<p><b>needForGaps</b> In NE-DC, indicates whether the SN requests gNB to configure measurements gaps.</p>
<p><b>ph-InfoSCG</b> Power headroom information in SCG that is needed in the reception of PHR MAC CE of MCG</p>
<p><b>ph-SupplementaryUplink</b> Power headroom information for supplementary uplink. In the case of (NG)EN-DC and NR-DC, this field is only present when two UL carriers are configured for a serving cell and one UL carrier reports type1 PH while the other reports type 3 PH.</p>
<p><b>ph-Type1or3</b> Type of power headroom for a certain serving cell in SCG (PSCell and activated SCells). Value <i>type1</i> refers to type 1 power headroom, value <i>type3</i> refers to type 3 power headroom. (See TS 38.321 [3]).</p>
<p><b>ph-Uplink</b> Power headroom information for uplink.</p>
<p><b>pSCellFrequency, pSCellFrequencyEUTRA</b> Indicates the frequency of PSCell in NR (i.e., <i>pSCellFrequency</i>) or E-UTRA (i.e., <i>pSCellFrequencyEUTRA</i>). In this version of the specification, <i>pSCellFrequency</i> is not used in NE-DC whereas <i>pSCellFrequencyEUTRA</i> is only used in NE-DC.</p>
<p><b>reportCGI-RequestNR, reportCGI-RequestEUTRA</b> Used by SN to indicate to MN about configuring <i>reportCGI</i> procedure. The request may optionally contain information about the cell for which SN intends to configure <i>reportCGI</i> procedure. In this version of the specification, the <i>reportCGI-RequestNR</i> is used in (NG)EN-DC and NR-DC whereas <i>reportCGI-RequestEUTRA</i> is used only for NE-DC.</p>
<p><b>requestedBC-MRDC</b> Used to request configuring a band combination and corresponding feature sets which are forbidden to use by MN (i.e. outside of the <i>allowedBC-ListMRDC</i>) to allow re-negotiation of the UE capabilities for SCG configuration.</p>
<p><b>requestedMaxInterFreqMeasIdSCG</b> Used to request the maximum number of allowed measurement identities to configure for inter-frequency measurement. This field is only used in NR-DC.</p>

<p><b>requestedMaxIntraFreqMeasIdSCG</b> Used to request the maximum number of allowed measurement identities to configure for intra-frequency measurement on each serving frequency.</p>
<p><b>requestedPDCCH-BlindDetectionSCG</b> Requested value of the reference number of cells for PDCCH blind detection allowed to be configured for the SCG.</p>
<p><b>requestedP-MaxEUTRA</b> Requested value for the maximum power for the serving cells the UE can use in E-UTRA SCG. This field is only used in NE-DC.</p>
<p><b>requestedP-MaxFR1</b> Requested value for the maximum power for the serving cells on frequency range 1 (FR1) in this secondary cell group (see TS 38.104 [12]) the UE can use in NR SCG.</p>
<p><b>requestedP-MaxFR2</b> Requested value for the maximum power for the serving cells on frequency range 2 (FR2) in this secondary cell group the UE can use in NR SCG. This field is only used in NR-DC.</p>
<p><b>requestedToffset</b> Requests the new value for the time offset restriction used by the SN for scheduling SCG transmissions (i.e. <math>T_{proc,SCG}^{max}</math>, see TS 38.213 [13]). This field is used in NR-DC only when the fields <i>nrdc-PC-mode-FR1-r16</i> or <i>nrdc-PC-mode-FR2-r16</i> are set to dynamic. Value ms0dot5 corresponds to 0.5 ms, value ms0dot75 corresponds to 0.75 ms, value ms1 corresponds to 1ms and so on.</p>
<p><b>scellFrequenciesSN-EUTRA, scellFrequenciesSN-NR</b> Indicates the frequency of all SCells configured in SCG. The field <i>scellFrequenciesSN-EUTRA</i> is used in NE-DC; the field <i>scellFrequenciesSN-NR</i> is used in (NG)EN-DC and NR-DC. In (NG)EN-DC, the field is optionally provided to the MN.</p>
<p><b>scg-CellGroupConfig</b> Contains the <i>RRCReconfiguration</i> message (containing only <i>secondaryCellGroup</i> and/or <i>measConfig</i> and/or <i>otherConfig</i>):</p> <ul style="list-style-type: none"> <li>- to be sent to the UE, used upon SCG establishment or modification, as generated (entirely) by the (target) SgNB. In this case, the SN sets the <i>RRCReconfiguration</i> message in accordance with clause 6 e.g. regarding the "Need" or "Cond" statements.</li> </ul> <p>or</p> <ul style="list-style-type: none"> <li>- including the current SCG configuration of the UE, when provided in response to a query from MN, or in SN triggered SN change in order to enable delta signaling by the target SN. In this case, the SN sets the <i>RRCReconfiguration</i> message in accordance with clause 11.2.3.</li> </ul> <p>The field is absent if neither SCG (re)configuration nor SCG configuration query nor SN triggered SN change is performed, e.g. at inter-node capability/configuration coordination which does not result in SCG (re)configuration towards the UE. This field is not applicable in NE-DC.</p>
<p><b>scg-CellGroupConfigEUTRA</b> Includes the E-UTRA <i>RRCCConnectionReconfiguration</i> message as specified in TS 36.331 [10]. In this version of the specification, the E-UTRA RRC message can only include the field <i>scg-Configuration</i>. Used to (re-)configure the SCG configuration upon SCG establishment or modification, as generated (entirely) by the (target) SeNB. This field is only used in NE-DC.</p>
<p><b>scg-RB-Config</b> Contains the IE <i>RadioBearerConfig</i>:</p> <ul style="list-style-type: none"> <li>- to be sent to the UE, used to (re-)configure the SCG RB configuration upon SCG establishment or modification, as generated (entirely) by the (target) SgNB or SeNB. In this case, the SN sets the <i>RadioBearerConfig</i> in accordance with clause 6, e.g. regarding the "Need" or "Cond" statements.</li> </ul> <p>or</p> <ul style="list-style-type: none"> <li>- including the current SCG RB configuration of the UE, when provided in response to a query from MN or in SN triggered SN change or in SN triggered SN release or bearer type change between SN terminated bearer to MN terminated bearer in order to enable delta signaling by the MN or target SN. In this case, the SN sets the <i>RadioBearerConfig</i> in accordance with clause 11.2.3.</li> </ul> <p>The field is absent if neither SCG (re)configuration nor SCG configuration query nor SN triggered SN change nor SN triggered SN release is performed, e.g. at inter-node capability/configuration coordination which does not result in SCG RB (re)configuration.</p>

<p><b>selectedBandCombination</b> Indicates the band combination selected by SN in (NG)EN-DC, NE-DC, and NR-DC. The SN should inform the MN with this field whenever the band combination and/or feature set it selected for the SCG changes (i.e. even if the new selection concerns a band combination and/or feature set that is allowed by the <i>allowedBC-ListMRDC</i>)</p>
<p><b>ueAssistanceInformationSCG</b> Includes for each UE assistance feature associated with the SCG, the information last reported by the UE in the NR <i>UEAssistanceInformation</i> message for the SCG, if any.</p>

<b>BandCombinationInfoSN field descriptions</b>
<p><b>bandCombinationIndex</b> In case of NR-DC, this field indicates the position of a band combination in the <i>supportedBandCombinationList</i>. In case of NE-DC, this field indicates the position of a band combination in the <i>supportedBandCombinationList</i> and/or <i>supportedBandCombinationListNEDC-Only</i>. In case of (NG)EN-DC, this field indicates the position of a band combination in the <i>supportedBandCombinationList</i> and/or <i>supportedBandCombinationList-UplinkTxSwitch</i>. Band combination entries in <i>supportedBandCombinationList</i> are referred by an index which corresponds to the position of a band combination in the <i>supportedBandCombinationList</i>. Band combination entries in <i>supportedBandCombinationListNEDC-Only</i> are referred by an index which corresponds to the position of a band combination in the <i>supportedBandCombinationListNEDC-Only</i> increased by the number of entries in <i>supportedBandCombinationList</i>. Band combination entries in <i>supportedBandCombinationList-UplinkTxSwitch</i> are referred by an index which corresponds to the position of a band combination in the <i>supportedBandCombinationList-UplinkTxSwitch</i> increased by the number of entries in <i>supportedBandCombinationList</i>.</p>
<p><b>requestedFeatureSets</b> The position in the <i>FeatureSetCombination</i> which identifies one <i>FeatureSetUplink/Downlink</i> for each band entry in the associated band combination</p>

## – CG-ConfigInfo

This message is used by master eNB or gNB to request the SgNB or SeNB to perform certain actions e.g. to establish, modify or release an SCG. The message may include additional information e.g. to assist the SgNB or SeNB to set the SCG configuration. It can also be used by a CU to request a DU to perform certain actions, e.g. to establish, or modify an MCG or SCG.

Direction: Master eNB or gNB to secondary gNB or eNB, alternatively CU to DU.

### CG-ConfigInfo message

```
-- ASN1START
-- TAG-CG-CONFIG-INFO-START

CG-ConfigInfo ::=
    SEQUENCE {
        criticalExtensions          CHOICE {
            c1                     CHOICE {
                cg-ConfigInfo      CG-ConfigInfo-IEs,
                spare3 NULL, spare2 NULL, spare1 NULL
            },
            criticalExtensionsFuture SEQUENCE {}
        }
    }

CG-ConfigInfo-IEs ::=
    SEQUENCE {
        ue-CapabilityInfo          OCTET STRING (CONTAINING UE-CapabilityRAT-ContainerList)    OPTIONAL, -- Cond SN-AddMod
        candidateCellInfoListMN    MeasResultList2NR                                OPTIONAL,
        candidateCellInfoListSN     OCTET STRING (CONTAINING MeasResultList2NR)        OPTIONAL,
```

measResultCellListSFTD-NR	MeasResultCellListSFTD-NR	OPTIONAL,
scgFailureInfo	SEQUENCE {	
failureType	ENUMERATED { t310-Expiry, randomAccessProblem, rlc-MaxNumRetx, synchReconfigFailure-SCG, scg-reconfigFailure, srb3-IntegrityFailure},	
measResultSCG	OCTET STRING (CONTAINING MeasResultSCG-Failure)	
}		OPTIONAL,
configRestrictInfo	ConfigRestrictInfoSCG	OPTIONAL,
drx-InfoMCG	DRX-Info	OPTIONAL,
measConfigMN	MeasConfigMN	OPTIONAL,
sourceConfigSCG	OCTET STRING (CONTAINING RRCReconfiguration)	OPTIONAL,
scg-RB-Config	OCTET STRING (CONTAINING RadioBearerConfig)	OPTIONAL,
mcg-RB-Config	OCTET STRING (CONTAINING RadioBearerConfig)	OPTIONAL,
mrdc-AssistanceInfo	MRDC-AssistanceInfo	OPTIONAL,
nonCriticalExtension	CG-ConfigInfo-v1540-IEs	OPTIONAL
}		
CG-ConfigInfo-v1540-IEs ::=	SEQUENCE {	
ph-InfoMCG	PH-TypeListMCG	OPTIONAL,
measResultReportCGI	SEQUENCE {	
ssbFrequency	ARFCN-ValueNR,	
cellForWhichToReportCGI	PhysCellId,	
cgi-Info	CGI-InfoNR	
}		OPTIONAL,
nonCriticalExtension	CG-ConfigInfo-v1560-IEs	OPTIONAL
}		
CG-ConfigInfo-v1560-IEs ::=	SEQUENCE {	
candidateCellInfoListMN-EUTRA	OCTET STRING	OPTIONAL,
candidateCellInfoListSN-EUTRA	OCTET STRING	OPTIONAL,
sourceConfigSCG-EUTRA	OCTET STRING	OPTIONAL,
scgFailureInfoEUTRA	SEQUENCE {	
failureTypeEUTRA	ENUMERATED { t313-Expiry, randomAccessProblem, rlc-MaxNumRetx, scg-ChangeFailure},	
measResultSCG-EUTRA	OCTET STRING	
}		OPTIONAL,
drx-ConfigMCG	DRX-Config	OPTIONAL,
measResultReportCGI-EUTRA	SEQUENCE {	
eutraFrequency	ARFCN-ValueEUTRA,	
cellForWhichToReportCGI-EUTRA	EUTRA-PhysCellId,	
cgi-InfoEUTRA	CGI-InfoEUTRA	
}		OPTIONAL,
measResultCellListSFTD-EUTRA	MeasResultCellListSFTD-EUTRA	OPTIONAL,
fr-InfoListMCG	FR-InfoList	OPTIONAL,
nonCriticalExtension	CG-ConfigInfo-v1570-IEs	OPTIONAL
}		
CG-ConfigInfo-v1570-IEs ::=	SEQUENCE {	
sftdFrequencyList-NR	SFTD-FrequencyList-NR	OPTIONAL,
sftdFrequencyList-EUTRA	SFTD-FrequencyList-EUTRA	OPTIONAL,
nonCriticalExtension	CG-ConfigInfo-v1590-IEs	OPTIONAL
}		

```

CG-ConfigInfo-v1590-IEs ::= SEQUENCE {
    servFrequenciesMN-NR          SEQUENCE (SIZE (1.. maxNrofServingCells-1)) OF ARFCN-ValueNR          OPTIONAL,
    nonCriticalExtension          CG-ConfigInfo-v1610-IEs          OPTIONAL
}

CG-ConfigInfo-v1610-IEs ::= SEQUENCE {
    drx-InfoMCG2                  DRX-Info2          OPTIONAL,
    alignedDRX-Indication          ENUMERATED {true}          OPTIONAL,
    scgFailureInfo-r16            SEQUENCE {
        failureType-r16            ENUMERATED { scg-lbtFailure-r16, beamFailureRecoveryFailure-r16,
                                                t312-Expiry-r16, bh-RLF-r16,
                                                spare4, spare3, spare2, spare1},
    }
    measResultSCG-r16            OCTET STRING (CONTAINING MeasResultSCG-Failure)          OPTIONAL,
    scgFailureInfoEUTRA-r16      SEQUENCE {
        failureTypeEUTRA-r16      ENUMERATED { scg-lbtFailure-r16, beamFailureRecoveryFailure-r16,
                                                t312-Expiry-r16, bh-RLF-r16,
                                                spare4, spare3, spare2, spare1},
    }
    measResultSCG-EUTRA-r16      OCTET STRING          OPTIONAL,
    sidelinkUEInformationNR-r16   OCTET STRING (CONTAINING SidelinkUEInformationNR-r16)          OPTIONAL,
    sidelinkUEInformationEUTRA-r16 OCTET STRING          OPTIONAL,
    nonCriticalExtension          CG-ConfigInfo-v1620-IEs          OPTIONAL
}

CG-ConfigInfo-v1620-IEs ::= SEQUENCE {
    ueAssistanceInformationSourceSCG-r16 OCTET STRING (CONTAINING UEAssistanceInformation)          OPTIONAL,
    nonCriticalExtension          SEQUENCE {}          OPTIONAL
}

SFTD-FrequencyList-NR ::= SEQUENCE (SIZE (1..maxCellsFTD)) OF ARFCN-ValueNR

SFTD-FrequencyList-EUTRA ::= SEQUENCE (SIZE (1..maxCellsFTD)) OF ARFCN-ValueEUTRA

ConfigRestrictInfoSCG ::= SEQUENCE {
    allowedBC-ListMRDC            BandCombinationInfoList          OPTIONAL,
    powerCoordination-FR1        SEQUENCE {
        p-maxNR-FR1                P-Max          OPTIONAL,
        p-maxEUTRA                  P-Max          OPTIONAL,
        p-maxUE-FR1                  P-Max          OPTIONAL
    }
    servCellIndexRangeSCG        SEQUENCE {
        lowBound                    ServCellIndex,
        upBound                      ServCellIndex
    }
    maxMeasFreqsSCG              INTEGER(1..maxMeasFreqsMN)          OPTIONAL,
    dummy                          INTEGER(1..maxMeasIdentitiesMN)          OPTIONAL,
    ...
    [[
    selectedBandEntriesMNList     SEQUENCE (SIZE (1..maxBandComb)) OF SelectedBandEntriesMN          OPTIONAL,
    pdcch-BlindDetectionSCG      INTEGER (1..15)          OPTIONAL,
    maxNumberROHC-ContextSessionsSN INTEGER(0.. 16384)          OPTIONAL
    ]],
    [[

```

```

maxIntraFreqMeasIdentitiesSCG    INTEGER(1..maxMeasIdentitiesMN)    OPTIONAL,
maxInterFreqMeasIdentitiesSCG    INTEGER(1..maxMeasIdentitiesMN)    OPTIONAL
]],
[[
p-maxNR-FR1-MCG-r16              P-Max                                OPTIONAL,
powerCoordination-FR2-r16        SEQUENCE {
  p-maxNR-FR2-MCG-r16            P-Max                                OPTIONAL,
  p-maxNR-FR2-SCG-r16           P-Max                                OPTIONAL,
  p-maxUE-FR2-r16               P-Max                                OPTIONAL,
}
nr-dc-PC-mode-FR1-r16            ENUMERATED {semi-static-mode1, semi-static-mode2, dynamic}    OPTIONAL,
nr-dc-PC-mode-FR2-r16            ENUMERATED {semi-static-mode1, semi-static-mode2, dynamic}    OPTIONAL,
maxMeasSRS-ResourceSCG-r16       INTEGER(0..maxNrofCLI-SRS-Resources-r16)    OPTIONAL,
maxMeasCLI-ResourceSCG-r16       INTEGER(0..maxNrofCLI-RSSI-Resources-r16)    OPTIONAL,
maxNumberEHC-ContextsSN-r16      INTEGER(0..65536)                            OPTIONAL,
allowedReducedConfigForOverheating-r16    OverheatingAssistance    OPTIONAL,
maxToffset-r16                  T-Offset-r16                            OPTIONAL
]]
}

SelectedBandEntriesMN ::=          SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BandEntryIndex

BandEntryIndex ::=                INTEGER (0.. maxNrofServingCells)

PH-TypeListMCG ::=                SEQUENCE (SIZE (1..maxNrofServingCells)) OF PH-InfoMCG

PH-InfoMCG ::=                    SEQUENCE {
  servCellIndex                  ServCellIndex,
  ph-Uplink                      PH-UplinkCarrierMCG,
  ph-SupplementaryUplink         PH-UplinkCarrierMCG                                OPTIONAL,
  ...
}

PH-UplinkCarrierMCG ::=           SEQUENCE {
  ph-TypeLor3                    ENUMERATED {type1, type3},
  ...
}

BandCombinationInfoList ::=       SEQUENCE (SIZE (1..maxBandComb)) OF BandCombinationInfo

BandCombinationInfo ::=           SEQUENCE {
  bandCombinationIndex           BandCombinationIndex,
  allowedFeatureSetsList         SEQUENCE (SIZE (1..maxFeatureSetsPerBand)) OF FeatureSetEntryIndex
}

FeatureSetEntryIndex ::=          INTEGER (1.. maxFeatureSetsPerBand)

DRX-Info ::=                      SEQUENCE {
  drx-LongCycleStartOffset       CHOICE {
    ms10                         INTEGER(0..9),
    ms20                         INTEGER(0..19),
    ms32                         INTEGER(0..31),
    ms40                         INTEGER(0..39),
    ms60                         INTEGER(0..59),

```

```

ms64 INTEGER(0..63),
ms70 INTEGER(0..69),
ms80 INTEGER(0..79),
ms128 INTEGER(0..127),
ms160 INTEGER(0..159),
ms256 INTEGER(0..255),
ms320 INTEGER(0..319),
ms512 INTEGER(0..511),
ms640 INTEGER(0..639),
ms1024 INTEGER(0..1023),
ms1280 INTEGER(0..1279),
ms2048 INTEGER(0..2047),
ms2560 INTEGER(0..2559),
ms5120 INTEGER(0..5119),
ms10240 INTEGER(0..10239)
},
shortDRX SEQUENCE {
  drx-ShortCycle ENUMERATED {
    ms2, ms3, ms4, ms5, ms6, ms7, ms8, ms10, ms14, ms16, ms20, ms30, ms32,
    ms35, ms40, ms64, ms80, ms128, ms160, ms256, ms320, ms512, ms640, spare9,
    spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 },
  drx-ShortCycleTimer INTEGER (1..16)
}
OPTIONAL
}
DRX-Info2 ::= SEQUENCE {
  drx-onDurationTimer CHOICE {
    subMilliseconds INTEGER (1..31),
    milliseconds ENUMERATED {
      ms1, ms2, ms3, ms4, ms5, ms6, ms8, ms10, ms20, ms30, ms40, ms50, ms60,
      ms80, ms100, ms200, ms300, ms400, ms500, ms600, ms800, ms1000, ms1200,
      ms1600, spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 }
  }
}
MeasConfigMN ::= SEQUENCE {
  measuredFrequenciesMN SEQUENCE (SIZE (1..maxMeasFreqsMN)) OF NR-FreqInfo OPTIONAL,
  measGapConfig SetupRelease { GapConfig } OPTIONAL,
  gapPurpose ENUMERATED {perUE, perFR1} OPTIONAL,
  ...,
  [[
  measGapConfigFR2 SetupRelease { GapConfig } OPTIONAL
  ]]
}
MRDC-AssistanceInfo ::= SEQUENCE {
  affectedCarrierFreqCombInfoListMRDC SEQUENCE (SIZE (1..maxNrofCombIDC)) OF AffectedCarrierFreqCombInfoMRDC,
  ...,
  [[
  overheatingAssistanceSCG-r16 OCTET STRING (CONTAINING OverheatingAssistance) OPTIONAL
  ]]
}

