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Content

Foreword

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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].

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; Subsriber and equipment trace; Trace control and confiuration 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".

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 id: 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 compromising 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-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
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
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.

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.

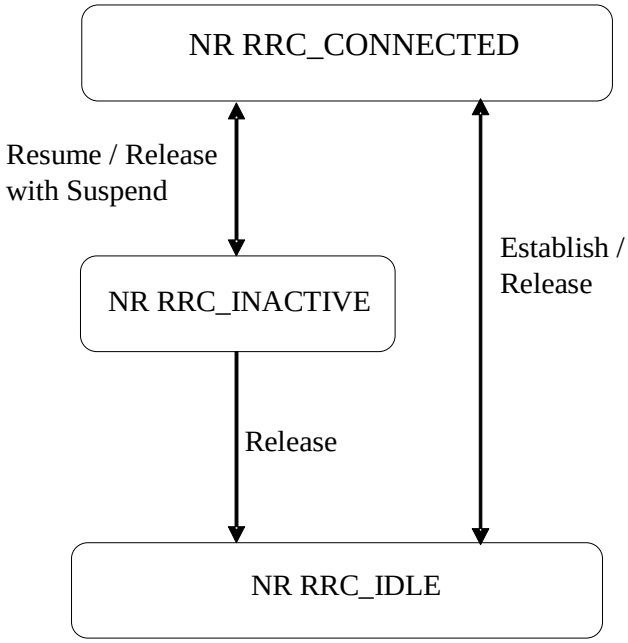

Figure 4.2.1-1: UE state machine and state transitions in NR

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.