```



```
AffectedCarrierFreqCombInfoMRDC ::= SEQUENCE {
    victimSystemType      VictimSystemType,
    interferenceDirectionMRDC  ENUMERATED {eutra-nr, nr, other, ultra-nr-other, nr-other, spare3, spare2, spare1},
    affectedCarrierFreqCombMRDC SEQUENCE {
        affectedCarrierFreqCombEUTRA AffectedCarrierFreqCombEUTRA OPTIONAL,
        affectedCarrierFreqCombNR     AffectedCarrierFreqCombNR     OPTIONAL
    }
}

VictimSystemType ::= SEQUENCE {
    gps          ENUMERATED {true} OPTIONAL,
    glonass      ENUMERATED {true} OPTIONAL,
    bds          ENUMERATED {true} OPTIONAL,
    galileo     ENUMERATED {true} OPTIONAL,
    wlan        ENUMERATED {true} OPTIONAL,
    bluetooth   ENUMERATED {true} OPTIONAL
}

AffectedCarrierFreqCombEUTRA ::= SEQUENCE (SIZE (1..maxNrofServingCellsEUTRA)) OF ARFCN-ValueEUTRA

AffectedCarrierFreqCombNR ::= SEQUENCE (SIZE (1..maxNrofServingCells)) OF ARFCN-ValueNR

-- TAG-CG-CONFIG-INFO-STOP
-- ASN1STOP
```

<b>CG-ConfigInfo field descriptions</b>
<p><b>alignedDRX-Indication</b> This field is signalled upon MN triggered CGI reporting by the UE that requires aligned DRX configurations between the MCG and the SCG (i.e. same DRX cycle and on-duration configured by MN completely contains on-duration configured by SN).</p>
<p><b>allowedBC-ListMRDC</b> A list of indices referring to band combinations in MR-DC capabilities from which SN is allowed to select the SCG band combination. Each entry refers to: - a band combination numbered according to <i>supportedBandCombinationList</i> and <i>supportedBandCombinationList-UplinkTxSwitch</i> in the <i>UE-MRDC-Capability</i> (in case of (NG)EN-DC), or according to <i>supportedBandCombinationList</i> and <i>supportedBandCombinationListNEDC-Only</i> in the <i>UE-MRDC-Capability</i> (in case of NE-DC), or according to <i>supportedBandCombinationList</i> in the <i>UE-NR-Capability</i> (in case of NR-DC), - and the Feature Sets allowed for each band entry. All MR-DC band combinations indicated by this field comprise the MCG band combination, which is a superset of the MCG band(s) selected by MN.</p>
<p><b>allowedReducedConfigForOverheating</b> Indicates the reduced configuration that the SCG is allowed to configure. <i>reducedMaxCCs</i> in <i>allowedReducedConfigForOverheating</i> indicates the maximum number of downlink/uplink PSCell/SCells that the SCG is allowed to configure. This field is used in (NG)EN-DC and NR-DC. <i>reducedMaxBW-FR1</i> and <i>reducedMaxBW-FR2</i> in <i>allowedReducedConfigForOverheating</i> indicates the maximum aggregated bandwidth across all downlink/uplink carriers of FR1 and FR2, respectively that the SCG is allowed to configure. This field is only used in NR-DC. <i>reducedMaxMIMO-LayersFR1</i> and <i>reducedMaxMIMO-LayersFR2</i> in <i>allowedReducedConfigForOverheating</i> indicates the maximum number of downlink/uplink MIMO layers of each serving cell operating on FR1 and FR2, respectively that the SCG is allowed to configure. This field is only used in NR-DC.</p>
<p><b>candidateCellInfoListMN, candidateCellInfoListSN</b> Contains information regarding cells that the master node or the source node suggests the target gNB or DU to consider configuring. For (NG)EN-DC, including CSI-RS measurement results in <i>candidateCellInfoListMN</i> is not supported in this version of the specification. For NR-DC, including SSB and/or CSI-RS measurement results in <i>candidateCellInfoListMN</i> is supported.</p>
<p><b>candidateCellInfoListMN-EUTRA, candidateCellInfoListSN-EUTRA</b> Includes the <i>MeasResultList3EUTRA</i> as specified in TS 36.331 [10]. Contains information regarding cells that the master node or the source node suggests the target secondary eNB to consider configuring. These fields are only used in NE-DC.</p>
<p><b>configRestrictInfo</b> Includes fields for which SgNB is explicitly indicated to observe a configuration restriction.</p>
<p><b>drx-ConfigMCG</b> This field contains the complete DRX configuration of the MCG. This field is only used in NR-DC.</p>
<p><b>drx-InfoMCG</b> This field contains the DRX long and short cycle configuration of the MCG. This field is used in (NG)EN-DC and NE-DC.</p>
<p><b>drx-InfoMCG2</b> This field contains the <i>drx-onDurationTimer</i> configuration of the MCG and a DRX alignment indication. This field is only used in (NG)EN-DC.</p>
<p><b>fr-InfoListMCG</b> Contains information of FR information of serving cells that include PCell and SCell(s) configured in MCG.</p>
<p><b>dummy</b> This field is not used in the specification and SN ignores the received value.</p>
<p><b>maxInterFreqMeasIdentitiesSCG</b> Indicates the maximum number of allowed measurement identities that the SCG is allowed to configure for inter-frequency measurement. The maximum value for this field is 10. If the field is absent, the SCG is allowed to configure inter-frequency measurements up to the maximum value. This field is only used in NR-DC.</p>
<p><b>maxIntraFreqMeasIdentitiesSCG</b> Indicates the maximum number of allowed measurement identities that the SCG is allowed to configure for intra-frequency measurement on each serving frequency. The maximum value for this field is 9 (in case of (NG)EN-DC or NR-DC) or 10 (in case of NE-DC). If the field is absent, the SCG is allowed to configure intra-frequency measurements up to the maximum value on each serving frequency.</p>
<p><b>maxMeasCLI-ResourceSCG</b> Indicates the maximum number of CLI RSSI resources that the SCG is allowed to configure.</p>

<b>maxMeasFreqsSCG</b>
Indicates the maximum number of NR inter-frequency carriers the SN is allowed to configure with PSCell for measurements.
<b>maxMeasSRS-ResourceSCG</b>
Indicates the maximum number of SRS resources that the SCG is allowed to configure for CLI measurement.
<b>maxNumberROHC-ContextSessionsSN</b>
Indicates the maximum number of ROHC context sessions allowed to SN terminated bearer, excluding context sessions that leave all headers uncompressed.
<b>maxNumberEHC-ContextsSN</b>
Indicates the maximum number of EHC contexts allowed to the SN terminated bearer. The field indicates the number of contexts in addition to CID = "all zeros", as specified in TS 38.323 [5].
<b>maxToffset</b>
Indicates the maximum Toffset value the SN is allowed to use for scheduling SCG transmissions (see TS 38.213 [13]). This field is used in NR-DC only when the fields <i>nrdc-PC-mode-FR1-r16</i> or <i>nrdc-PC-mode-FR2-r16</i> are set to dynamic. Value <i>ms0dot5</i> corresponds to 0.5 ms, value <i>ms0dot75</i> corresponds to 0.75 ms, value <i>ms1</i> corresponds to 1 ms and so on.
<b>measuredFrequenciesMN</b>
Used by MN to indicate a list of frequencies measured by the UE.
<b>measGapConfig</b>
Indicates the FR1 and perUE measurement gap configuration configured by MN.
<b>measGapConfigFR2</b>
Indicates the FR2 measurement gap configuration configured by MN.
<b>mcg-RB-Config</b>
Contains all of the fields in the IE <i>RadioBearerConfig</i> used in MCG, used by the SN to support delta configuration to UE, for bearer type change between MN terminated bearer with NR PDCP to SN terminated bearer. It is also used to indicate the PDCP duplication related information for MN terminated split bearer (whether duplication is configured and if so, whether it is initially activated) in SN Addition/Modification procedure. Otherwise, this field is absent.
<b>measResultReportCGI, measResultReportCGI-EUTRA</b>
Used by MN to provide SN with CGI-Info for the cell as per SN's request. In this version of the specification, the <i>measResultReportCGI</i> is used for (NG)EN-DC and NR-DC and the <i>measResultReportCGI-EUTRA</i> is used only for NE-DC.
<b>measResultSCG-EUTRA</b>
This field includes the <i>MeasResultSCG-FailureMRDC</i> IE as specified in TS 36.331 [10]. This field is only used in NE-DC.
<b>measResultSFTD-EUTRA</b>
SFTD measurement results between the PCell and the E-UTRA PScell in NE-DC. This field is only used in NE-DC.
<b>nrdc-AssistanceInfo</b>
Contains the IDC assistance information for MR-DC reported by the UE (see TS 36.331 [10]).
<b>nrdc-PC-mode-FR1</b>
Indicates the uplink power sharing mode that the UE uses in NR-DC FR1 (see TS 38.213 [13], clause 7.6).
<b>nrdc-PC-mode-FR2</b>
Indicates the uplink power sharing mode that the UE uses in NR-DC FR2 (see TS 38.213 [13], clause 7.6).
<b>overheatingAssistanceSCG</b>
Contains the UE's preference on reduced configuration for NR SCG to address overheating. This field is only used in (NG)EN-DC.
<b>p-maxEUTRA</b>
Indicates the maximum total transmit power to be used by the UE in the E-UTRA cell group (see TS 36.104 [33]). This field is used in (NG)EN-DC and NE-DC.
<b>p-maxNR-FR1</b>
Indicates the maximum total transmit power to be used by the UE in the NR cell group across all serving cells in frequency range 1 (FR1) (see TS 38.104 [12]). The field is used in (NG)EN-DC and NE-DC.
<b>p-maxUE-FR1</b>
Indicates the maximum total transmit power to be used by the UE across all serving cells in frequency range 1 (FR1).

<b>p-maxNR-FR1-MCG</b>
Indicates the maximum total transmit power to be used by the UE in the NR cell group across all serving cells in frequency range 1 (FR1) (see TS 38.104 [12]) the UE can use in NR MCG. This field is only used in NR-DC.
<b>p-maxNR-FR2-SCG</b>
Indicates the maximum total transmit power to be used by the UE in the NR cell group across all serving cells in frequency range 2 (FR2) (see TS 38.104 [12]) the UE can use in NR SCG.
<b>p-maxUE-FR2</b>
Indicates the maximum total transmit power to be used by the UE across all serving cells in frequency range 2 (FR2).
<b>p-maxNR-FR2-MCG</b>
Indicates the maximum total transmit power to be used by the UE in the NR cell group across all serving cells in frequency range 2 (FR2) (see TS 38.104 [12]) the UE can use in NR MCG.
<b>pdccch-BlindDetectionSCG</b>
Indicates the maximum value of the reference number of cells for PDCCH blind detection allowed to be configured for the SCG.
<b>ph-InfoMCG</b>
Power headroom information in MCG that is needed in the reception of PHR MAC CE in SCG.
<b>ph-SupplementaryUplink</b>
Power headroom information for supplementary uplink. For UE in (NG)EN-DC, this field is absent.
<b>ph-Type1or3</b>
Type of power headroom for a serving cell in MCG (PCell and activated SCells). <i>type1</i> refers to type 1 power headroom, <i>type3</i> refers to type 3 power headroom. (See TS 38.321 [3]).
<b>ph-Uplink</b>
Power headroom information for uplink.
<b>powerCoordination-FR1</b>
Indicates the maximum power that the UE can use in FR1.
<b>powerCoordination-FR2</b>
Indicates the maximum power that the UE can use in frequency range 2 (FR2). This field is only used in NR-DC.
<b>scgFailureInfo</b>
Contains SCG failure type and measurement results. In case the sender has no measurement results available, the sender may include one empty entry (i.e. without any optional fields present) in <i>measResultPerMOList</i> . This field is used in (NG)EN-DC and NR-DC.
<b>scgFailureInfoEUTRA</b>
Contains SCG failure type and measurement results of the EUTRA secondary cell group. This field is only used in NE-DC.
<b>scg-RB-Config</b>
Contains all of the fields in the IE RadioBearerConfig used in SCG, used to allow the target SN to use delta configuration to the UE, e.g. during SN change. The field is signalled upon change of SN. Otherwise, the field is absent. This field is also absent when master eNB uses full configuration option.
<b>selectedBandEntriesMNList</b>
A list of indices referring to the position of a band entry selected by the MN, in each band combination entry in <i>allowedBC-ListMRDC</i> IE. <i>BandEntryIndex</i> 0 identifies the first band in the <i>bandList</i> of the <i>BandCombination</i> , <i>BandEntryIndex</i> 1 identifies the second band in the <i>bandList</i> of the <i>BandCombination</i> , and so on. This <i>selectedBandEntriesMNList</i> includes the same number of entries, and listed in the same order as in <i>allowedBC-ListMRDC</i> . The SN uses this information to determine which bands out of the NR band combinations in <i>allowedBC-ListMRDC</i> it can configure in SCG. This field is only used in NR-DC.
<b>servCellIndexRangeSCG</b>
Range of serving cell indices that SN is allowed to configure for SCG serving cells.
<b>servFrequenciesMN-NR</b>
Indicates the frequency of all serving cells that include PCell and SCell(s) configured in MCG. This field is only used in NR-DC.
<b>sftdFrequencyList-NR</b>
Includes a list of SSB frequencies. Each entry identifies the SSB frequency of a PCell, which corresponds to one <i>MeasResultCellSFTD-NR</i> entry in the <i>MeasResultCellListSFTD-NR</i> .

<b>sftdFrequencyList-EUTRA</b>
Includes a list of E-UTRA frequencies. Each entry identifies the carrier frequency of a PSCell, which corresponds to one <i>MeasResultSFTD-EUTRA</i> entry in the <i>MeasResultCellListSFTD-EUTRA</i> .
<b>sidelinkUEInformationEUTRA</b>
This field contains the E-UTRA <i>SidelinkUEInformation</i> message as specified in TS 36.331 [10].
<b>sidelinkUEInformationNR</b>
This field contains the NR <i>SidelinkUEInformationNR</i> message.
<b>sourceConfigSCG</b>
Includes all of the current SCG configurations used by the target SN to build delta configuration to be sent to UE, e.g. during SN change. The field contains the <i>RRCReconfiguration</i> message, i.e. including <i>secondaryCellGroup</i> and <i>measConfig</i> . The field is signalled upon change of SN, unless MN uses full configuration option. Otherwise, the field is absent.
<b>sourceConfigSCG-EUTRA</b>
Includes the E-UTRA <i>RRCConnectionReconfiguration</i> message as specified in TS 36.331 [10]. In this version of the specification, the E-UTRA RRC message can only include the field <i>scg-Configuration</i> . In this version of the specification, this field is absent when master gNB uses full configuration option. This field is only used in NE-DC.
<b>ueAssistanceInformationSourceSCG</b>
Includes for each UE assistance feature associated with the SCG, the information last reported by the UE in the NR <i>UEAssistanceInformation</i> message for the source SCG, if any.
<b>ue-CapabilityInfo</b>
Contains the IE <i>UE-CapabilityRAT-ContainerList</i> supported by the UE (see NOTE 3). A gNB that retrieves MRDC related capability containers ensures that the set of included MRDC containers is consistent w.r.t. the feature set related information.

#### **BandCombinationInfo field descriptions**

<b>allowedFeatureSetsList</b>
Defines a subset of the entries in a <i>FeatureSetCombination</i> . Each index identifies a position in the <i>FeatureSetCombination</i> , which corresponds to one <i>FeatureSetUplink/Downlink</i> for each band entry in the associated band combination.
<b>bandCombinationIndex</b>
In case of NR-DC, this field indicates the position of a band combination in the <i>supportedBandCombinationList</i> . In case of NE-DC, this field indicates the position of a band combination in the <i>supportedBandCombinationList</i> and/or <i>supportedBandCombinationListNEDC-Only</i> . In case of (NG)EN-DC, this field indicates the position of a band combination in the <i>supportedBandCombinationList</i> and/or <i>supportedBandCombinationList-UplinkTxSwitch</i> . Band combination entries in <i>supportedBandCombinationList</i> are referred by an index which corresponds to the position of a band combination in the <i>supportedBandCombinationList</i> . Band combination entries in <i>supportedBandCombinationListNEDC-Only</i> are referred by an index which corresponds to the position of a band combination in the <i>supportedBandCombinationListNEDC-Only</i> increased by the number of entries in <i>supportedBandCombinationList</i> . Band combination entries in <i>supportedBandCombinationList-UplinkTxSwitch</i> are referred by an index which corresponds to the position of a band combination in the <i>supportedBandCombinationList-UplinkTxSwitch</i> increased by the number of entries in <i>supportedBandCombinationList</i> .

Conditional Presence	Explanation
<i>SN-AddMod</i>	The field is mandatory present upon SN addition and SN change. It is optionally present upon SN modification and inter-MN handover without SN change. Otherwise, the field is absent.

NOTE 3: The following table indicates per MN RAT and SN RAT whether RAT capabilities are included or not in *ue-CapabilityInfo*.

MN RAT	SN RAT	NR capabilities	E-UTRA capabilities	MR-DC capabilities
E-UTRA	NR	Need not be included if the UE Radio Capability ID as specified in 23.502 [43] is used. Included otherwise	Not included	Need not be included if the UE Radio Capability ID as specified in 23.502 [43] is used. Included otherwise
NR	E-UTRA	Not included	Need not be included if the UE Radio Capability ID as specified in 23.502 [43] is used. Included otherwise	Need not be included if the UE Radio Capability ID as specified in 23.502 [43] is used. Included otherwise
NR	NR	Need not be included if the UE Radio Capability ID as specified in 23.502 [43] is used. Included otherwise	Not included	Not included

### – *MeasurementTimingConfiguration*

The *MeasurementTimingConfiguration* message is used to convey assistance information for measurement timing.

Direction: en-gNB to eNB, eNB to en-gNB, gNB to gNB, ng-eNB to gNB, gNB to ng-eNB, ng-eNB to ng-eNB, gNB DU to gNB CU, and gNB CU to gNB DU.

#### ***MeasurementTimingConfiguration* message**

```
-- ASN1START
-- TAG-MEASUREMENT-TIMING-CONFIGURATION-START

MeasurementTimingConfiguration ::= SEQUENCE {
    criticalExtensions          CHOICE {
        c1                     CHOICE {
            measTimingConf      MeasurementTimingConfiguration-IEs,
            spare3 NULL, spare2 NULL, spare1 NULL
        },
        criticalExtensionsFuture SEQUENCE {}
    }
}

MeasurementTimingConfiguration-IEs ::= SEQUENCE {
    measTiming                MeasTimingList                               OPTIONAL,
    nonCriticalExtension       MeasurementTimingConfiguration-v1550-IEs    OPTIONAL
}

MeasurementTimingConfiguration-v1550-IEs ::= SEQUENCE {
    campOnFirstSSB            BOOLEAN,
    psCellOnlyOnFirstSSB     BOOLEAN,
    nonCriticalExtension       MeasurementTimingConfiguration-v1610-IEs    OPTIONAL
}

MeasurementTimingConfiguration-v1610-IEs ::= SEQUENCE {
    csi-RS-Config-r16         SEQUENCE {
        csi-RS-SubcarrierSpacing-r16 SubcarrierSpacing,

```

```

        csi-RS-CellMobility-r16          CSI-RS-CellMobility,
        refSSBFreq-r16                  ARFCN-ValueNR
    },
    nonCriticalExtension                  SEQUENCE {}                               OPTIONAL
}

MeasTimingList ::= SEQUENCE (SIZE (1..maxMeasFreqsMN)) OF MeasTiming

MeasTiming ::= SEQUENCE {
    frequencyAndTiming                   SEQUENCE {
        carrierFreq                       ARFCN-ValueNR,
        ssbSubcarrierSpacing              SubcarrierSpacing,
        ssb-MeasurementTimingConfiguration SSB-MTC,
        ss-RSSI-Measurement                SS-RSSI-Measurement                               OPTIONAL
    }
    ...,
    [[
        ssb-ToMeasure                     SSB-ToMeasure                               OPTIONAL,
        physCellId                         PhysCellId                                       OPTIONAL
    ]]
}

-- TAG-MEASUREMENT-TIMING-CONFIGURATION-STOP
-- ASN1STOP

```

#### **MeasTiming field descriptions**

##### **carrierFreq, ssbSubcarrierSpacing**

Indicates the frequency and subcarrier spacing of the SS block of the cell for which this message is included, or of other SS blocks within the same carrier.

##### **ssb-MeasurementTimingConfiguration**

Indicates the SMTC which can be used to search for SSB of the cell for which the message is included. When the message is included in "Served NR Cell Information" (see TS 36.423 [37]), "Served Cell Information NR" (see TS 38.423 [35]), or "Served Cell Information" (see TS 38.473 [36]), the timing is based on the cell for which the message is included. When the message is included in "NR Neighbour Information" (see TS 36.423 [37]), or "Served Cell Information" (see TS 38.423 [35]), the timing is based on the cell indicated in the "Served NR Cell Information" or "Served Cell Information NR" with which the "NR Neighbour Information" or "Neighbour Information NR" is provided. When the message is included in "CU to DU RRC Information", the timing is based on the cell indicated by SpCell ID with which the message is included.

##### **ss-RSSI-Measurement**

Provides the configuration which can be used for RSSI measurements of the cell for which the message is included.

<i>MeasurementTimingConfiguration</i> field descriptions
<p><b>campOnFirstSSB</b> Value <i>true</i> indicates that the SSB indicated in the first instance of <i>MeasTiming</i> in the <i>measTiming</i> list can be used for camping and for a PCell configuration (i.e. in <i>spCellConfigCommon</i> of the <i>masterCellGroup</i>).</p>
<p><b>csi-RS-CellMobility</b> Indicates the CSI-RS configuration of the cell for which this message is included. The timing of the CSI-RS resources is based on the SSB indicated by <i>refSSBFreq</i>.</p>
<p><b>csi-RS-SubcarrierSpacing</b> Indicates the subcarrier spacing of the CSI-RS resources included in <i>csi-rs-CellMobility</i>.</p>
<p><b>measTiming</b> A list of SMTC information, SSB RSSI measurement information and associated NR frequency exchanged via EN-DC X2 Setup, EN-DC Configuration Update, Xn Setup and NG-RAN Node Configuration Update procedures, or F1 messages between gNB DU and gNB CU.</p>
<p><b>physCellId</b> Physical Cell Identity of the SSB on the ARFCN indicated by <i>carrierFreq</i>.</p>
<p><b>psCellOnlyOnFirstSSB</b> Value <i>true</i> indicates that only the SSB indicated in the first instance of <i>MeasTiming</i> in the <i>measTiming</i> list can be used for a PSCell configuration (i.e. in <i>spCellConfigCommon</i> of the <i>secondaryCellGroup</i>).</p>
<p><b>ssb-ToMeasure</b> The set of SS blocks to be measured within the SMTC measurement duration (see TS 38.215 [9]).</p>

## – *UERadioPagingInformation*

This message is used to transfer radio paging information, covering both upload to and download from the 5GC, and between gNBs.

Direction: gNB to/ from 5GC and gNB to/from gNB

### ***UERadioPagingInformation* message**

```

-- ASN1START
-- TAG-UE-RADIO-PAGING-INFORMATION-START

UERadioPagingInformation ::= SEQUENCE {
    criticalExtensions          CHOICE {
        c1                     CHOICE {
            ueRadioPagingInformation          UERadioPagingInformation-IEs,
            spare7 NULL,
            spare6 NULL, spare5 NULL, spare4 NULL,
            spare3 NULL, spare2 NULL, spare1 NULL
        },
        criticalExtensionsFuture          SEQUENCE {}
    }
}

UERadioPagingInformation-IEs ::= SEQUENCE {
    supportedBandListNRForPaging          SEQUENCE (SIZE (1..maxBands)) OF FreqBandIndicatorNR          OPTIONAL,
    nonCriticalExtension                  SEQUENCE {}          OPTIONAL
}

```



```
-- TAG-UE-RADIO-PAGING-INFORMATION-STOP
-- ASN1STOP
```

#### **UERadioPagingInformation field descriptions**

##### **supportedBandListNRForPaging**

Indicates the UE supported NR frequency bands which are derived by the gNB from *UE-NR-Capability*.

#### – *UERadioAccessCapabilityInformation*

This message is used to transfer UE radio access capability information, covering both upload to and download from the 5GC.

Direction: ng-eNB or gNB to/ from 5GC

#### **UERadioAccessCapabilityInformation message**

```
-- ASN1START
-- TAG-UE-RADIO-ACCESS-CAPABILITY-INFORMATION-START
```

```
UERadioAccessCapabilityInformation ::= SEQUENCE {
    criticalExtensions          CHOICE {
        c1                     CHOICE {
            ueRadioAccessCapabilityInformation  UERadioAccessCapabilityInformation-IEs,
            spare7 NULL,
            spare6 NULL, spare5 NULL, spare4 NULL,
            spare3 NULL, spare2 NULL, spare1 NULL
        },
        criticalExtensionsFuture  SEQUENCE {}
    }
}

UERadioAccessCapabilityInformation-IEs ::= SEQUENCE {
    ue-RadioAccessCapabilityInfo  OCTET STRING (CONTAINING UE-CapabilityRAT-ContainerList),
    nonCriticalExtension          SEQUENCE {}
}

-- TAG-UE-RADIO-ACCESS-CAPABILITY-INFORMATION-STOP
-- ASN1STOP
```

#### **UERadioAccessCapabilityInformation-IEs field descriptions**

##### **ue-RadioAccessCapabilityInfo**

Including NR, MR-DC, E-UTRA radio access capabilities. A gNB that retrieves MRDC related capability containers ensures that the set of included MRDC containers is consistent w.r.t. the feature set related information.

### 11.2.3 Mandatory information in inter-node RRC messages

For the *AS-Config* transferred within the *HandoverPreparationInformation*:

- The source node shall include all fields necessary to reflect the AS configuration of the UE, except for the fields *sourceSCG-NR-Config*, *sourceSCG-EUTRA-Config* and *sourceRB-SN-Config*, which can be omitted in case the source MN did not receive the latest configuration from the source SN. For *RRCReconfiguration* included in the field *rrcReconfiguration*, *ReconfigurationWithSync* is included with only the mandatory subfields (e.g. *newUE-Identity* and *t304*) and *ServingCellConfigCommon*;
- Need codes or conditions specified for subfields according to IEs defined in clause 6 do not apply. I.e. some fields shall be included regardless of the "Need" or "Cond" e.g. *discardTimer*;
- Based on the received AS configuration, the target node can indicate the delta (difference) to the UE's AS configuration (as included in *HandoverCommand*). The fields *newUE-Identity* and *t304* included in *ReconfigurationWithSync* are not used for delta configuration purpose.

The *candidateCellInfoListSN(-EUTRA)* in *CG-Config* and the *candidateCellInfoListMN(-EUTRA)/candidateCellInfoListSN(-EUTRA)* in *CG-ConfigInfo* need not be included in procedures that do not involve a change of node.

For a field that conveys the UE configuration in *CG-Config* (SN initiated change of SN configuration, or SCG configuration query) and in *CG-ConfigInfo* upon change of SN (i.e. *mcg-RB-Config*, *scg-RB-Config* and *sourceConfigSCG*):

- The source node shall include all fields necessary to reflect the AS configuration of the UE, unless stated otherwise in the field description or in this sub-clause. For *RRCReconfiguration* included in the field *scg-CellGroupConfig* in *CG-Config*, *ReconfigurationWithSync* is included with only the mandatory subfields (e.g. *newUE-Identity* and *t304*) and *ServingCellConfigCommon*;
- Need codes or conditions specified for subfields according to IEs defined in clause 6 do not apply;
- Based on the received AS configuration, the target node can indicate the delta (difference) to the UE's AS configuration (as included in *CG-Config*). The fields *newUE-Identity* and *t304* included in *ReconfigurationWithSync* are not used for delta configuration purpose.

For the other fields in *CG-Config* and *CG-ConfigInfo*, the sender shall always signal the appropriate value even if same as indicated in the previous RRC INM, unless explicitly stated otherwise. As an exception to this general rule, the absence of the below listed fields means that the receiver maintains the values informed via the previous message. Note that every time there is a change in the configuration covered by a listed field, the MN shall include the field and it shall provide the full configuration provided by that field. Otherwise, if there is no change, the field can be omitted:

- *configRestrictInfo*;
- *gapPurpose*;
- *measGapConfig* (for which delta signaling applies);
- *measGapConfigFR2* (for which delta signaling applies);
- *measResultCellListSFTD*;
- *measResultSFTD-EUTRA*;

- *sftdFrequencyList-EUTRA*;
- *sftdFrequencyList-NR*;
- *ue-CapabilityInfo*;
- *servFrequenciesMN-NR*;
- *scellFrequenciesSN-EUTRA*;
- *scellFrequenciesSN-NR*.

## 11.3 Inter-node RRC information element definitions

-

## 11.4 Inter-node RRC multiplicity and type constraint values

### – Multiplicity and type constraints definitions

```

-- ASN1START
-- TAG-NR-MULTIPLICITY-AND-CONSTRAINTS-START

maxMeasFreqsMN          INTEGER ::= 32 -- Maximum number of MN-configured measurement frequencies
maxMeasFreqsSN          INTEGER ::= 32 -- Maximum number of SN-configured measurement frequencies
maxMeasIdentitiesMN     INTEGER ::= 62 -- Maximum number of measurement identities that a UE can be configured with
maxCellPrep             INTEGER ::= 32 -- Maximum number of cells prepared for handover

-- TAG-NR-MULTIPLICITY-AND-CONSTRAINTS-STOP
-- ASN1STOP

```

### – *End of NR-InterNodeDefinitions*

```

-- ASN1START
-- TAG-NR-INTER-NODE-DEFINITIONS-END-START

END

-- TAG-NR-INTER-NODE-DEFINITIONS-END-STOP
-- ASN1STOP

```

## 12 Processing delay requirements for RRC procedures

The UE performance requirements for RRC procedures are specified in the following tables. The performance requirement is expressed as the time in [ms] from the end of reception of the network -> UE message on the UE physical layer up to when the UE shall be ready for the reception of uplink grant for the UE -> network 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). In case the RRC procedure triggers BWP switching, the RRC procedure delay is the value defined in the following table plus the BWP switching delay defined in TS 38.133 [14], clause 8.6.3.

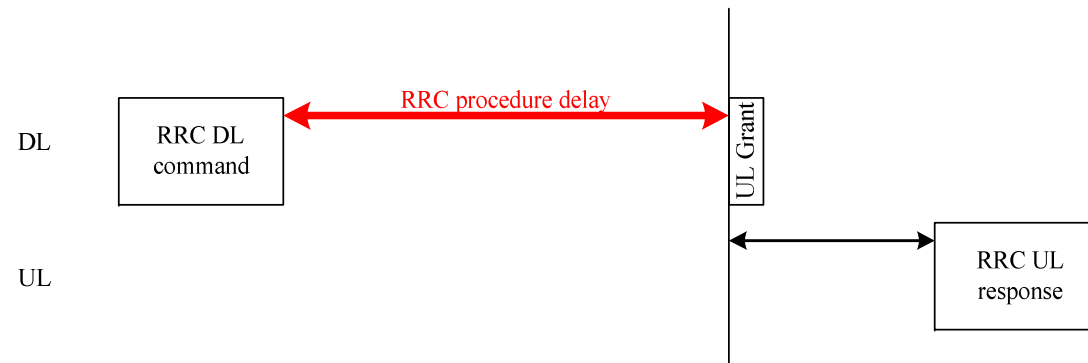


Figure 12.1-1: Illustration of RRC procedure delay

**Table 12.1-1: UE performance requirements for RRC procedures for UEs**

Procedure title:	Network -> UE	UE -> Network	Value [ms]	Notes
<b>RRC Connection Control Procedures</b>				
RRC reconfiguration	<i>RRCReconfiguration</i>	<i>RRCReconfigurationComplete</i>	10	
RRC reconfiguration (scell addition/release)	<i>RRCReconfiguration</i>	<i>RRCReconfigurationComplete</i>	16	
RRC reconfiguration (SCG establishment/ modification/ release)	<i>RRCReconfiguration</i>	<i>RRCReconfigurationComplete</i>	16	
RRC setup	<i>RRCSetup</i>	<i>RRCSetupComplete</i>	10	
RRC Release	<i>RRCRelease</i>		NA	
RRC re-establishment	<i>RRCReestablishment</i>	<i>RRCReestablishmentComplete</i>	10	
RRC resume	<i>RRCResume</i>	<i>RRCResumeComplete</i>	6 or 10	Value=6 applies for a UE supporting reduced CP latency for the case of RRCResume message only including MAC and PHY configuration, and no DRX, SPS, configured grant, CA or MIMO re-configuration will be triggered by this message. Further, the UL grant for transmission of <i>RRCResumeComplete</i> and the data is transmitted over common search space with DCI format 0_0. In this scenario, the RRC procedure delay [ms] can extend beyond the reception of the UL grant, up to 7 ms.  For other cases, Value = 10 applies.
RRC resume (scell addition)	<i>RRCResume</i>	<i>RRCResumeComplete</i>	16	
Initial AS security activation	<i>SecurityModeCommand</i>	<i>SecurityModeComplete/SecurityModeFailure</i>	5	
Other procedures				
UE assistance information		<i>UEAssistanceInformation</i>	NA	

<b>Procedure title:</b>	<b>Network -&gt; UE</b>	<b>UE -&gt; Network</b>	<b>Value [ms]</b>	<b>Notes</b>
UE capability transfer	<i>UECapabilityEnquiry</i>	<i>UECapabilityInformation</i>	80	
Counter check	<i>CounterCheck</i>	<i>CounterCheckResponse</i>	5	
UE information	<i>UEInformationRequest</i>	<i>UEInformationResponse</i>	15	

---

## Annex A (informative): Guidelines, mainly on use of ASN.1

### A.1 Introduction

The following clauses contain guidelines for the specification of RRC protocol data units (PDUs) with ASN.1.

---

### A.2 Procedural specification

#### A.2.1 General principles

The procedural specification provides an overall high level description regarding the UE behaviour in a particular scenario.

It should be noted that most of the UE behaviour associated with the reception of a particular field is covered by the applicable parts of the PDU specification. The procedural specification may also include specific details of the UE behaviour upon reception of a field, but typically this should be done only for cases that are not easy to capture in the PDU clause e.g. general actions, more complicated actions depending on the value of multiple fields.

Likewise, the procedural specification need not specify the UE requirements regarding the setting of fields within the messages that are sent to the network i.e. this may also be covered by the PDU specification.

#### A.2.2 More detailed aspects

The following more detailed conventions should be used:

- Bullets:
  - Capitals should be used in the same manner as in other parts of the procedural text i.e. in most cases no capital applies since the bullets are part of the sentence starting with 'The UE shall:'
  - All bullets, including the last one in a sub-clause, should end with a semi-colon i.e. an ';'.
- Conditions:
  - Whenever multiple conditions apply, a semi-colon should be used at the end of each conditions with the exception of the last one, i.e. as in 'if cond1, or cond2.'



## A.3 PDU specification

### A.3.1 General principles

#### A.3.1.1 ASN.1 sections

The RRC PDU contents are formally and completely described using abstract syntax notation (ASN.1), see X.680 [6], X.681 [7].

The complete ASN.1 code is divided into a number of ASN.1 sections in the specifications. In order to facilitate the extraction of the complete ASN.1 code from the specification, each ASN.1 section begins with the following:

- a first text paragraph consisting entirely of an *ASN.1 start tag*, which consists of a double hyphen followed by a single space and the text string "ASN1START" (in all upper case letters);
- a second text paragraph consisting entirely of a *block start tag* is included, which consists of a double hyphen followed by a single space and the text string "TAG-NAME-START" (in all upper case letters), where the "NAME" refers to the main name of the paragraph (in all upper-case letters).

Similarly, each ASN.1 section ends with the following:

- a first text paragraph consisting entirely of a *blockstop tag*, which consists of a double hyphen followed by a single space and the text string "TAG-NAME-STOP" (in all upper-case letters), where the "NAME" refers to the main name of the paragraph (in all upper-case letters);
- a second text paragraph consisting entirely of an *ASN.1 stop tag*, which consists of a double hyphen followed by a singlespace and the text "ASN1STOP" (in all upper case letters).

This results in the following tags:

```
-- ASN1START
-- TAG-NAME-START

-- TAG-NAME-STOP
-- ASN1STOP
```

The text paragraphs containing either of the start and stop tags should not contain any ASN.1 code significant for the complete description of the RRC PDU contents. The complete ASN.1 code may be extracted by copying all the text paragraphs between an ASN.1 start tag and the following ASN.1 stop tag in the order they appear, throughout the specification.

**NOTE:** A typical procedure for extraction of the complete ASN.1 code consists of a first step where the entire RRC PDU contents description (ultimately the entire specification) is saved into a plain text (ASCII) file format, followed by a second step where the actual extraction takes place, based on the occurrence of the ASN.1 start and stop tags.

### A.3.1.2 ASN.1 identifier naming conventions

The naming of identifiers (i.e., the ASN.1 field and type identifiers) should be based on the following guidelines:

- Message (PDU) identifiers should be ordinary mixed case without hyphenation. These identifiers, *e.g.*, the *RRCCConnectionModificationCommand*, should be used for reference in the procedure text. Abbreviations should be avoided in these identifiers and abbreviated forms of these identifiers should not be used.
- Type identifiers other than PDU identifiers should be ordinary mixed case, with hyphenation used to set off acronyms only where an adjacent letter is a capital, *e.g.*, *EstablishmentCause*, *SelectedPLMN* (not *Selected-PLMN*, since the "d" in "Selected" is lowercase), *InitialUE-Identity* and *MeasSFN-SFN-TimeDifference*.
- Field identifiers shall start with a lowercase letter and use mixed case thereafter, *e.g.*, *establishmentCause*. If a field identifier begins with an acronym (which would normally be in upper case), the entire acronym is lowercase (*plmn-Identity*, not *pLMN-Identity*). The acronym is set off with a hyphen (*ue-Identity*, not *ueIdentity*), in order to facilitate a consistent search pattern with corresponding type identifiers.
- Identifiers should convey the meaning of the identifier and should avoid adding unnecessary postfixes (e.g. abstractions like 'Info') for the name.
- Identifiers that are likely to be keywords of some language, especially widely used languages, such as C++ or Java, should be avoided to the extent possible.
- Identifiers, other than PDU identifiers, longer than 25 characters should be avoided where possible. It is recommended to use abbreviations, which should be done in a consistent manner i.e. use 'Meas' instead of 'Measurement' for all occurrences. Examples of typical abbreviations are given in table A.3.1.2.1-1 below.
- *For future extension:* When an extension is introduced a suffix is added to the identifier of the concerned ASN.1 field and/or type. A suffix of the form "-rX" is used, with X indicating the release, for ASN.1 fields or types introduced in a later release (i.e. a release later than the original/first release of the protocol) as well as for ASN.1 fields or types for which a revision is introduced in a later release replacing a previous version, *e.g.*, *Foo-r9* for the Rel-9 version of the ASN.1 type *Foo*. A suffix of the form "-rXb" is used for the first revision of a field that it appears in the same release (X) as the original version of the field, "-rXc" for a second intra-release revision and so on. A suffix of the form "-vXYZ" is used for ASN.1 fields or types that only are an extension of a corresponding earlier field or type (see sub-clause A.4), *e.g.*, *AnElement-v10b0* for the extension of the ASN.1 type *AnElement* introduced in version 10.11.0 of the specification. A number 0..9, 10, 11, *etc.* is used to represent the first part of the version number, indicating the release of the protocol. Lower case letters *a, b, c, etc.* are used to represent the second (and third) part of the version number if they are greater than 9. In the procedural specification, in field descriptions as well as in headings suffices are not used, unless there is a clear need to distinguish the extension from the original field.
- More generally, in case there is a need to distinguish different variants of an ASN.1 field or IE, a suffix should be added at the end of the identifiers *e.g.* *MeasObjectUTRA*, *ConfigCommon*. When there is no particular need to distinguish the fields (*e.g.* because the field is included in different IEs), a common field identifier name may be used. This may be attractive *e.g.* in case the procedural specification is the same for the different variants.
- It should be avoided to use field identifiers with the same name within the elements of a CHOICE, including using a CHOICE inside a SEQUENCE (to avoid certain compiler errors).

Table A.3.1.2-1: Examples of typical abbreviations used in ASN.1 identifiers

Abbreviation	Abbreviated word
Config	Configuration
DL	Downlink
Ext	Extension
Freq	Frequency
Id	Identity
Ind	Indication
Meas	Measurement
MIB	MasterInformationBlock
Neigh	Neighbour(ing)
Param(s)	Parameter(s)
Phys	Physical
PCI	Physical Cell Id
Proc	Process
Reconfig	Reconfiguration
Reest	Re-establishment
Req	Request
Rx	Reception
Sched	Scheduling
SIB	SystemInformationBlock
Sync	Synchronisation
Thr	Threshold
Tx	Transmission
UL	Uplink

NOTE: The table A.3.1.2.1-1 is not exhaustive. Additional abbreviations may be used in ASN.1 identifiers when needed.

### A.3.1.3 Text references using ASN.1 identifiers

A text reference into the RRC PDU contents description from other parts of the specification is made using the ASN.1 field identifier of the referenced type. The ASN.1 field and type identifiers used in text references should be in the *italic font style*. The "do not check spelling and grammar" attribute in Word should be set. Quotation marks (i.e., "") should not be used around the ASN.1 field or type identifier.

A reference to an RRC PDU should be made using the corresponding ASN.1 field identifier followed by the word "message", e.g., a reference to the *RRCRelease* message.

A reference to a specific part of an RRC PDU, or to a specific part of any other ASN.1 type, should be made using the corresponding ASN.1 field identifier followed by the word "field", e.g., a reference to the *prioritisedBitRate* field in the example below.

```
-- /example/ ASN1START
```

```
LogicalChannelConfig ::=
    ul-SpecificParameters
        priority
        SEQUENCE {
            SEQUENCE {
                Priority,
```

```

        prioritisedBitRate          PrioritisedBitRate,
        bucketSizeDuration         BucketSizeDuration,
        logicalChannelGroup        INTEGER (0..3)
    }                                OPTIONAL
}
-- ASN1STOP

```

NOTE: All the ASN.1 start tags in the ASN.1 sections, used as examples in this annex to the specification, are deliberately distorted, in order not to include them when the ASN.1 description of the RRC PDU contents is extracted from the specification.

A reference to a specific type of information element should be made using the corresponding ASN.1 type identifier preceded by the acronym "IE", e.g., a reference to the IE *LogicalChannelConfig* in the example above.

References to a specific type of information element should only be used when those are generic, i.e., without regard to the particular context wherein the specific type of information element is used. If the reference is related to a particular context, e.g., an RRC PDU type (message) wherein the information element is used, the corresponding field identifier in that context should be used in the text reference.

A reference to a specific value of an ASN.1 field should be made using the corresponding ASN.1 value without using quotation marks around the ASN.1 value, e.g., 'if the *status* field is set to value *true*'.

## A.3.2 High-level message structure

Within each logical channel type, the associated RRC PDU (message) types are alternatives within a CHOICE, as shown in the example below.

```

-- /example/ ASN1START

DL-DCCH-Message ::= SEQUENCE {
    message          DL-DCCH-MessageType
}

DL-DCCH-MessageType ::= CHOICE {
    c1              CHOICE {
        dlInformationTransfer          DLInformationTransfer,
        handoverFromEUTRAPreparationRequest HandoverFromEUTRAPreparationRequest,
        mobilityFromEUTRACommand       MobilityFromEUTRACommand,
        rrcConnectionReconfiguration  RRCConnectionReconfiguration,
        rrcConnectionRelease          RRCConnectionRelease,
        securityModeCommand           SecurityModeCommand,
        ueCapabilityEnquiry            UECapabilityEnquiry,
        spare1 NULL
    },
    messageClassExtension SEQUENCE {}
}

-- ASN1STOP

```

A nested two-level CHOICE structure is used, where the alternative PDU types are alternatives within the inner level *c1* CHOICE.

Spare alternatives (i.e., *spare1* in this case) may be included within the *c1* CHOICE to facilitate future extension. The number of such spare alternatives should not extend the total number of alternatives beyond an integer-power-of-two number of alternatives (i.e., eight in this case).

Further extension of the number of alternative PDU types is facilitated using the *messageClassExtension* alternative in the outer level CHOICE.

### A.3.3 Message definition

Each PDU (message) type is specified in an ASN.1 section similar to the one shown in the example below.

```
-- /example/ ASN1START

RRCConnectionReconfiguration ::= SEQUENCE {
    rrc-TransactionIdentifier      RRC-TransactionIdentifier,
    criticalExtensions             CHOICE {
        c1                        CHOICE {
            rrcConnectionReconfiguration-r8      RRCConnectionReconfiguration-r8-IEs,
            spare3 NULL, spare2 NULL, spare1 NULL
        },
        criticalExtensionsFuture      SEQUENCE {}
    }
}

RRCConnectionReconfiguration-r8-IEs ::= SEQUENCE {
    -- Enter the IEs here.
    ...
}

-- ASN1STOP
```

Hooks for *critical* and *non-critical* extension should normally be included in the PDU type specification. How these hooks are used is further described in sub-clause A.4.

Critical extensions are characterised by a redefinition of the PDU contents and need to be governed by a mechanism for protocol version agreement between the encoder and the decoder of the PDU, such that the encoder is prevented from sending a critically extended version of the PDU type, which is not comprehended by the decoder.

Critical extension of a PDU type is facilitated by a two-level CHOICE structure, where the alternative PDU contents are alternatives within the inner level *c1* CHOICE. Spare alternatives (i.e., *spare3* down to *spare1* in this case) may be included within the *c1* CHOICE. The number of spare alternatives to be included in the original PDU specification should be decided case by case, based on the expected rate of critical extension in the future releases of the protocol.

Further critical extension, when the spare alternatives from the original specifications are used up, is facilitated using the *criticalExtensionsFuture* in the outer level CHOICE.

In PDU types where critical extension is not expected in the future releases of the protocol, the inner level *c1* CHOICE and the spare alternatives may be excluded, as shown in the example below.

```
-- /example/ ASN1START
```

```

RRCConnectionReconfigurationComplete ::= SEQUENCE {
    rrc-TransactionIdentifier      RRC-TransactionIdentifier,
    criticalExtensions             CHOICE {
        rrcConnectionReconfigurationComplete-r8
        RRCConnectionReconfigurationComplete-r8-IEs,
        criticalExtensionsFuture   SEQUENCE {}
    }
}

RRCConnectionReconfigurationComplete-r8-IEs ::= SEQUENCE {
    -- Enter the fields here.
    ...
}

-- ASN1STOP

```

Non-critical extensions are characterised by the addition of new information to the original specification of the PDU type. If not comprehended, a non-critical extension may be skipped by the decoder, whilst the decoder is still able to complete the decoding of the comprehended parts of the PDU contents.

Non-critical extensions at locations other than the end of the message or other than at the end of a field contained in a BIT or OCTET STRING are facilitated by use of the ASN.1 extension marker "...". The original specification of a PDU type should normally include the extension marker at the end of the sequence of information elements contained.

Non-critical extensions at the end of the message or at the end of a field that is contained in a BIT or OCTET STRING may be facilitated by use of an empty sequence that is marked OPTIONAL e.g. as shown in the following example:

```

-- /example/ ASN1START

RRCMessage-r8-IEs ::=
    field1          SEQUENCE {
                    InformationElement1,
                    InformationElement2,

    nonCriticalExtension SEQUENCE {} OPTIONAL
}

-- ASN1STOP

```

The ASN.1 section specifying the contents of a PDU type may be followed by a *field description* table where a further description of, e.g., the semantic properties of the fields may be included. The general format of this table is shown in the example below. The field description table is absent in case there are no fields for which further description needs to be provided e.g. because the PDU does not include any fields, or because an IE is defined for each field while there is nothing specific regarding the use of this IE that needs to be specified.

%PDU-TypeIdentifier% field descriptions	
%field identifier%	Field description.
%field identifier%	Field description.

The field description table has one column. The header row shall contain the ASN.1 type identifier of the PDU type.

The following rows are used to provide field descriptions. Each row shall include a first paragraph with a *field identifier* (in ***bold and italic*** font style) referring to the part of the PDU to which it applies. The following paragraphs at the same row may include (in regular font style), e.g., semantic description, references to other specifications and/or specification of value units, which are relevant for the particular part of the PDU.

The parts of the PDU contents that do not require a field description shall be omitted from the field description table.

## A.3.4 Information elements

Each IE (information element) type is specified in an ASN.1 section similar to the one shown in the example below.

```
-- /example/ ASN1START
PRACH-ConfigSIB ::=
    rootSequenceIndex
    prach-ConfigInfo
}
SEQUENCE {
    INTEGER (0..1023),
    PRACH-ConfigInfo
}

PRACH-Config ::=
    rootSequenceIndex
    prach-ConfigInfo
}
SEQUENCE {
    INTEGER (0..1023),
    PRACH-ConfigInfo OPTIONAL -- Need N
}

PRACH-ConfigInfo ::=
    prach-ConfigIndex
    highSpeedFlag
    zeroCorrelationZoneConfig
}
SEQUENCE {
    ENUMERATED {ffs},
    ENUMERATED {ffs},
    ENUMERATED {ffs}
}
-- ASN1STOP
```

IEs should be introduced whenever there are multiple fields for which the same set of values apply. IEs may also be defined for other reasons e.g. to break down a ASN.1 definition in to smaller pieces.

A group of closely related IE type definitions, like the IEs *PRACH-ConfigSIB* and *PRACH-Config* in this example, are preferably placed together in a common ASN.1 section. The IE type identifiers should in this case have a common base, defined as the *generic type identifier*. It may be complemented by a suffix to distinguish the different variants. The "*PRACH-Config*" is the generic type identifier in this example, and the "*SIB*" suffix is added to distinguish the variant. The sub-clause heading and generic references to a group of closely related IEs defined in this way should use the generic type identifier.

The same principle should apply if a new version, or an extension version, of an existing IE is created for *critical* or *non-critical* extension of the protocol (see sub-clause A.4). The new version, or the extension version, of the IE is included in the same ASN.1 section defining the original. A suffix is added to the type identifier, using the naming conventions defined in sub-clause A.3.1.2, indicating the release or version of the where the new version, or extension version, was introduced.

Local IE type definitions, like the IE *PRACH-ConfigInfo* in the example above, may be included in the ASN.1 section and be referenced in the other IE types defined in the same ASN.1 section. The use of locally defined IE types should be encouraged, as a tool to break up large and complex IE type definitions. It can improve the readability of the

code. There may also be a benefit for the software implementation of the protocol end-points, as these IE types are typically provided by the ASN.1 compiler as independent data elements, to be used in the software implementation.

An IE type defined in a local context, like the IE *PRACH-ConfigInfo*, should not be referenced directly from other ASN.1 sections in the RRC specification. An IE type which is referenced in more than one ASN.1 section should be defined in a separate sub-clause, with a separate heading and a separate ASN.1 section (possibly as one in a set of closely related IE types, like the IEs *PRACH-ConfigSIB* and *PRACH-Config* in the example above). Such IE types are also referred to as 'global IEs'.

**NOTE:** Referring to an IE type, that is defined as a local IE type in the context of another ASN.1 section, does not generate an ASN.1 compilation error. Nevertheless, using a locally defined IE type in that way makes the IE type definition difficult to find, as it would not be visible at an outline level of the specification. It should be avoided.

The ASN.1 section specifying the contents of one or more IE types, like in the example above, may be followed by a *field description* table, where a further description of, e.g., the semantic properties of the fields of the information elements may be included. This table may be absent, similar as indicated in sub-clause A.3.3 for the specification of the PDU type. The general format of the *field description* table is the same as shown in sub-clause A.3.3 for the specification of the PDU type.

## A.3.5 Fields with optional presence

A field with optional presence may be declared with the keyword `DEFAULT`. It identifies a default value to be assumed, if the sender does not include a value for that field in the encoding:

```
-- /example/ ASN1START
PreambleInfo ::=
    numberOfRA-Preambles      SEQUENCE {
        INTEGER (1..64)      DEFAULT 1,
        ...
    }
-- ASN1STOP
```

Alternatively, a field with optional presence may be declared with the keyword `OPTIONAL`. It identifies a field for which a value can be omitted. The omission carries semantics, which is different from any normal value of the field:

```
-- /example/ ASN1START
PRACH-Config ::=
    rootSequenceIndex         SEQUENCE {
        INTEGER (0..1023),
        prach-ConfigInfo      PRACH-ConfigInfo      OPTIONAL -- Need N
    }
-- ASN1STOP
```

The semantics of an optionally present field, in the case it is omitted, should be indicated at the end of the paragraph including the keyword `OPTIONAL`, using a short comment text with a need code. The need code includes the keyword "Need", followed by one of the predefined semantics tags (S, M, N or R) defined in sub-clause 6.1. If the semantics tag S is used, the semantics of the absent field are further specified either in the field description table following the ASN.1 section, or in procedure text.



The addition of OPTIONAL keywords for capability groups is based on the following guideline. If there is more than one field in the lower level IE, then OPTIONAL keyword is added at the group level. If there is only one field in the lower level IE, OPTIONAL keyword is not added at the group level.

### A.3.6 Fields with conditional presence

A field with conditional presence is declared with the keyword OPTIONAL. In addition, a short comment text shall be included at the end of the paragraph including the keyword OPTIONAL. The comment text includes the keyword "Cond", followed by a condition tag associated with the field ("UL" in this example):

```
-- /example/ ASN1START
LogicalChannelConfig ::=
    ul-SpecificParameters
        priority
        ...
    } OPTIONAL -- Cond UL
-- ASN1STOP
```

When conditionally present fields are included in an ASN.1 section, the field description table after the ASN.1 section shall be followed by a *conditional presence* table. The conditional presence table specifies the conditions for including the fields with conditional presence in the particular ASN.1 section.

Conditional presence	Explanation
UL	Specification of the conditions for including the field associated with the condition tag = "UL". Semantics in case of optional presence under certain conditions may also be specified.

The conditional presence table has two columns. The first column (heading: "Conditional presence") contains the condition tag (in *italic* font style), which links the fields with a condition tag in the ASN.1 section to an entry in the table. The second column (heading: "Explanation") contains a text specification of the conditions and requirements for the presence of the field. The second column may also include semantics, in case of an optional presence of the field, under certain conditions i.e. using the same predefined tags as defined for optional fields in A.3.5.

Conditional presence should primarily be used when presence of a field depends on the presence and/or value of other fields within the same message. If the presence of a field depends on whether another feature/function has been configured, while this function can be configured independently e.g. by another message and/or at another point in time, the relation is best reflected by means of a statement in the field description table.

If the ASN.1 section does not include any fields with conditional presence, the conditional presence table shall not be included.

Whenever a field is only applicable in specific cases e.g. TDD, use of conditional presence should be considered.

### A.3.7 Guidelines on use of lists with elements of SEQUENCE type

Where an information element has the form of a list (the SEQUENCE OF construct in ASN.1) with the type of the list elements being a SEQUENCE data type, an information element shall be defined for the list elements even if it would not otherwise be needed.

For example, a list of PLMN identities with reservation flags is defined as in the following example:

```
-- /example/ ASN1START
PLMN-IdentityInfoList ::= SEQUENCE (SIZE (1..6)) OF PLMN-IdentityInfo
PLMN-IdentityInfo ::= SEQUENCE {
    plmn-Identity          PLMN-Identity,
    cellReservedForOperatorUse  ENUMERATED {reserved, notReserved}
}
-- ASN1STOP
```

rather than as in the following (bad) example, which may cause generated code to contain types with unpredictable names:

```
-- /bad example/ ASN1START
PLMN-IdentityList ::= SEQUENCE (SIZE (1..6)) OF SEQUENCE {
    plmn-Identity          PLMN-Identity,
    cellReservedForOperatorUse  ENUMERATED {reserved, notReserved}
}
-- ASN1STOP
```

### A.3.8 Guidelines on use of parameterised SetupRelease type

The usage of the parameterised *SetupRelease* type is like a function call in programming languages where the element type parameter is passed as a parameter. The parameterised type only implies a textual change in abstract syntax where all references to the parameterised type are replaced by the release/setup choice. Two examples of the usage are shown below:

```
-- /example/ ASN1START
RRCMessage-rX-IEs ::= SEQUENCE {
    field-rX          SetupRelease { IE-rX }          OPTIONAL,      -- Need M
    ...
}

RRCMessage-rX-IEs ::= SEQUENCE {
    field-rX          SetupRelease { Element-rX }    OPTIONAL,      -- Need M
}

Element-rX ::= SEQUENCE {
    field1-rX          IE1-rX,
    field2-rX          IE2-rX          OPTIONAL,      -- Need N
}
-- /example/ ASN1STOP
```

The *SetupRelease* is always be used with only named IEs, i.e. the example below is not allowed:

```
-- /example/ ASN1START
RRCMessage-rX-IEs ::= SEQUENCE {
  field-rX      SetupRelease { SEQUENCE { -- Unnamed SEQUENCES are not allowed!
    field1-rX   IE1-rX,
    field2-rX   IE2-rX          OPTIONAL    -- Need N
  }
}
OPTIONAL, -- Need M
-- /example/ ASN1STOP
```

If a field defined using the parameterized SetupRelease type requires procedural text, the field is referred to using the values defined for the type itself, namely, "setup" and "release". For example, procedural text for field-rX above could be as follows:

- 1> if *field-rX* is set to "setup":
  - 2> do something;
- 1> else (*field-rX* is set to "release"):
  - 2> release *field-rX* (if appropriate).

### A.3.9 Guidelines on use of ToAddModList and ToReleaseList

In order to benefit from delta signalling when modifying lists with many and/or large elements, so-called add/mod- and release- lists should be used. Instead of a single list containing all elements of the list, the ASN.1 provides two lists. One list is used to convey the actual elements that are to be added to the list or modified in the list. The second list conveys only the identities (IDs) of the list elements that are to be released from the list. In other words, the ASN.1 defines only means to signal modifications to a list maintained in the receiver (typically the UE). An example is provided below:

```
-- /example/ ASN1START
AnExampleIE ::= SEQUENCE {
  elementsToAddModList SEQUENCE (SIZE (1..maxNrofElements)) OF Element OPTIONAL, -- Need N
  elementsToReleaseList SEQUENCE (SIZE (1..maxNrofElements)) OF ElementId OPTIONAL, -- Need N
  ...
}

Element ::= SEQUENCE {
  elementId ElementId,
  aField    INTEG ER (0..16777215),
  anotherField OCTET STRING,
  ...
}
```

```

ElementId ::=                INTEGER (0..maxNrofElements-1)
maxNrofElements              INTEGER ::= 50
maxNrofElements-1           INTEGER ::= 49
-- /example/ ASN1STOP

```

As can be seen, the elements of the list must contain an identity (INTEGER) that identifies the elements unambiguously upon addition, modification and removal. It is recommended to define an IE for that identifier (here *ElementId*) so that it can be used both for a field inside the element as well as in the *elementsToReleaseList*.

Both lists should be made OPTIONAL and flagged as "Need N". The need code reflects that the UE does not maintain the received lists as such but rather updates its configuration using the information therein. In other words, it is not possible to provide via delta signalling an update to a previously signalled *elementsToAddModList* or *elementsToReleaseList* (which Need M would imply). The update is always in relation to the UE's internal configuration.

Note that the release of parent field also releases all of the child fields, regardless of whether they have been added via *AddModList* or as normal fields.

If no procedural text is provided for a set of *ToAddModList* and *ToReleaseList*, the following generic procedure applies:

The UE shall:

- 1> for each *ElementId* in the *elementsToReleaseList*,:
  - 2> if the current UE configuration includes an *Element* with the given *ElementId*:
    - 3> release the *Element* from the current UE configuration;
- 1> for each *Element* in the *elementsToAddModList*:
  - 2> if the current UE configuration includes an *Element* with the given *ElementId*:
    - 3> modify the configured *Element* in accordance with the received *Element*;
  - 2> else:
    - 3> add received *Element* to the UE configuration.

### A.3.10 Guidelines on use of of lists (without *ToAddModList* and *ToReleaseList*)

As per subclause 6.1.3, when using lists without the *ToAddModList* and *ToReleaseList* structure, the contents of the lists are always replaced. To illustrate this, an example is provided below:

```

-- /example/ ASN1START
-- TAG_EXAMPLE_LISTS_START
AnExampleIE ::= SEQUENCE {

```

```

elementList          SEQUENCE (SIZE (1..maxNrofElements)) OF Element          OPTIONAL, -- Need M
...
[[
elementListExt-v2030 SEQUENCE (SIZE (1..maxNrofElementsExt)) OF Element      OPTIONAL, -- Need M
]]
}]

Element ::=          SEQUENCE {
  useFeatureX        BOOLEAN,
  aField              INTEGER (0..127)                                         OPTIONAL, -- Need M
  anotherField       INTEGER (0..127)                                         OPTIONAL, -- Need R
  ...
}

maxNrofElements      INTEGER ::= 8
maxNrofElements-1    INTEGER ::= 7
maxNrofElementsExt   INTEGER ::= 8
maxNrofElementsExt-1 INTEGER ::= 7

-- TAG_EXAMPLE_LISTS_STOP
-- /example/ ASN1STOP

```

As can be seen, the *elementList* list itself uses Need M, but each list entry *Element* contains mandatory, Need M and Need R fields. If the list is first signalled to UE with 3 entries, and subsequently again with 2 entries, UE shall retain only the latter list, i.e. the list with 2 elements will completely replace the list with 3 elements. That also means that the field *aField* will be treated as if it was newly created, i.e. network must include it if it wishes UE to utilize the field even if it was previously signalled. This also implies that the Need M field (*aField*) will be treated in the same way as the Need R field (*anotherField*), i.e. delta signalling is not applied and the network has to signal the field to ensure UE does not release the value (which is why Need M should not normally be used in the entries of these lists).

## A.4 Extension of the PDU specifications

### A.4.1 General principles to ensure compatibility

It is essential that extension of the protocol does not affect interoperability i.e. it is essential that implementations based on different versions of the RRC protocol are able to interoperate. In particular, this requirement applies for the following kind of protocol extensions:

- Introduction of new PDU types (i.e. these should not cause unexpected behaviour or damage).
- Introduction of additional fields in an extensible PDUs (i.e. it should be possible to ignore uncomprehended extensions without affecting the handling of the other parts of the message).
- Introduction of additional values of an extensible field of PDUs. If used, the behaviour upon reception of an uncomprehended value should be defined.

It should be noted that the PDU extension mechanism may depend on the logical channel used to transfer the message e.g. for some PDUs an implementation may be aware of the protocol version of the peer in which case selective ignoring of extensions may not be required.

The non-critical extension mechanism is the primary mechanism for introducing protocol extensions i.e. the critical extension mechanism is used merely when there is a need to introduce a 'clean' message version. Such a need appears when the last message version includes a large number of non-critical extensions, which results in issues like readability, overhead associated with the extension markers. The critical extension mechanism may also be considered when it is complicated to accommodate the extensions by means of non-critical extension mechanisms.

## A.4.2 Critical extension of messages and fields

The mechanisms to critically extend a message are defined in A.3.3. There are both "outer branch" and "inner branch" mechanisms available. The "outer branch" consists of a CHOICE having the name *criticalExtensions*, with two values, *c1* and *criticalExtensionsFuture*. The *criticalExtensionsFuture* branch consists of an empty SEQUENCE, while the *c1* branch contains the "inner branch" mechanism.

The "inner branch" structure is a CHOICE with values of the form "*MessageName-rX-IEs*" (e.g., "*RRConnectionReconfiguration-r8-IEs*") or "*spareX*", with the spare values having type NULL. The "-rX-IEs" structures contain the *complete* structure of the message IEs for the appropriate release; i.e., the critical extension branch for the Rel-10 version of a message includes all Rel-8 and Rel-9 fields (that are not obviated in the later version), rather than containing only the additional Rel-10 fields.

The following guidelines may be used when deciding which mechanism to introduce for a particular message, i.e. only an 'outer branch', or an 'outer branch' in combination with an 'inner branch' including a certain number of spares:

- For certain messages, e.g. initial uplink messages, messages transmitted on a broadcast channel, critical extension may not be applicable.
- An outer branch may be sufficient for messages not including any fields.
- The number of spares within inner branch should reflect the likelihood that the message will be critically extended in future releases (since each release with a critical extension for the message consumes one of the spare values). The estimation of the critical extension likelihood may be based on the number, size and changeability of the fields included in the message.
- In messages where an inner branch extension mechanism is available, all spare values of the inner branch should be used before any critical extensions are added using the outer branch.

The following example illustrates the use of the critical extension mechanism by showing the ASN.1 of the original and of a later release

```
-- /example/ ASN1START                -- Original release
RRCMessage ::=
  rrc-TransactionIdentifier
  criticalExtensions
    c1
      rrcMessage-r8
      spare3 NULL, spare2 NULL, spare1 NULL
    },
  criticalExtensionsFuture
}
-- ASN1STOP
```

```

-- /example/ ASN1START
-- Later release
RRCMessage ::=
  rrc-TransactionIdentifier
  criticalExtensions
    c1
      rrcMessage-r8
      rrcMessage-r10
      rrcMessage-r11
      rrcMessage-r14
    },
  later
    c2
      rrcMessage-r16
      spare7 NULL, spare6 NULL, spare5 NULL, spare4 NULL,
      spare3 NULL, spare2 NULL, spare1 NULL
    },
  criticalExtensionsFuture
}
}
-- ASN1STOP

```

It is important to note that critical extensions may also be used at the level of individual fields i.e. a field may be replaced by a critically extended version. When sending the extended version, the original version may also be included (e.g. original field is mandatory, E-UTRAN is unaware if UE supports the extended version). In such cases, a UE supporting both versions may be required to ignore the original field. The following example illustrates the use of the critical extension mechanism by showing the ASN.1 of the original and of a later release.

```

-- /example/ ASN1START
-- Original release
RRCMessage ::=
  rrc-TransactionIdentifier
  criticalExtensions
    c1
      rrcMessage-r8
      spare3 NULL, spare2 NULL, spare1 NULL
    },
  criticalExtensionsFuture
}
}

RRCMessage-rN-IEs ::= SEQUENCE {
  field1-rN
  field2-rN
  nonCriticalExtension
}

RRCConnectionReconfiguration-vMxy-IEs ::= SEQUENCE {
  field2-rM
  nonCriticalExtension
}

```

```
}
-- ASN1STOP
```

Conditional presence	Explanation
NoField2rN	The field is optionally present, need N, if field2-rN is absent. Otherwise the field is absent

Finally, it is noted that a critical extension may be introduced in the same release as the one in which the original field was introduced e.g. to correct an essential ASN.1 error. In such cases a UE capability may be introduced, to assist the network in deciding whether or not to use the critical extension.

## A.4.3 Non-critical extension of messages

### A.4.3.1 General principles

The mechanisms to extend a message in a non-critical manner are defined in A.3.3. W.r.t. the use of extension markers, the following additional guidelines apply:

- When further non-critical extensions are added to a message that has been critically extended, the inclusion of these non-critical extensions in earlier critical branches of the message should be avoided when possible.
- The extension marker ("...") is the primary non-critical extension mechanism that is used but empty sequences may be used if length determinant is not required. Examples of cases where a length determinant is not required:
  - at the end of a message;
  - at the end of a structure contained in a BIT STRING or OCTET STRING.
- When an extension marker is available, non-critical extensions are preferably placed at the location (e.g. the IE) where the concerned parameter belongs from a logical/functional perspective (referred to as the '*default extension location*').
- It is desirable to aggregate extensions of the same release or version of the specification into a group, which should be placed at the lowest possible level.
- In specific cases it may be preferable to place extensions elsewhere (referred to as the '*actual extension location*') e.g. when it is possible to aggregate several extensions in a group. In such a case, the group should be placed at the lowest suitable level in the message. <TBD: ref to separate example>
- In case placement at the default extension location affects earlier critical branches of the message, locating the extension at a following higher level in the message should be considered.
- In case an extension is not placed at the default extension location, an IE should be defined. The IE's ASN.1 definition should be placed in the same ASN.1 section as the default extension location. In case there are intermediate levels in-between the actual and the default extension location, an IE may be defined for each level. Intermediate levels are primarily introduced for readability and overview. Hence intermediate levels need not always be introduced e.g. they may not be needed when the default and the actual extension location are within the same ASN.1 section. <TBD: ref to separate example>



### A.4.3.2 Further guidelines

Further to the general principles defined in the previous section, the following additional guidelines apply regarding the use of extension markers:

- Extension markers within SEQUENCE:
  - Extension markers are primarily, but not exclusively, introduced at the higher nesting levels.
  - Extension markers are introduced for a SEQUENCE comprising several fields as well as for information elements whose extension would result in complex structures without it (e.g. re-introducing another list).
  - Extension markers are introduced to make it possible to maintain important information structures e.g. parameters relevant for one particular RAT.
  - Extension markers are also used for size critical messages (i.e. messages on BCCH, BR-BCCH, PCCH and CCCH), although introduced somewhat more carefully.
  - The extension fields introduced (or frozen) in a specific version of the specification are grouped together using double brackets.
- Extension markers within ENUMERATED:
  - Spare values may be used until the number of values reaches the next power of 2, while the extension marker caters for extension beyond that limit, given that the use of spare values in a later Release is possible without any error cases.
  - A suffix of the form "vXYZ" is used for the identifier of each new value, e.g. "value-vXYZ".
- Extension markers within CHOICE:
  - Extension markers are introduced when extension is foreseen and when comprehension is not required by the receiver i.e. behaviour is defined for the case where the receiver cannot comprehend the extended value (e.g. ignoring an optional CHOICE field). It should be noted that defining the behaviour of a receiver upon receiving a not comprehended choice value is not required if the sender is aware whether or not the receiver supports the extended value.
  - A suffix of the form "vXYZ" is used for the identifier of each new choice value, e.g. "choice-vXYZ".

Non-critical extensions at the end of a message/ of a field contained in an OCTET or BIT STRING:

- When a nonCriticalExtension is actually used, a "Need" code should not be provided for the field, which always is a group including at least one extension and a field facilitating further possible extensions. For simplicity, it is recommended not to provide a "Need" code when the field is not actually used either.

Further, more general, guidelines:

- In case a need code is not provided for a group, a "Need" code is provided for all individual extension fields within the group i.e. including for fields that are not marked as OPTIONAL. The latter is to clarify the action upon absence of the whole group.

### A.4.3.3 Typical example of evolution of IE with local extensions

The following example illustrates the use of the extension marker for a number of elementary cases (sequence, enumerated, choice). The example also illustrates how the IE may be revised in case the critical extension mechanism is used.

**NOTE** In case there is a need to support further extensions of release n while the ASN.1 of release (n+1) has been frozen, without requiring the release n receiver to support decoding of release (n+1) extensions, more advanced mechanisms are needed e.g. including multiple extension markers.

```
-- /example/ ASN1START

InformationElement1 ::=
  field1
  field2
    field2a
    field2b
    ...,
    field2c-v960
  },
  ...,
  [[
  field3-r9
  ]],
  [[
  field3-v9a0
  field4-r9
  ]]
}

InformationElement1-r10 ::=
  field1
  field2
    field2a
    field2b
    field2c-v960
    ...,
    field2d-v12b0
  },
  field3-r9
  field4-r9
  field5-r10
  field6-r10
  ...,
  [[
  field3-v1170
  ]]
}

-- ASN1STOP
```

```

SEQUENCE {
  ENUMERATED {
    value1, value2, value3, value4-v880,
    ..., value5-v960 },
  CHOICE {
    BOOLEAN,
    InformationElement2b,
    InformationElement2c-r9
  }
  InformationElement3-r9 OPTIONAL -- Need R
  InformationElement3-v9a0 OPTIONAL, -- Need R
  InformationElement4 OPTIONAL -- Need R
}

SEQUENCE {
  ENUMERATED {
    value1, value2, value3, value4-v880,
    value5-v960, value6-v1170, spare2, spare1, ... },
  CHOICE {
    BOOLEAN,
    InformationElement2b,
    InformationElement2c-r9,
    INTEGER (0..63)
  }
  InformationElement3-r10 OPTIONAL, -- Need R
  InformationElement4 OPTIONAL, -- Need R
  BOOLEAN,
  InformationElement6-r10 OPTIONAL, -- Need R
  InformationElement3-v1170 OPTIONAL -- Need R
}

```

Some remarks regarding the extensions of *InformationElement1* as shown in the above example:

- The *InformationElement1* is initially extended with a number of non-critical extensions. In release 10 however, a critical extension is introduced for the message using this IE. Consequently, a new version of the IE *InformationElement1* (i.e. *InformationElement1-r10*) is defined in which the earlier non-critical extensions are incorporated by means of a revision of the original field.
- The *value4-v880* is replacing a spare value defined in the original protocol version for *field1*. Likewise *value6-v1170* replaces *spare3* that was originally defined in the r10 version of *field1*.
- Within the critically extended release 10 version of *InformationElement1*, the names of the original fields/IEs are not changed, unless there is a real need to distinguish them from other fields/IEs. E.g. the *field1* and *InformationElement4* were defined in the original protocol version (release 8) and hence not tagged. Moreover, the *field3-r9* is introduced in release 9 and not re-tagged; although, the *InformationElement3* is also critically extended and therefore tagged *InformationElement3-r10* in the release 10 version of *InformationElement1*.

#### A.4.3.4 Typical examples of non critical extension at the end of a message

The following example illustrates the use of non-critical extensions at the end of the message or at the end of a field that is contained in a BIT or OCTET STRING i.e. when an empty sequence is used.

```
-- /example/ ASN1START
RRCTest-r8-IEs ::=
    SEQUENCE {
        field1
            InformationElement1,
        field2
            InformationElement2,
        field3
            InformationElement3
        nonCriticalExtension
            RRCMessage-v860-IEs
    }
    OPTIONAL, -- Need N
    OPTIONAL

RRCTest-v860-IEs ::=
    SEQUENCE {
        field4-v860
            InformationElement4
        field5-v860
            BOOLEAN
        nonCriticalExtension
            RRCMessage-v940-IEs
    }
    OPTIONAL, -- Need S
    OPTIONAL, -- Cond C54
    OPTIONAL

RRCTest-v940-IEs ::=
    SEQUENCE {
        field6-v940
            InformationElement6-r9
        nonCriticalExtensions
            SEQUENCE {}
    }
    OPTIONAL, -- Need R
    OPTIONAL

-- ASN1STOP
```

Some remarks regarding the extensions shown in the above example:

- The *InformationElement4* is introduced in the original version of the protocol (release 8) and hence no suffix is used.

### A.4.3.5 Examples of non-critical extensions not placed at the default extension location

The following example illustrates the use of non-critical extensions in case an extension is not placed at the default extension location.

#### – *ParentIE-WithEM*

The IE *ParentIE-WithEM* is an example of a high level IE including the extension marker (EM). The root encoding of this IE includes two lower level IEs *ChildIE1-WithoutEM* and *ChildIE2-WithoutEM* which not include the extension marker. Consequently, non-critical extensions of the Child-IEs have to be included at the level of the Parent-IE.

The example illustrates how the two extension IEs *ChildIE1-WithoutEM-vNx0* and *ChildIE2-WithoutEM-vNx0* (both in release N) are used to connect non-critical extensions with a default extension location in the lower level IEs to the actual extension location in this IE.

#### ***ParentIE-WithEM* information element**

```
-- /example/ ASN1START
ParentIE-WithEM ::= SEQUENCE {
  -- Root encoding, including:
  childIE1-WithoutEM      ChildIE1-WithoutEM      OPTIONAL,      -- Need N
  childIE2-WithoutEM      ChildIE2-WithoutEM      OPTIONAL,      -- Need N
  ...,
  [[
  childIE1-WithoutEM-vNx0  ChildIE1-WithoutEM-vNx0  OPTIONAL,      -- Need N
  childIE2-WithoutEM-vNx0  ChildIE2-WithoutEM-vNx0  OPTIONAL,      -- Need N
  ]]
}
-- ASN1STOP
```

Some remarks regarding the extensions shown in the above example:

- The fields *childIEx-WithoutEM-vNx0* may not really need to be optional (depends on what is defined at the next lower level).
- In general, especially when there are several nesting levels, fields should be marked as optional only when there is a clear reason.

#### – *ChildIE1-WithoutEM*

The IE *ChildIE1-WithoutEM* is an example of a lower level IE, used to control certain radio configurations including a configurable feature which can be setup or released using the local IE *ChIE1-ConfigurableFeature*. The example illustrates how the new field *chIE1-NewField* is added in release N to the configuration of the configurable feature. The example is based on the following assumptions:

- When initially configuring as well as when modifying the new field, the original fields of the configurable feature have to be provided also i.e. as if the extended ones were present within the setup branch of this feature.
- When the configurable feature is released, the new field should be released also.

- When omitting the original fields of the configurable feature the UE continues using the existing values (which is used to optimise the signalling for features that typically continue unchanged upon handover).
- When omitting the new field of the configurable feature the UE releases the existing values and discontinues the associated functionality (which may be used to support release of unsupported functionality upon handover to an eNB supporting an earlier protocol version).

The above assumptions, which affect the use of conditions and need codes, may not always apply. Hence, the example should not be re-used blindly.

### ***ChildIE1-WithoutEM* information element**

```
-- /example/ ASN1START
ChildIE1-WithoutEM ::= SEQUENCE {
  -- Root encoding, including:
  chIE1-ConfigurableFeature ChIE1-ConfigurableFeature OPTIONAL -- Need N
}
ChildIE1-WithoutEM-vNx0 ::= SEQUENCE {
  chIE1-ConfigurableFeature-vNx0 ChIE1-ConfigurableFeature-vNx0 OPTIONAL -- Cond ConfigF
}
ChIE1-ConfigurableFeature ::= CHOICE {
  release NULL,
  setup SEQUENCE {
    -- Root encoding
  }
}
ChIE1-ConfigurableFeature-vNx0 ::= SEQUENCE {
  chIE1-NewField-rN INTEGER (0..31)
}
-- ASN1STOP
```

Conditional presence	Explanation
<i>ConfigF</i>	The field is optional present, need R, in case of chIE1-ConfigurableFeature is included and set to "setup"; otherwise the field is absent and the UE shall delete any existing value for this field.

### – ***ChildIE2-WithoutEM***

The IE *ChildIE2-WithoutEM* is an example of a lower level IE, typically used to control certain radio configurations. The example illustrates how the new field *chIE1-NewField* is added in release N to the configuration of the configurable feature.

### ***ChildIE2-WithoutEM* information element**

```
-- /example/ ASN1START
```

```

ChildIE2-WithoutEM ::= CHOICE {
  release
  setup
  -- Root encoding
}
ChildIE2-WithoutEM-vNx0 ::= SEQUENCE {
  chIE2-NewField-rN INTEGER (0..31) OPTIONAL -- Cond ConfigF
}
-- ASN1STOP

```

Conditional presence	Explanation
<i>ConfigF</i>	The field is optional present, need R, in case of chIE2-ConfigurableFeature is included and set to "setup"; otherwise the field is absent and the UE shall delete any existing value for this field.

## A.5 Guidelines regarding inclusion of transaction identifiers in RRC messages

The following rules provide guidance on which messages should include a Transaction identifier

- 1: DL messages on CCCH that move UE to RRC-Idle should not include the RRC transaction identifier.
- 2: All network initiated DL messages by default should include the RRC transaction identifier.
- 3: All UL messages that are direct response to a DL message with an RRC Transaction identifier should include the RRC Transaction identifier.
- 4: All UL messages that require a direct DL response message should include an RRC transaction identifier.
- 5: All UL messages that are not in response to a DL message nor require a corresponding response from the network should not include the RRC Transaction identifier.

## A.6 Guidelines regarding use of need codes

The following rule provides guidance for determining need codes for optional downlink fields:

- if the field needs to be stored by the UE (i.e. maintained) when absent:
  - use Need M (=Maintain);
- else, if the field needs to be released by the UE when absent:
  - use Need R (=Release);

- else, if UE shall take no action when the field is absent (i.e. UE does not even need to maintain any existing value of the field):
  - use Need N (=None);
- else (UE behaviour upon absence does not fit any of the above conditions):
  - use Need S (=Specified);
  - specify the UE behaviour upon absence of the field in the procedural text or in the field description table.

---

## A.7 Guidelines regarding use of conditions

Conditions are primarily used to specify network restrictions, for which the following types can be distinguished:

- Message Contents related constraints e.g. that a field B is mandatory present if the same message includes field A and when it is set value X.
- Configuration Constraints e.g. that a field D can only be signalled if field C is configured and set to value Y. (i.e. regardless of whether field C is present in the same message or previously configured).

The use of these conditions is illustrated by an example.

```
-- /example/ ASN1START
RRCMessage-IEs ::= SEQUENCE {
    fieldA          FieldA          OPTIONAL,  -- Need M
    fieldB          FieldB          OPTIONAL,  -- Cond FieldAsetToX
    fieldC          FieldC          OPTIONAL,  -- Need M
    fieldD          FieldD          OPTIONAL,  -- Cond FieldCsetToY
    nonCriticalExtension  SEQUENCE {}  OPTIONAL
}
-- /example/ ASN1STOP
```

Conditional presence	Explanation
<i>FieldAsetToX</i>	The field is mandatory present if fieldA is included and set to valueX. Otherwise the field is optionally present, need R.
<i>FieldCsetToY</i>	The field is optionally present, need M, if fieldC is configured and set to valueY. Otherwise the field is absent and the UE does not maintain the value

---

## A.8 Miscellaneous

The following miscellaneous convention should be used:

- UE capabilities: TS 38.306 [26] specifies that the network should in general respect the UE's capabilities. Hence there is no need to include statement clarifying that the network, when setting the value of a certain configuration field, shall respect the related UE capabilities unless there is a particular need e.g. particularly complicated cases.



---

## Annex B (informative): RRC Information

### B.1 Protection of RRC messages

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

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

A – I...Messages that can be sent without integrity protection after AS security activation

A – C...Messages that can be sent unciphered after AS security activation

NA... Message can never be sent after AS security activation

Message	P	A-I	A-C	Comment
<i>CounterCheck</i>	-	-	-	
<i>CounterCheckResponse</i>	-	-	-	
<i>DedicatedSIBRequest</i>	+	-	-	
<i>DLDedicatedMessageSegment</i>	NOTE 1			
<i>DLInformationTransfer</i>	+	-	-	
<i>DLInformationTransferMRDC</i>	-	-	-	
<i>FailureInformation</i>	-	-	-	
<i>LocationMeasurementIndication</i>	-	-	-	
<i>MCGFailureInformation</i>	-	-	-	
<i>MIB</i>	+	+	+	
<i>MeasurementReport</i>	-	-	-	Measurement configuration may be sent prior to AS security activation. But: In order to protect privacy of UEs, <i>MeasurementReport</i> is only sent from the UE after successful AS security activation.
<i>MobilityFromNRCommand</i>	-	-	-	
<i>Paging</i>	+	+	+	
<i>RRCReconfiguration</i>	+	-	-	The message shall not be sent unprotected before AS security activation if it is used to perform handover or to establish SRB2 and DRBs.
<i>RRCReconfigurationComplete</i>	+	-	-	Unprotected, if sent as response to <i>RRCReconfiguration</i> which was sent before AS security activation.
<i>RRCReestablishment</i>	-	-	+	Integrity protection applied, but no ciphering.
<i>RRCReestablishmentComplete</i>	-	-	-	
<i>RRCReestablishmentRequest</i>	-	-	+	This message is not protected by PDCP operation. However, a <i>shortMAC-I</i> is included.
<i>RRCReject</i>	+	+	+	Justification for A-I and A-C: the message can be sent in SRB0 in RRC_INACTIVE state, after the AS security is activated.
<i>RRCRelease</i>	+	-	-	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. <i>RRCRelease</i> message sent before AS security activation cannot include <i>deprioritisationReq</i> , <i>suspendConfig</i> , <i>redirectedCarrierInfo</i> , <i>cellReselectionPriorities</i> information fields.
<i>RRCResume</i>	-	-	-	
<i>RRCResumeComplete</i>	-	-	-	
<i>RRCResumeRequest</i>	-	-	+	This message is not protected by PDCP operation. However, a <i>resumeMAC-I</i> is included.
<i>RRCResumeRequest1</i>	-	-	+	This message is not protected by PDCP operation. However, a <i>resumeMAC-I</i> is included.
<i>RRCSetup</i>	+	+	+	Justification for A-I and A-C: the message can be sent in SRB0 in RRC_INACTIVE or RRC_CONNECTED states, after the AS security is activated.
<i>RRCSetupComplete</i>	+	NA	NA	
<i>RRCSetupRequest</i>	+	NA	NA	
<i>RRCSystemInfoRequest</i>	+	+	+	Justification for A-I and A-C: the message can be sent in SRB0 in RRC_INACTIVE state, after the AS security is activated.
<i>SIB1</i>	+	+	+	
<i>SCGFailureInformation</i>	-	-	-	
<i>SCGFailureInformationEUTRA</i>	-	-	-	
<i>SecurityModeCommand</i>	+	NA	NA	Integrity protection applied, but no ciphering (integrity verification done after the message received by RRC).
<i>SecurityModeComplete</i>	-	-	+	The message is sent after AS security activation. Integrity protection applied, but no ciphering. Ciphering is applied after completing the procedure.
<i>SecurityModeFailure</i>	+	NA	NA	Neither integrity protection nor ciphering applied.

Message	P	A-I	A-C	Comment
<i>SystemInformation</i>	+	+	+	
<i>UEAssistanceInformation</i>	-	-	-	
<i>UECapabilityEnquiry</i>	+	-	-	The network should retrieve UE capabilities only after AS security activation.
<i>UECapabilityInformation</i>	+	-	-	
<i>ULDedicatedMessageSegment</i>	+	-	-	
<i>UEInformationRequest</i>	-	-	-	
<i>UEInformationResponse</i>	-	-	-	In order to protect privacy of UEs, <i>UEInformationResponse</i> is only sent from the UE after successful security activation
<i>ULInformationTransfer</i>	+	-	-	
<i>ULInformationTransferMRDC</i>	-	-	-	

NOTE 1: This message type carries segments of other RRC messages. The protection of an instance of this message is the same as for the message which this message is carrying.

## B.2 Description of BWP configuration options

There are two possible ways to configure BWP#0 (i.e. the initial BWP) for a UE:

- 1) Configure *BWP-DownlinkCommon* and *BWP-UplinkCommon* in *ServingCellConfigCommon*, but do not configure dedicated configurations in *BWP-DownlinkDedicated* or *BWP-UplinkDedicated* in *ServingCellConfig*.
- 2) Configure both *BWP-DownlinkCommon* and *BWP-UplinkCommon* in *ServingCellConfigCommon* and configure dedicated configurations in at least one of *BWP-DownlinkDedicated* or *BWP-UplinkDedicated* in *ServingCellConfig*.

The same way of configuration is used for UL BWP#0 and DL BWP#0 if both are configured.

With the first option (illustrated by figure B2-1 below), the BWP#0 is not considered to be an RRC-configured BWP, i.e. UE only supporting one BWP can still be configured with BWP#1 in addition to BWP#0 when using this configuration. The BWP#0 can still be used even if it does not have the dedicated configuration, albeit in a more limited manner since only the SIB1-defined configurations are available. For example, only DCI format 1\_0 can be used with BWP#0 without dedicated configuration, so changing to another BWP requires RRCReconfiguration since DCI format 1\_0 doesn't support DCI-based switching.



Figure B2-1: BWP#0 configuration without dedicated configuration

With the second option (illustrated by figure B2-2 below), the BWP#0 is considered to be an RRC-configured BWP, i.e. UE only supporting one BWP cannot be configured with BWP#1 in addition to BWP#0 when using this configuration. However, UE supporting more than one BWP can still switch to and from BWP#0 e.g. via DCI normally, and there are no explicit limitations to using the BWP#0 (compared to the first option).

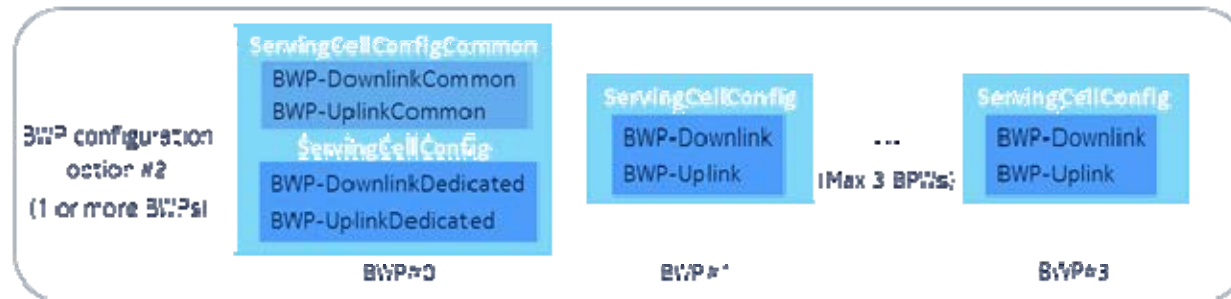


Figure B2-2: BWP#0 configuration with dedicated configuration

For BWP#0, the *BWP-DownlinkCommon* and *BWP-UplinkCommon* in *ServingCellConfigCommon* should match the parameters configured by MIB and SIB1 (if provided) in the corresponding serving cell.

## Annex C (normative): List of CRs Containing Early Implementable Features and Corrections

This annex lists the Change Requests (CRs) whose changes may be implemented by a UE of an earlier release than which the CR was approved in (i.e. CRs that contain on their coversheets the sentence "Implementation of this CR from Rel-N will not cause interoperability issues").

**Table C-1: List of CRs Containing Early Implementable Features and Corrections**

<b>TDoc Number (RP-xxxxxx): CR Title</b>	<b>CR Number(s)</b>	<b>CR Revision Number(s)</b>	<b>Earliest Implementable Release</b>	<b>Additional Information</b>
RP-200335: Correction on usage of access category 2 for UAC for RNA update	1141	2	Release 15	
RP-201185: Introduction of signalling for high-speed train scenarios	1464	5	Release 15	
RP-201216: Release-16 UE capabilities based on RAN1, RAN4 feature lists and RAN2	1665	2	Release 15	Early implementation part is referring to the aspect covered by R2-2006203: Extension of CSI-RS capabilities per codebook type

## Annex D (normative): UE requirements on ASN.1 comprehension

This clause specifies UE requirements regarding the ASN.1 transfer syntax support, i.e. the ASN.1 definitions to be comprehended by the UE.

A UE that indicates release X in field *accessStratumRelease* shall comprehend the entire transfer syntax (ASN.1) of release X, in particular at least the first version upon ASN.1 freeze. The UE is however not required to support dedicated signalling related transfer syntax associated with optional features it does not support.

In case a UE that indicates release X in field *accessStratumRelease* supports a feature specified in release Y, which is later than release X, (i.e. early UE implementation) additional requirements apply. The UE obviously also has to support the ASN.1 parts related to indicating support of the feature (in UE capabilities).

### Critical extensions (dedicated signaling)

If the early implemented feature involves one or more critical extensions in dedicated signalling, the UE shall comprehend the parts of the transfer syntax (ASN.1) of release Y that are related to the feature implemented early. This, in particular, concerns the ASN.1 parts related to configuration of the feature.

If configuration of an early implemented feature introduced in release Y involves a message or field that has been critically extended, the UE shall support configuration of all features supported by the UE that are associated with sub-fields of this critical extension. Apart from the early implemented feature(s), the UE needs, however, not to support functionality beyond what is defined in the release the UE indicates in access stratum release.

Let's consider the example of a UE indicating value X in field *accessStratumRelease* that supports the features A1, A3, and A5, associated with fields *fieldA1*, *fieldA3* and *fieldA5* of *InformationElementA* (see ASN.1 below).

The feature A5 implemented early is associated with *fieldA5*, and can only be configured by the -rY version of *InformationElementA*. In such case, the UE should support configuration of all the features A1, A3 and A5 associated with fields *fieldA1*, *fieldA3* and *fieldA5* by the -rY version of *InformationElementA*.

If, however, one of the features was modified, e.g. the feature A3 associated with *fieldA3*, the network should assume the UE only supports the feature A3 according to the release it indicated in field *accessStratumRelease* (i.e. X).

The UE is neither required to support the additional code-point (*n80-vY0*) nor the additional sub-field (*fieldA3c-rY*).

```

InformationElementA-rX ::= SEQUENCE {
    fieldA1-rX      InformationElementA1-rX      OPTIONAL,  -- Need N
    fieldA2-rX      InformationElementA2-rX      OPTIONAL,  -- Need R
    fieldA3-rX      InformationElementA3-rX      OPTIONAL,  -- Need R
}

InformationElementA-rY ::= SEQUENCE {
    fieldA1-rY      InformationElementA1-rX      OPTIONAL,  -- Need N
    fieldA2-rY      InformationElementA2-rX      OPTIONAL,  -- Need R
    fieldA3-rY      InformationElementA3-rY      OPTIONAL,  -- Need R
    fieldA4-rY      InformationElementA4-rY      OPTIONAL,  -- Need R
    fieldA5-rY      InformationElementA5-rY      OPTIONAL,  -- Need R
}

InformationElementA3-rX ::= SEQUENCE {
    fieldA3a-rX      InformationElementA3a-rX      OPTIONAL,  -- Need N

```

```

    fieldA3b-rX          ENUMERATED {n10, n20, n40}          OPTIONAL    -- Need R
}
InformationElementA3-rY ::= SEQUENCE {
    fieldA3a-rY          InformationElementA3a-rX            OPTIONAL,   -- Need N
    fieldA3b-rY          ENUMERATED {n10, n20, n40, n80-vY0} OPTIONAL,   -- Need R
    fieldA3c-rY          InformationElementA3c-rY            OPTIONAL    -- Need R
}

```

### Non-critical extensions (dedicated and broadcast signaling)

If the early implemented feature involves one or more non-critical extensions, the UE shall comprehend the parts of the transfer syntax (ASN.1) of release Y that are related to the feature implemented early.

If the early implemented feature involves one or more non-critical extensions in dedicated signaling, the network does not include extensions introduced after the release X that are not the parts related to the feature which the UE indicates early support of in UE capabilities. The UE shall anyway comprehend the parts of the transfer syntax (ASN.1) which indicate absence of such extensions.

If the early implemented feature involves one or more non-critical extensions in system information, the SIB(s) containing the release Y fields related to the early implemented features may also include other extensions introduced after the release X that are not the parts related to the feature which the UE supports. The UE shall comprehend such intermediate fields (but again is not required to support the functionality associated with these intermediate fields, in case this concerns optional features not supported by the UE).

## Annex E (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Category	Subject/Comment	New version
04/2017	RAN2 #97bis	R2-1703395					0.0.1
04/2017	RAN2 #97bis	R2-1703922					0.0.2
05/2017	RAN2 #98	R2-1705815					0.0.3
06/2017	RAN2 #NR2	R2-1707187					0.0.4
08/2017	RAN2 #99	R2-1708468					0.0.5
09/2017	RAN2 #99bis	R2-1710557					0.1.0
11/2017	RAN2 #100	R2-1713629					0.2.0
11/2017	RAN2 #100	R2-1714126					0.3.0
12/2017	RAN2 #100	R2-1714259					0.4.0
12/2017	RP#78	RP-172570				Submitted for Approval in RAN#78	1.0.0
12/2017	RP#78					Upgraded to Rel-15 (MCC)	15.0.0
03/2018	RP#79	RP-180479	0008	1	F	Corrections for EN-DC (Note: the clause numbering between 15.0.0 and 15.1.0 has changed in some cases).	15.1.0
06/2018	RP-80	RP-181326	0042	7	F	Miscellaneous EN-DC corrections	15.2.0
	RP-80					Correction: Duplicate Foreword clause removed & ASN.1 clauses touched up	15.2.1
09/2018	RP-81	RP-181942	0100	4	F	Introduction of SA	15.3.0
12/2018	RP-82	RP-182656	0179	3	F	Handling of Resume Failure	15.4.0
	RP-82	RP-182651	0187	1	F	Clarification on the presence of ra-ResponseWindow	15.4.0
	RP-82	RP-182656	0188	3	F	Addition of RAN specific Access Category	15.4.0
	RP-82	RP-182653	0199	2	F	CR for TS38.331 on MIB	15.4.0
	RP-82	RP-182653	0200	1	F	CR for TS38.331 on PDCCH-ConfigSIB	15.4.0
	RP-82	RP-182661	0202	2	F	Handling Cell Reselection during SI Request	15.4.0
	RP-82	RP-182649	0213	2	F	Corrections on security field descriptions	15.4.0
	RP-82	RP-182649	0216	2	F	Remain issue for T302	15.4.0
	RP-82	RP-182649	0219	1	F	[C204] Handling of timer T380	15.4.0
	RP-82	RP-182655	0229	2	F	Clarification on configured grant timer in 38.331	15.4.0
	RP-82	RP-182663	0232	2	F	CR for ServingCellConfigCommon in 38.331	15.4.0
	RP-82	RP-182659	0234	3	F	Introduction of cell level rate matching parameters in ServingCellConfig	15.4.0
	RP-82	RP-182650	0235	2	F	CR for introducing PSCell frequency in CG-Config	15.4.0
	RP-82	RP-182650	0236	2	F	CR for security handling for eLTE in 38.331	15.4.0
	RP-82	RP-182650	0237	1	F	Handling on simultaneously triggered NAS&AS events (I770)	15.4.0
	RP-82	RP-182650	0238	2	F	Handling on security keys for resume procedure (I774)	15.4.0
	RP-82	RP-182664	0239	5	F	RIL I556, I557, I558 on RB handling when resuming	15.4.0
	RP-82	RP-182650	0242	2	F	Security for RRC connection release	15.4.0
	RP-82	RP-182650	0243	4	F	Corrections on reestablishment and security procedures	15.4.0
	RP-82	RP-182650	0244	1	F	RIL I118 on release case to upper layers for CN paging for a UE in RRC_INACTIVE	15.4.0
	RP-82	RP-182650	0246	2	F	CR on SI request procedure in TS38.331	15.4.0
	RP-82	RP-182650	0248	2	F	CR to 38331 on ul-DataSplitThreshold for SRB	15.4.0
	RP-82	RP-182652	0249	2	F	Clarification of guami-Type	15.4.0
	RP-82	RP-182652	0252	1	F	CR to 38.331 on Protection of RRC messages Table	15.4.0
	RP-82	RP-182663	0254	2	F	Access barring check after handover	15.4.0
	RP-82	RP-182663	0259	3	F	Stop of T390 and related UE actions	15.4.0
	RP-82	RP-182657	0260	4	F	Corrections for handover between NR and E-UTRA	15.4.0
	RP-82	RP-182738	0267	3	F	CR on ssb-ToMeasure in MeasurementTimingConfiguration	15.4.0
	RP-82	RP-182659	0269	3	F	Clarification of the applicability of 38.331 to EN-DC	15.4.0



	RP-82	RP-182654	0270	3	F	Clarification on the smtc signalled for intra-NR handover, PSCell change or SCell addition	15.4.0
	RP-82	RP-182654	0273	3	F	CR on fallback to the setup procedure	15.4.0
	RP-82	RP-182654	0275	1	F	Correction on cell sorting for periodical measurement reporting	15.4.0
	RP-82	RP-182660	0277	2	F	Measurement related actions upon re-establishment	15.4.0
	RP-82	RP-182654	0278	1	F	CR on threshold description for cell quality derivation	15.4.0
	RP-82	RP-182654	0282	1	F	CR to avoid unnecessary L3 filtered beam measurements	15.4.0
	RP-82	RP-182660	0283	2	F	CR on CGI reporting	15.4.0
	RP-82	RP-182660	0291	3	F	Additional UE capabilities for NR standalone	15.4.0
	RP-82	RP-182667	0294	4	F	NR RRC Processing Time	15.4.0
	RP-82	RP-182812	0295	5	F	Update of L1/RF capabilities	15.4.0
	RP-82	RP-182651	0296	2	F	UE configuration on re-establishment procedure	15.4.0
	RP-82	RP-182651	0298	2	F	SIB size limitation [M201]	15.4.0
	RP-82	RP-182651	0299	2	F	Correction on SRS-TPC-CommandConfig	15.4.0
	RP-82	RP-182651	0302	2	F	Clarification on counter check procedure	15.4.0
	RP-82	RP-182666	0307	4	F	CR on the Clarification for the Support of the Delay Budget Report in NR	15.4.0
	RP-82	RP-182666	0320	3	F	ssb-PositionsInBurst correction	15.4.0
	RP-82	RP-182666	0325	3	F	Barring behaviour when SIB1 reception fails	15.4.0
	RP-82	RP-182666	0329	5	F	System Information Storing and Validity Clarifications and Corrections	15.4.0
	RP-82	RP-182666	0330	3	F	SIBs required before initiating connection	15.4.0
	RP-82	RP-182652	0333	1	F	On contents of measObjectEUTRA	15.4.0
	RP-82	RP-182654	0335	2	F	A3 and A5 corrections – neighbouring cell definition	15.4.0
	RP-82	RP-182650	0339	2	F	SI reception in RRC Connected mode (RIL#I1611)	15.4.0
	RP-82	RP-182650	0340	2	F	Miscellaneous corrections on SI procedures	15.4.0
	RP-82	RP-182652	0342	1	F	On RRM measurements related procedural text corrections	15.4.0
	RP-82	RP-182651	0344	1	F	Clarification for absence of nr-NS-PmaxList IE	15.4.0
	RP-82	RP-182652	0345	2	F	Clarification on paging in connected mode	15.4.0
	RP-82	RP-182651	0350	2	F	ASN.1 correction to fr-InfoListSCG in CG-Config	15.4.0
	RP-82	RP-182661	0355	2	F	Update of L2 capability parameters	15.4.0
	RP-82	RP-182651	0364	1	F	Procedures for full config at RRCResume	15.4.0
	RP-82	RP-182651	0365	2	F	Clarification of PDCP-Config field descriptions	15.4.0
	RP-82	RP-182653	0368	2	F	UE Context handling during handover to NR	15.4.0
	RP-82	RP-182652	0371	2	F	[E255] CR to 38.331 on corrections related to CGI reporting timer T321	15.4.0
	RP-82	RP-182655	0375	3	F	R2-1817981 CR to 38.331 on pendingRnaUpdate setting	15.4.0
	RP-82	RP-182653	0376	2	F	Introducing procedure for reporting RLC failures	15.4.0
	RP-82	RP-182654	0379	2	F	Correction of frequency band indication in MeasObjectNR	15.4.0
	RP-82	RP-182654	0382	2	F	RRC connection release triggered by upper layers	15.4.0
	RP-82	RP-182660	0384	3	F	Correction to configuration of measurement object	15.4.0
	RP-82	RP-182665	0388	3	F	Correction to 38331 in SRS-Config	15.4.0
	RP-82	RP-182657	0391	2	F	Correction for PowerControl-related issues	15.4.0
	RP-82	RP-182668	0395	4	F	Inter-band EN-DC Configured Output Power requirements	15.4.0
	RP-82	RP-182655	0396	2	F	E573 Configuration of SRB1 during Resume	15.4.0
	RP-82	RP-182655	0402	1	F	Triggers for abortion of RRC establishment	15.4.0
	RP-82	RP-182656	0406	2	F	Correction on CN type indication for Redirection from NR to E-UTRA	15.4.0
	RP-82	RP-182664	0409	4	F	Miscellaneous minor corrections	15.4.0
	RP-82	RP-182654	0410	1	F	Invalidation of L1 parameter nrofCQIsPerReport	15.4.0
	RP-82	RP-182654	0411	1	F	Clarifications on RNA update and CN registration (N023)	15.4.0
	RP-82	RP-182666	0412	3	F	Missing optionality bit in CG-ConfigInfo	15.4.0
	RP-82	RP-182662	0414	2	F	Clarification for the implementation of UE feature list item 6-1 (BWP op1)	15.4.0
	RP-82	RP-182654	0417	1	F	Clarification on ssb-PositionsInBurst	15.4.0
	RP-82	RP-182667	0418	3	F	Correction to commonControlResourceSet	15.4.0
	RP-82	RP-182667	0420	2	F	Correction to TDD configuration in SIB1	15.4.0
	RP-82	RP-182668	0421	5	F	Clarification on handling of default parameters	15.4.0
	RP-82	RP-182663	0429	2	F	SRB3 integrity protection failure handling	15.4.0
	RP-82	RP-182653	0431	2	F	Corrections to the field descriptions of System Information	15.4.0
	RP-82	RP-182653	0434	1	F	Correction to SI provision in connected mode	15.4.0
	RP-82	RP-182661	0436	3	F	PDCCH Monitoring Occasions in SI Window	15.4.0
	RP-82	RP-182655	0438	3	F	CR on SI Message Acquisition	15.4.0
	RP-82	RP-182652	0439	1	F	Update of nas-SecurityParamFromNR according to LS from SA3	15.4.0
	RP-82	RP-182652	0445	2	F	Correction to Default MAC Cell Group configuration	15.4.0
	RP-82	RP-182652	0447	1	F	Correction to missing field descriptions of PLMN Identity	15.4.0
	RP-82	RP-182657	0448	2	F	Introducing PDCP suspend procedure	15.4.0
	RP-82	RP-182657	0449	2	F	Correction to PDCP statusReportRequired	15.4.0
	RP-82	RP-182664	0454	3	F	CR to 38.331 on the ambiguity of targetCellIdentity in Resume/Reestablishment MAC-I calculation	15.4.0
	RP-82	RP-182655	0457	1	F	Corrections on P-Max description	15.4.0
	RP-82	RP-182651	0460	2	F	Clarification on Configuration of multiplePHR for EN-DC and NR-CA	15.4.0
	RP-82	RP-182656	0469	2	F	Correction on conditional presence of PCellOnly	15.4.0
	RP-82	RP-182657	0474	4	F	Introduction of power boosting indicator for pi2BPSK waveform	15.4.0
	RP-82	RP-182655	0475	1	F	Correction on the allowedBC-ListMRDC	15.4.0
	RP-82	RP-182649	0476	2	F	Removal of restriction on RB removal and addition	15.4.0

	RP-82	RP-182649	0482	2	F	Correction to full configuration	15.4.0
	RP-82	RP-182661	0492	3	F	CR on MeasurementTimingConfiguration	15.4.0
	RP-82	RP-182654	0502	1	F	Bandwidth configuration for initial BWP	15.4.0
	RP-82	RP-182664	0503	4	F	CORESET#0 configuration when SIB1 is not broadcast	15.4.0
	RP-82	RP-182663	0506	1	F	Correction on the behaviors with cell reselection while T302 is running	15.4.0
	RP-82	RP-182661	0509	2	F	Correction on SDAP reconfiguration handling	15.4.0
	RP-82	RP-182663	0510	1	F	Clarification for the UE behaviour in camped normally and camped on any cell states	15.4.0
	RP-82	RP-182663	0514	2	F	Correction to description of parameter Ns nAndPagingFrameOffset	15.4.0
	RP-82	RP-182649	0515	-	F	Correction to description of parameter Ns	15.4.0
	RP-82	RP-182661	0516	1	F	CR on UE behaviour after SI Acquisition Failure	15.4.0
	RP-82	RP-182662	0518	1	F	CR on PUCCH-ConfigCommon	15.4.0
	RP-82	RP-182662	0520	1	F	Clarifications on receiving RRCReject without wait timer	15.4.0
	RP-82	RP-182665	0522	1	F	CR on powerControlOffset	15.4.0
	RP-82	RP-182664	0524	2	F	Correction to configuration of firstPDCCH-MonitoringOccasionOfPO	15.4.0
	RP-82	RP-182660	0539	1	F	R on PCCH-Config	15.4.0
	RP-82	RP-182649	0541	-	F	Clarification to no barring configuration for Implicit UAC	15.4.0
	RP-82	RP-182649	0542	-	F	Correction to Access Category and barring config determination for implicit access barring	15.4.0
	RP-82	RP-182664	0543	2	F	Per serving cell MIMO layer configuration	15.4.0
	RP-82	RP-182661	0545	1	F	Correction to reconfiguration with sync	15.4.0
	RP-82	RP-182659	0552	1	F	Correction for SSB power	15.4.0
	RP-82	RP-182659	0554	1	F	Corrections on SearchSpace configuration	15.4.0
	RP-82	RP-182665	0558	1	F	Correction for TCI state in ControlResourceSet	15.4.0
	RP-82	RP-182663	0560	1	F	CR for the optional configuration of subbandSize	15.4.0
	RP-82	RP-182650	0562	-	F	Correction on ShortMAC-I description in 38.331	15.4.0
	RP-82	RP-182661	0567	1	F	CR to the field descriptions of System Information	15.4.0
	RP-82	RP-182650	0569	-	F	Clarification on SRB3 release	15.4.0
	RP-82	RP-182650	0570	-	F	Avoiding security risk for RLC UM bearers during termination point change	15.4.0
	RP-82	RP-182660	0571	1	F	MO configuration with SSB SCS for a given SSB frequency	15.4.0
	RP-82	RP-182663	0572	1	F	Barring alleviation for emergency service	15.4.0
	RP-82	RP-182664	0575	1	F	Corrections for security configurations during setup of SRB1	15.4.0
	RP-82	RP-182660	0577	1	F	Clarification of UE behaviour when frequencyBandList is absent in SIB4	15.4.0
	RP-82	RP-182661	0578	2	F	Handling of missing fields in SIB1	15.4.0
	RP-82	RP-182659	0580	1	F	Correction to ControlResourceSetZero	15.4.0
	RP-82	RP-182667	0582	2	F	Full configuration for inter-RAT handover	15.4.0
	RP-82	RP-182664	0587	1	F	Corrections on number of RadiLinkMonitoringRS condifuration	15.4.0
	RP-82	RP-182659	0591	1	F	Clarification on phr-Type2OtherCell	15.4.0
	RP-82	RP-182667	0594	2	F	Addition of PCI in MeasTiming	15.4.0
	RP-82	RP-182667	0600	5	F	Clarifications to SIBs requiring request procedure	15.4.0
	RP-82	RP-182659	0601	1	F	Correction for support of initial downlink BWP	15.4.0
	RP-82	RP-182657	0602	1	F	Miscellaneous corrections related to idle mode SIBs	15.4.0
	RP-82	RP-182657	0603	1	F	Correction for missing fields in SIB2 and SIB4	15.4.0
	RP-82	RP-182657	0604	2	F	Correction to Q-QualMin value range	15.4.0
	RP-82	RP-182663	0616	1	F	Clarification of cell reselection during resume procedure	15.4.0
	RP-82	RP-182663	0617	1	F	Determination of Access Identities for RRC-triggered Access Attempts	15.4.0
	RP-82	RP-182663	0618	1	F	CR to 38.331 on stopping of timer T390 upon reception of RRCRelease	15.4.0
	RP-82	RP-182840	0620	3	F	CR on MN/SN coordination for report CGI procedure	15.4.0
	RP-82	RP-182666	0624	2	F	CR to 38.331 on aligning I-RNTI terminology in paging and SuspendConfig (Alt.2)	15.4.0
	RP-82	RP-182665	0627	2	F	CR to 38.331 on IRAT Cell reselection in RRC_INACTIVE	15.4.0
	RP-82	RP-182662	0638	1	F	CR for pendingRnaUpdate set	15.4.0
	RP-82	RP-182665	0640	2	F	Corrections on BWP ID	15.4.0
	RP-82	RP-182664	0643	1	F	Inter-frequency handover capability	15.4.0
	RP-82	RP-182659	0646	1	F	Search space configuration for DCI format 2_0 monitoring	15.4.0
	RP-82	RP-182739	0647	3	F	Correction on power headroom configuration exchange	15.4.0
	RP-82	RP-182665	0649	2	F	UE capability on PA architecture	15.4.0
	RP-82	RP-182662	0654	1	F	CR on pdsch-TimeDomainAllocationList and pusch-TimeDomainAllocationList	15.4.0
	RP-82	RP-182664	0655	1	F	Correction on the SSB based RACH configuration	15.4.0
	RP-82	RP-182659	0656	1	F	CR on starting bit of Format 2-3	15.4.0
	RP-82	RP-182663	0660	1	C	CR on wait timer in RRC release	15.4.0
	RP-82	RP-182662	0664	1	F	SCell release at RRC Reestablishment	15.4.0
	RP-82	RP-182663	0665	1	F	Clean up of SRB1 terminology	15.4.0
	RP-82	RP-182662	0670	1	F	Correction on the size of PUCCH resource ID	15.4.0
	RP-82	RP-182667	0673	3	F	CR to 38.331 on Integrity Check failure at RRC Reestablishment	15.4.0
	RP-82	RP-182661	0680	1	F	Correction on SI message acquisition timing	15.4.0
	RP-82	RP-182653	0682	-	F	Add t-ReselectionNR-SF in SIB2	15.4.0
	RP-82	RP-182654	0683	-	F	freqBandIndicatorNR correction in MultiFrequencyBandListNR-SIB	15.4.0
	RP-82	RP-182658	0684	2	F	Corrections to CellSelectionInfo in SIB1 and SIB4	15.4.0
	RP-82	RP-182654	0686	-	F	Correction on the field description of DRX timers	15.4.0

	RP-82	RP-182661	0687	1	F	Correction on DC subcarrier usage in SetupComplete message	15.4.0
	RP-82	RP-182665	0688	3	F	Various carrier frequency definiton corrections	15.4.0
	RP-82	RP-182661	0689	1	F	CR on signaling contiguous and non-contiguous EN-DC capability	15.4.0
	RP-82	RP-182654	0692	-	F	Update of the usage of QCL type-C	15.4.0
	RP-82	RP-182659	0694	1	F	Cleanup of references to L1 specifications	15.4.0
	RP-82	RP-182660	0695	1	F	Correction of MeasResultEUTRA	15.4.0
	RP-82	RP-182660	0696	1	F	Missing need code for reffreqCSI-RS	15.4.0
	RP-82	RP-182661	0697	2	F	Missing procedure text in RRC Reconfiguration	15.4.0
	RP-82	RP-182781	0700	3	F	Correction to UE capability procedures in 38.331	15.4.0
	RP-82	RP-182667	0701	1	F	Correction to aperiodicTriggeringOffset	15.4.0
	RP-82	RP-182664	0709	1	F	CR to 38.331 on including serving cell measurements	15.4.0
	RP-82	RP-182660	0711	1	F	CR to 38.331 on associatedSSB	15.4.0
	RP-82	RP-182662	0714	1	F	CR on 38.331 for RRCResumeRequest and RRCResumeRequest1 and protection of RRCResumeRequest1	15.4.0
	RP-82	RP-182667	0715	2	F	Correction for reporting of NR serving cell measurements when rsType is missing	15.4.0
	RP-82	RP-182656	0719	1	F	Clarification of the values for RangeToBestCell	15.4.0
	RP-82	RP-182668	0721	2	F	CR on handling of timer T380	15.4.0
	RP-82	RP-182662	0723	2	F	CR on supporting signalling only connection	15.4.0
	RP-82	RP-182838	0725	3	F	Signalling introduction of SRS switching capability	15.4.0
	RP-82	RP-182667	0729	3	B	CR on signalling introduction of UE overheating support in NR SA scenario	15.4.0
	RP-82	RP-182856	0730	4	F	CR on SRS antenna switching	15.4.0
	RP-82	RP-182660	0731	1	F	Correction to offsetToPointA	15.4.0
	RP-82	RP-182655	0732	-	F	Correction to cell selection parameters	15.4.0
	RP-82	RP-182665	0746	2	F	CR to 38.331 on stopping T302 and UE related actions	15.4.0
	RP-82	RP-182666	0750	2	F	Correction on indication for user plane resource release	15.4.0
	RP-82	RP-182662	0767	1	F	Correction on the terminology scg-ChangeFailure	15.4.0
	RP-82	RP-182661	0768	1	F	Correction on default configuration	15.4.0
	RP-82	RP-182660	0772	1	F	Clarification of measurement object for beam reporting for NR cells	15.4.0
	RP-82	RP-182667	0773	3	F	CR to 38.331 on UE AS Context definition – Include suspendConfig	15.4.0
	RP-82	RP-182661	0778	1	F	CR to 38.331 on HO support in Setup Procedure	15.4.0
	RP-82	RP-182656	0781	-	F	CR on description of k0	15.4.0
	RP-82	RP-182666	0783	2	F	CR to 38.331 on removing FFS of locationInfo	15.4.0
	RP-82	RP-182661	0787	-	F	Clarification on MIB Acquisition	15.4.0
	RP-82	RP-182662	0788	-	F	CR to 38331 on release after completion of inter-RAT HO	15.4.0
	RP-82	RP-182662	0789	-	F	CR to 38.331 on rbg-Size in PDSCH-Config, PUSCH-Config and ConfiguredGrantConfig	15.4.0
	RP-82	RP-182657	0790	-	F	Advanced processing time configuration for PDSCH and PUSCH	15.4.0
	RP-82	RP-182896	0791	2	F	UE specific channel bandwidth signaling	15.4.0

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	RP-83	RP-190541	0593	2	F	Removal of creation of MCG MAC entity	15.5.0
	RP-83	RP-190633	0792	1	F	Capability for aperiodic CSI-RS triggering with different numerology between PDCCH and CSI-RS	15.5.0
	RP-83	RP-190541	0796	2	F	Correction on Mapping between SSBs and PDCCH Monitoring Occasions in SI Window	15.5.0
	RP-83	RP-190541	0797	2	F	Correction to SI Reqeust Procedure	15.5.0
	RP-83	RP-190546	0798	2	F	CR to 38.331 on clarification of reportCGI	15.5.0
	RP-83	RP-190545	0799	2	F	Describing mandatory/optional information in inter-node RRC messages	15.5.0
	RP-83	RP-190541	0800	1	F	Search space configuration for cross carrier scheduling	15.5.0
	RP-83	RP-190542	0803	1	F	Clarification on FeatureSetCombinationId zero value	15.5.0
	RP-83	RP-190546	0805	2	F	Clarification on UE Capability Request Filtering	15.5.0
	RP-83	RP-190545	0807	3	F	Miscellaneous non-controversial corrections	15.5.0
	RP-83	RP-190541	0808	2	F	CR to 38.331 on MAC configuration	15.5.0
	RP-83	RP-190543	0810	2	F	Correction to SCG failiure	15.5.0
	RP-83	RP-190540	0811	1	F	Clarifying handling of parent and child IE need nodes	15.5.0
	RP-83	RP-190544	0812	2	F	Clarification to channel bandwidth signalling	15.5.0
	RP-83	RP-190541	0813	1	F	Clarifications to BWP configuration options	15.5.0
	RP-83	RP-190543	0822	2	F	Correction to EUTRA-MBSFN-SubframeConfig	15.5.0
	RP-83	RP-190545	0823	2	F	Clarification on dedicated serving cell configuration in Re-establishment	15.5.0
	RP-83	RP-190541	0828	2	F	Clarification on the BWP id configuration	15.5.0
	RP-83	RP-190541	0836	1	F	Upon entering a new PLMN which is in the list of EPLMNs in RRC INACTIVE state	15.5.0
	RP-83	RP-190546	0843	1	F	EUTRA UE capability filtering in NR UE capability enquiry	15.5.0
	RP-83	RP-190543	0847	2	F	Correction to SIB1 transmission during handover	15.5.0
	RP-83	RP-190545	0850	2	F	Clarification to monitoring occasion of PWS notification	15.5.0
	RP-83	RP-190541	0853	1	F	HandoverPreparationInformation for CU/DU	15.5.0
	RP-83	RP-190542	0855	1	F	CR to introduce simultaneousRxDataSSB-DiffNumerology for NR SA	15.5.0
	RP-83	RP-190550	0858	-	F	Condition on integrity protection for DRB	15.5.0
	RP-83	RP-190544	0860	2	F	Handling on UE Inactive AS context upon resume	15.5.0
	RP-83	RP-190542	0861	1	F	Miscellaneous Corrections for INACTIVE	15.5.0
	RP-83	RP-190542	0864	1	F	Correction on RRC processing delay	15.5.0
	RP-83	RP-190540	0865	-	F	Dummify the ue-BeamLockFunction IE	15.5.0
	RP-83	RP-190545	0866	2	F	Further update of Need codes	15.5.0
	RP-83	RP-190541	0867	1	F	Corrections to reestablishment procedure	15.5.0
	RP-83	RP-190545	0868	2	F	CR on use of positioning measurement gaps for subframe and slot timing detection towards E-UTRA	15.5.0
	RP-83	RP-190542	0876	2	F	Barring alleviation when T302 or T390 is stopped	15.5.0
	RP-83	RP-190544	0877	2	F	Correction on smtc configuration in NR SCell addition procedure	15.5.0
	RP-83	RP-190543	0884	2	F	Correction on the configuration for transform preceding of PUSCH	15.5.0
	RP-83	RP-190543	0896	2	F	Correction to Need Codes in system information	15.5.0
	RP-83	RP-190541	0897	1	F	Corrections on drb-ContinueROHC	15.5.0
	RP-83	RP-190541	0898	1	F	Correction on outOfOrderDelivery	15.5.0
	RP-83	RP-190542	0902	1	F	Corrections on radio link failure related actions	15.5.0
	RP-83	RP-190541	0904	1	F	Clarification for SIB validity	15.5.0
	RP-83	RP-190540	0905	-	F	Corrections to MFBI	15.5.0
	RP-83	RP-190542	0912	1	F	CR on clarification on the description of NIA0	15.5.0
	RP-83	RP-190542	0913	1	F	CR on the number of bits of downlink NAS COUNT value	15.5.0
	RP-83	RP-190541	0920	1	F	CR to 38.331 for not supporting different quantities for thresholds in Event A5 and B2	15.5.0
	RP-83	RP-190544	0922	2	F	CR on SSB type indication	15.5.0
	RP-83	RP-190545	0923	2	F	Correction for measurements of serving cells without SSB or without CSI-RS	15.5.0
	RP-83	RP-190540	0930	-	F	CR on introduction of UE assistance information in inter-node message	15.5.0
	RP-83	RP-190540	0931	-	F	CR on description of SRS carrier switching	15.5.0
	RP-83	RP-190542	0932	1	F	Clarification on the relation between CA configuration and supported featureset combination_Option1	15.5.0
	RP-83	RP-190545	0935	2	F	Unification of EN-DC terminology	15.5.0
	RP-83	RP-190550	0938	-	F	PDCP re-establishment during SRB modification for EUTRA/5GC	15.5.0
	RP-83	RP-190541	0939	1	F	The support of drb-ContinueROHC	15.5.0
	RP-83	RP-190541	0948	1	F	Correction on PTRS port index	15.5.0
	RP-83	RP-190541	0956	1	F	CR on the supplementaryUplink and uplinkConfig	15.5.0
	RP-83	RP-190545	0963	2	F	Correction on MIB acquisition upon Reconfiguration with Sync	15.5.0
	RP-83	RP-190543	0967	2	F	Qoffset for inter-RAT cell reselection	15.5.0
	RP-83	RP-190541	0975	1	F	Correction on SI scheduling	15.5.0
	RP-83	RP-190543	0976	2	F	Correction of uac-AccessCategory1-SelectionAssistanceInfo field description	15.5.0
	RP-83	RP-190546	0978	3	F	Correction on going to RRC_IDLE upon inter-RAT cell reselection in RRC_INACTIVE	15.5.0
	RP-83	RP-190543	0981	2	F	Clarification on nrofSS-BlocksToAverage and absThreshSS-BlocksConsolidation	15.5.0
	RP-83	RP-190543	0984	3	F	Correction on compilation of featureSets for NR container	15.5.0
	RP-83	RP-190540	0985	-	F	Enable and disable of security at DRB setup	15.5.0

	RP-83	RP-190545	0986	2	F	Clarification on TCI state ID	15.5.0
	RP-83	RP-190544	0987	-	F	Clarification for random access on SUL	15.5.0
	RP-83	RP-190545	0988	1	F	Correction on supportedBandwidthCombinationSetEUTRA-v1530 usage	15.5.0
	RP-83	RP-190544	0989	-	F	CR on Processing delay requirements for RRC Resume procedures in TS 38.331	15.5.0
04/2019	RP-83					MCC: Formatting error correction (missing carriage return) in the end of clause 5.3.5.11.	15.5.1
06/2019	RP-84	RP-191379	0906	5	F	Reconfig with sync terminology	15.6.0
	RP-84	RP-191378	0916	5	B	Introduction of late drop NGEN-DC, NE-DC and NR-DC	15.6.0
	RP-84	RP-191374	0996	2	F	Correction to the need code of some fields in SIB2	15.6.0
	RP-84	RP-191377	1003	3	F	Clarification for handling of suspendConfig	15.6.0
	RP-84	RP-191377	1005	3	F	Reporting of serving cell and best neighbour cell and sorting of beam	15.6.0
	RP-84	RP-191377	1011	1	F	On T321 timer related informative text correction	15.6.0
	RP-84	RP-191377	1013	1	C	CR to direct current report for UL and SUL	15.6.0
	RP-84	RP-191380	1014	1	F	Correction on storing UE AS Inactive Context	15.6.0
	RP-84	RP-191373	1015	-	F	Correction on ReconfigurationWithSync	15.6.0
	RP-84	RP-191380	1016	2	F	Correction on Handover from NR to EUTRAN	15.6.0
	RP-84	RP-191373	1018	-	F	Introduction of additional UE capability on HARQ-ACK multiplexing on PUSCH	15.6.0
	RP-84	RP-191378	1019	1	F	Correction on bar indication of emergency service (access category 2)	15.6.0
	RP-84	RP-191373	1020	-	F	Correction on UE configuration for RRC Resume procedure	15.6.0
	RP-84	RP-191373	1021	-	F	RRC release with suspend configuration and inter-RAT redirection	15.6.0
	RP-84	RP-191373	1022	-	F	RRC Reconfiguration via SRB3 in EN-DC	15.6.0
	RP-84	RP-191373	1023	-	F	Corrections on RLC bearer setup	15.6.0
	RP-84	RP-191373	1024	-	F	Clarification to Permitted MaxCID for ROHC and Uplink-Only ROHC	15.6.0
	RP-84	RP-191373	1025	-	F	Coordination of ROHC capability for MR-DC	15.6.0
	RP-84	RP-191373	1026	-	F	Correction on the rlmInSyncOutOfSyncThreshold	15.6.0
	RP-84	RP-191373	1027	-	F	Correction on description of tci-PresentInDCI	15.6.0
	RP-84	RP-191374	1031	-	F	RRC processing delay for UE capability transfer	15.6.0
	RP-84	RP-191377	1032	1	F	Handling of SMTC configuration	15.6.0
	RP-84	RP-191378	1033	1	F	Clarification on filters used to generate FeatureSets (38.331)	15.6.0
	RP-84	RP-191374	1034	-	F	Correction of behavior for eutra-nr-only	15.6.0
	RP-84	RP-191377	1038	1	F	Clarification on CSI-RS resource configuration in MO	15.6.0
	RP-84	RP-191378	1039	2	F	Update on usage of Need codes	15.6.0
	RP-84	RP-191377	1040	1	F	Ignore additional fields in RRC Release message before security activation	15.6.0
	RP-84	RP-191374	1041	-	F	Correction on use of Null algorithm for DRBs during emergency calls in LSM	15.6.0
	RP-84	RP-191380	1042	2	F	NR changes for FullConfig for Inter-RAT intra-system HO	15.6.0
	RP-84	RP-191376	1043	2	F	Monitoring of short messages with multi-beams	15.6.0
	RP-84	RP-191377	1045	1	F	Clarification of commonControlResourceSet frequency reference point	15.6.0
	RP-84	RP-191379	1046	2	F	CR on capability of maxUplinkDutyCycle for FR2	15.6.0
	RP-84	RP-191374	1049	-	F	CR to subcarrierSpacing in RateMatchPattern and SCS-SpecificCarrier	15.6.0
	RP-84	RP-191377	1053	1	F	CR on transferring common configuration during handover and SN change	15.6.0
	RP-84	RP-191381	1054	2	F	Correction to barring alleviation	15.6.0
	RP-84	RP-191381	1055	3	F	UE behaviour on the cell without TAC	15.6.0
	RP-84	RP-191379	1058	2	F	Correction to RRC resume	15.6.0
	RP-84	RP-191376	1061	1	F	Corrections to inter-node messages	15.6.0
	RP-84	RP-191378	1063	1	F	Clarification on mandatory information in inter node RRC messages	15.6.0
	RP-84	RP-191374	1066	-	F	Correction to PWS reception	15.6.0
	RP-84	RP-191377	1068	1	F	Serving cell measurement handling with different rsType configuration scenarios	15.6.0
	RP-84	RP-191374	1069	-	F	On CGI reporting contents	15.6.0
	RP-84	RP-191374	1071	-	F	CR for 38.331 on security related corrections to UE and Network initiated RRC procedures to increase user's security and privacy	15.6.0
	RP-84	RP-191379	1072	3	F	Correction on the issue with NCP and ECP for RateMatchPattern	15.6.0
	RP-84	RP-191377	1075	1	F	Security protection of RRC messages	15.6.0
	RP-84	RP-191381	1076	1	F	Introduction of a new NR band for LTE/NR spectrum sharing in Band 41/n41	15.6.0
	RP-84	RP-191375	1077	-	F	Stop of T302 and T390 at reception of RRCRelease with waitTime	15.6.0
	RP-84	RP-191375	1078	-	F	Restriction of piggybacking of NAS PDUs	15.6.0
	RP-84	RP-191379	1079	3	F	Correction on intra-band fallback behavior with FeatureSetsPerCC	15.6.0
	RP-84	RP-191375	1081	-	F	Removal of spurious requirement on consistency of feature set combination IDs	15.6.0
	RP-84	RP-191381	1082	3	F	Miscellaneous non-controversial corrections Set II	15.6.0
	RP-84	RP-191377	1083	1	F	Correction to configuration of security in RadioBearerConfig	15.6.0
	RP-84	RP-191379	1086	2	F	CR to 38.331 on MeasurementTimingConfiguration	15.6.0
	RP-84	RP-191375	1088	-	F	Correction to the description of subcarrierspacing usage in ServingCellConfigCommon	15.6.0
	RP-84	RP-191375	1089	-	F	38.331 Clarification on multiple TA capabilities	15.6.0
	RP-84	RP-191375	1091	-	F	Set beamCorrespondenceCA dummy	15.6.0
	RP-84	RP-191377	1092	1	F	Correction on Measurement Report Triggering for Periodical Report	15.6.0
	RP-84	RP-191375	1094	-	F	Correction on PDCP duplication configuration	15.6.0
	RP-84	RP-191375	1095	-	F	Correction on BWP configuration	15.6.0

	RP-84	RP-191377	1097	1	F	Correction on configuration of pucch-ResourceCommon	15.6.0
	RP-84	RP-191376	1098	1	F	Clarification of PUCCH reconfiguration on NR UL and SUL	15.6.0
	RP-84	RP-191375	1100	1	F	Correction on initial BWP configuration in DownlinkConfigCommon and UplinkConfigCommon	15.6.0
	RP-84	RP-191377	1101	1	F	Correction on PUCCH cell	15.6.0
	RP-84	RP-191377	1103	1	F	Correction on the pdcp-Config	15.6.0
	RP-84	RP-191379	1104	2	F	Correction on pathlossReferenceLinking	15.6.0
	RP-84	RP-191381	1106	2	F	Clarification of dedicated priority handling from RRC_INACTIVE to RRC_IDLE	15.6.0
	RP-84	RP-191375	1110	-	F	Clarification on sending condition for mcg-RB-Config	15.6.0
	RP-84	RP-191375	1111	-	F	Clarification of timing reference for CSI-RS resources	15.6.0
	RP-84	RP-191376	1113	-	F	Setting of resumeCause for NAS triggered event	15.6.0
	RP-84	RP-191376	1114	-	F	UE capability signalling for FD-MIMO processing capabilities for EN-DC	15.6.0
	RP-84	RP-191376	1115	-	F	Modified UE capability on different numerologies within the same PUCCH group	15.6.0
	RP-84	RP-191478	1116	2	F	Clarification to commonSearchSpaceList in PDCCH-ConfigCommon	15.6.0
	RP-84	RP-191589	1117	1	F	Removal of "Capability for aperiodic CSI-RS triggering with different numerology between PDCCH and CSI-RS"	15.6.0
09/2019	RP-85	RP-192196	1120	1	C	Additional capability signalling for 1024QAM support	15.7.0
	RP-85	RP-192191	1121	1	F	Correction on TDD-UL-DL-Config	15.7.0
	RP-85	RP-192191	1122	1	F	Correction of the secondHopPRB Parameter	15.7.0
	RP-85	RP-192190	1123	-	F	RSRP reporting of SFTD measurement in NR-DC	15.7.0
	RP-85	RP-192191	1124	1	F	Small Corrections for System Information	15.7.0
	RP-85	RP-192194	1125	-	F	Corrections for Inter-node Messages	15.7.0
	RP-85	RP-192191	1126	1	F	Clarification of Layer 3 Filtering for E-UTRA	15.7.0
	RP-85	RP-192190	1127	-	F	Clarification on FailureInformation report for NE-DC	15.7.0
	RP-85	RP-192191	1136	1	F	Clarification to fullConfig in NR	15.7.0
	RP-85	RP-192190	1137	-	F	Updates for positioning measurement gaps for subframe and slot timing detection towards E-UTRA	15.7.0
	RP-85	RP-192191	1138	1	F	Clarification for enabling of configured PUSCH frequency hopping	15.7.0
	RP-85	RP-192191	1139	1	B	Introduction of SFTD measurement to neighbour cells for NR SA	15.7.0
	RP-85	RP-192192	1144	1	F	Corrections to 38.331 on SI-schedulingInfo	15.7.0
	RP-85	RP-192193	1148	2	F	Clarification on SRB2 and DRB configuration	15.7.0
	RP-85	RP-192191	1151	2	F	PDU session release indication to upper layers during Full Configuration	15.7.0
	RP-85	RP-192191	1160	1	F	Clarification on max payload of PUCCH-ResourceSet	15.7.0
	RP-85	RP-192191	1161	1	F	Clarification on PUSCH configuration	15.7.0
	RP-85	RP-192192	1167	1	F	Correction of condition HO-toNR and HO-Conn	15.7.0
	RP-85	RP-192192	1172	1	F	Clarifying UE capability freqHoppingPUCCH-F0-2 and freqHoppingPUCCH-F1-3-4	15.7.0
	RP-85	RP-192190	1173	1	F	Clarification on selectedBandCombination	15.7.0
	RP-85	RP-192193	1174	2	F	Clarifying handling of information elements on the F1 interface	15.7.0
	RP-85	RP-192192	1178	1	F	Correction of field descriptions in UE-CapabilityRequestFilterCommon (38.331)	15.7.0
	RP-85	RP-192190	1179	-	F	Clarification of ca-ParametersNR-forDC (38.331)	15.7.0
	RP-85	RP-192193	1183	2	F	Correction on reestablishRLC	15.7.0
	RP-85	RP-192191	1185	1	F	Correction on SFTD measurement configuration	15.7.0
	RP-85	RP-192193	1191	2	F	Handling of embedded RRC message in RRCReconfiguration procedure	15.7.0
	RP-85	RP-192192	1201	2	F	Clarification on definition of PUSCH-Less SCell	15.7.0
	RP-85	RP-192190	1204	-	F	Correction on non-critical extension for NRDC-Parameters	15.7.0
	RP-85	RP-192191	1208	1	F	Correction on UE actions upon going to RRC_IDLE	15.7.0
	RP-85	RP-192192	1211	1	F	Correction on the acquisition of MIB and SIB1 for re-establishment	15.7.0
	RP-85	RP-192192	1212	1	F	Correction on band selection in SIB1	15.7.0
	RP-85	RP-192193	1213	2	F	Correction on the actions upon reception of SIB2 and SIB4	15.7.0
	RP-85	RP-192193	1219	3	F	Miscellaneous non-controversial corrections Set III	15.7.0
	RP-85	RP-192194	1220	3	F	Channel Bandwidth validation upon SIB1 acquisition	15.7.0
	RP-85	RP-192193	1224	1	F	Correction of presence conditions for common PSCell parameters	15.7.0
	RP-85	RP-192190	1226	-	F	Release of unnecessary power restrictions upon RRC connection re-establishment in NE-DC and NR-DC	15.7.0
	RP-85	RP-192193	1232	2	F	Correction of field inclusion for inter-node message	15.7.0
	RP-85	RP-192192	1234	1	F	SFTD measurement information in CG-ConfigInfo	15.7.0
	RP-85	RP-192192	1235	1	F	Correction for UE context retrieval	15.7.0
	RP-85	RP-192190	1236	-	F	Correction on CGI measurements	15.7.0
	RP-85	RP-192191	1237	1	F	Corrections to SIB8 for CMAS geo-fencing	15.7.0
	RP-85	RP-192194	1242	3	F	Corrections on the condition of RBTermChange	15.7.0
	RP-85	RP-192192	1243	1	F	CR on clarification of aggregated bandwidth for overheating	15.7.0
	RP-85	RP-192190	1244	-	F	Clarification on the selectedBandEntriesMN - Understanding 1	15.7.0
	RP-85	RP-192194	1253	1	F	Correction on RRC connection release indication after handover	15.7.0
	RP-85	RP-192193	1254	2	F	Corrections on SIB1 configuration	15.7.0
	RP-85	RP-192191	1256	1	F	Correction on inter-RAT cell re-selection when UE is in RRC_IDLE	15.7.0
	RP-85	RP-192193	1257	2	F	maxMIMO-Layers for the normal uplink and the supplementary uplink_Option 1	15.7.0

	RP-85	RP-192193	1261	1	F	Correction on overheating indication	15.7.0
	RP-85	RP-192192	1262	-	F	Handling lists other than AddMod	15.7.0
	RP-85	RP-192193	1263	1	F	Releasing source cell ConfigCommon fields not present in target cell	15.7.0
	RP-85	RP-192347	1265	-	C	Introduction of UE capability for NR-DC with SFN synchronization between PCell and PSCell	15.7.0
12/2019	RP-86	RP-192934	1147	2	C	Security requirement for UE capability enquiry for NR	15.8.0
	RP-86	RP-192934	1267	1	F	Corrections on CG-Config	15.8.0
	RP-86	RP-192934	1273	1	F	CR to introduce timer for DRX based SFTD measurement	15.8.0
	RP-86	RP-192934	1274	1	F	Correction on absence of gapPurpose	15.8.0
	RP-86	RP-192934	1278	1	F	Correction on field description of cellReselectionInfoCommon	15.8.0
	RP-86	RP-192935	1283	2	F	Clarifying the alignment of capability filtering across LTE and NR in MR-DC	15.8.0
	RP-86	RP-192934	1292	1	F	Correction for P-Max in FR2	15.8.0
	RP-86	RP-192934	1296	2	F	Correction on frequency indication in SIB1 and SIB2	15.8.0
	RP-86	RP-192937	1300	2	F	Handling of AS-Config in HandoverPreparationInformation	15.8.0
	RP-86	RP-192936	1301	2	F	Corrections on scg-RB-Config in CG-Config	15.8.0
	RP-86	RP-192937	1305	2	F	Correction on MCG measurements in SCGFailureInformation	15.8.0
	RP-86	RP-192937	1308	3	F	Correction of SRB3 handling at full configuration (Alt2)	15.8.0
	RP-86	RP-192936	1309	2	F	Correction to integrity protection in DRB addition and modification	15.8.0
	RP-86	RP-192938	1323	3	F	Miscellaneous non-controversial corrections Set IV	15.8.0
	RP-86	RP-192935	1325	2	F	Presence and absence of TAC in NR cell	15.8.0
	RP-86	RP-192935	1332	4	F	Security Algorithms for Radio Bearers	15.8.0
	RP-86	RP-192934	1333	1	F	Correction on the Msg3 based on demand system information	15.8.0
	RP-86	RP-192935	1335	2	F	Clarification for aggregated bandwidth for overheating	15.8.0
	RP-86	RP-192935	1337	1	F	Clarification on the feature set report in EUTRAN	15.8.0
	RP-86	RP-192934	1341	1	F	CR to 38.331 on CGI information	15.8.0
	RP-86	RP-192936	1357	1	F	Restoring SDAP and RoHC contexts during Resumption	15.8.0
	RP-86	RP-192934	1358	-	F	Conditional presence on ue-CapabilityInfo and servCellIndexRangeSCG for inter-MN handover without SN change	15.8.0
	RP-86	RP-192934	1362	-	F	Configuration limitation for RRCRelease message in R15	15.8.0
	RP-86	RP-192937	1368	1	F	Correction to AS security key update	15.8.0
	RP-86	RP-192936	1369	1	F	Correction on the condition of RBTermChange	15.8.0
	RP-86	RP-192936	1375	1	F	Correction on the configuration of split SRB	15.8.0
	RP-86	RP-192934	1378	-	F	Correction on camping conditions	15.8.0
	RP-86	RP-192937	1379	1	F	Correction on CORESET location	15.8.0
	RP-86	RP-192938	1381	2	F	Correction to key derivation for the UE configured with sk-counter	15.8.0
	RP-86	RP-192936	1383	1	F	Correction on the pre-condition for reconfiguration with sync of SCG	15.8.0
	RP-86	RP-192935	1385	-	F	Correction on AS-Config	15.8.0
	RP-86	RP-192935	1387	-	F	Correction on measurement reporting in NR-DC	15.8.0
	RP-86	RP-192936	1389	1	F	Correction on SIB1 description	15.8.0
	RP-86	RP-192937	1402	1	F	Correction to Feature Set Combination and Band combination list for NR-DC (38.331)	15.8.0
	RP-86	RP-192937	1403	2	F	Security requirements for split PDU session (38.331)	15.8.0
	RP-86	RP-192938	1405	2	F	Correction of UE assistance information	15.8.0
	RP-86	RP-192936	1406	1	F	Clarification regarding inter-node transfer of UE capability containers	15.8.0
	RP-86	RP-192749	1421	1	F	NE-DC dynamic power sharing capability	15.8.0
03/2020	RP-87	RP-200335	1272	3	F	Corrections on maxMeasIdentitiesSCG-NR in MR-DC	15.9.0
	RP-87	RP-200334	1409	2	F	CR on BWCS for inter-ENDC BC with intra-ENDC BC (38.331)	15.9.0
	RP-87	RP-200334	1410	4	F	CR to 38.331 on support of 70MHz channel bandwidth	15.9.0
	RP-87	RP-200335	1440	2	F	Clarification on the PLMN-IdentityInfoList	15.9.0
	RP-87	RP-200334	1444	1	F	Correction on removal of NR-DC and NE-DC band combinations when capabilityRequestFilterCommon is absent	15.9.0
	RP-87	RP-200334	1450	1	F	Correction on reporting of uplink TX direct current	15.9.0
	RP-87	RP-200334	1454	1	F	Corrections to the Location measurement indication procedure	15.9.0
	RP-87	RP-200334	1455	-	F	Introduction of provisions for late non-critical extensions	15.9.0
	RP-87	RP-200334	1460	1	F	Correction on p-maxNR-FR1 for NE-DC	15.9.0
	RP-87	RP-200334	1461	-	F	Correction on SFTD frequency list in INM	15.9.0
	RP-87	RP-200335	1472	2	F	Miscellaneous non-controversial corrections Set V	15.9.0
	RP-87	RP-200335	1475	1	F	Capability coordination for NE-DC	15.9.0
	RP-87	RP-200335	1483	2	F	CR on fallback BC reporting	15.9.0
	RP-87	RP-200334	1484	1	F	CR on overheating assistance reporting in handover case	15.9.0
	RP-87	RP-200334	1496	1	F	Correction on NZP-CSI-RS-ResourceSet	15.9.0
	RP-87	RP-200335	1501	1	F	UE capability of intra-band requirements for inter-band EN-DC/NE-DC	15.9.0
03/2020	RP-87	RP-200335	1141	2	F	Correction on usage of access category 2 for UAC for RNA update	16.0.0
	RP-87	RP-200358	1149	2	F	NAS handling error of nas-Container for security key derivation	16.0.0
	RP-87	RP-200356	1152	3	F	CR on capability of maxUplinkDutyCycle for inter-band EN-DC PC2 UE	16.0.0
	RP-87	RP-200357	1168	3	F	Support of releasing UL configuration	16.0.0
	RP-87	RP-200357	1218	3	B	Introduction of a second SMTC per frequency carrier in idle/inactive	16.0.0
	RP-87	RP-200358	1312	3	C	Introduction of voice fallback indication	16.0.0
	RP-87	RP-200358	1354	2	C	CR to 38.331 on CSI-RS inter-node message	16.0.0
	RP-87	RP-200335	1361	1	B	PRACH prioritization parameters for MPS and MCS	16.0.0
	RP-87	RP-200358	1433	2	B	Introduction of downgraded configuration for SRS antenna switching	16.0.0

	RP-87	RP-200355	1434	2	B	Introducing autonomous gap in CGI reporting	16.0.0
	RP-87	RP-200351	1441	1	B	Introduction of UECapabilityInformation segmentation in TS38.331	16.0.0
	RP-87	RP-200358	1443	1	B	Introduction of NR IDC solution	16.0.0
	RP-87	RP-200350	1446	1	B	Introduction of SRVCC from 5G to 3G	16.0.0
	RP-87	RP-200341	1462	2	B	Introduction of on-demand SI procedure in RRC_CONNECTED	16.0.0
	RP-87	RP-200358	1465	1	B	Introduction of DL RRC segmentation	16.0.0
	RP-87	RP-200353	1468	1	B	Introducing the support of Non-Public Networks	16.0.0
	RP-87	RP-200344	1469	3	B	CR for 38.331 for Power Savings	16.0.0
	RP-87	RP-200349	1471	4	B	38.331 CR on Integrated Access and Backhaul for NR	16.0.0
	RP-87	RP-200348	1476	3	B	CR for 38.331 for CA&DC enh	16.0.0
	RP-87	RP-200341	1477	2	B	Introduction of NR operation with Shared Spectrum Access in RRC	16.0.0
	RP-87	RP-200347	1478	2	B	Introduction of NR mobility enhancement	16.0.0
	RP-87	RP-200335	1486	-	B	Introduction of additional RACH configurations for TDD FR1	16.0.0
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## History

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