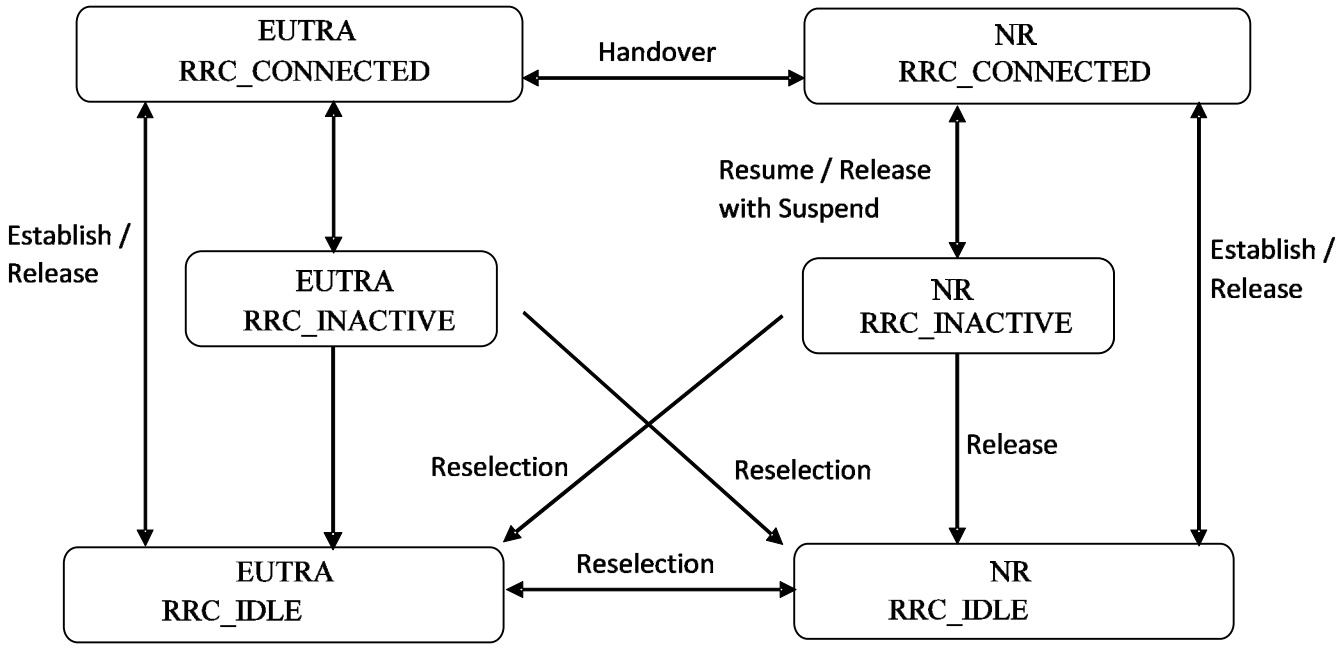

Figure 4.2.1-2: UE state machine and state transitions between NR/5GC, E-UTRA/EPC and E-UTRA/5GC

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].

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 subclause 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 s*ystemInformationAreaID*;

- 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

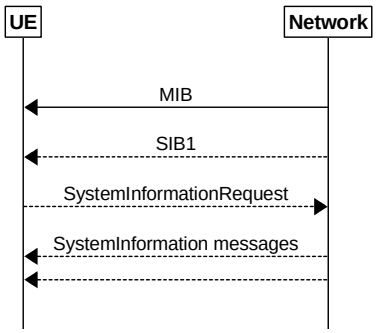

Figure 5.2.2.1-1: System information acquisition

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) and *SIB11* (if the UE is configured for idle/inactive measurements).

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, see TS 23.501 [32]) 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 v*alueTag* 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 v*alueTag* 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 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 $[x \times N+K]^{th}$ PDCCH monitoring occasion (s) for SI message in SI-window corresponds to the K^{th} transmitted SSB, where x = 0, 1, ...X-1, K = 1, 2, …N, N is the number of actual transmitted SSBs determined according to *ssb-PositionsInBurst* in *SIB1* and X is equal to CEIL(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 SFN mod $T = \text{FLOOR}(x/N)$, 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 concatented 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 SFN mod $T = \text{FLOOR}(x/N)$, 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 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 SFN mod $T = \text{FLOOR}(x/N)$, 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 SIB(s)

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> if the procedure is triggered to request the required posSIB(s):

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 Request for on demand system information 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*;

3> 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> 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*, *pdcch-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> forward the received *posSIB-MappingInfo* to upper layers, if included;

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 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 *NPN-IdentityInfo* 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> apply the configuration included in the *servingCellConfigCommon*;

2> 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:

3> use the stored version of the required SIB;

2> else if the UE has an active BWP configured with common search space configured 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:

3> 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*:

4> acquire the SI message(s) corresponding to the requested SIB(s) as defined in sub-clause 5.2.2.3.5;

3> 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*:

4> trigger a request to acquire the required SIB(s) as defined in sub-clause 5.2.2.3.5;

3> for the SI message(s) that, according to the *posSI-SchedulingInfo*, contain at least one requsted posSIB and for which *posSI-BroadcastStatus* is set to *broadcasting*:

4> acquire the SI message(s) corresponding to the requested posSIB(s) as defined in sub-clause 5.2.2.3.5;

3> for the SI message(s) that, according to the *posSI-SchedulingInfo*, contain at least one requsted posSIB and for which *posSI-BroadcastStatus* is set to *notBroadcasting*:

4> trigger a request to acquire the requested posSIB(s) as defined in sub-clause 5.2.2.3.5;

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

2> else if the UE has an active BWP not configured with common search space configured 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:

3> trigger a request to acquire the required SIB(s) as defined in sub-clause 5.2.2.3.5;

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 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 supplementary uplink; and

4> if the UE supports at least one *additionalSpectrumEmission* in the *NR-NS-PmaxList* for a supported supplementary uplink band; and

4> if the UE supports an uplink channel bandwidth with a maximum transmission bandwith 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 supplementary uplink as configured in the serving cell;

5> select the first frequency band in the *frequencyBandList* of supplementary uplink 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 supplementary uplink channel bandwidth with a maximum transmission bandwidth which
- is contained withn 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-PmaxListSUL*:

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 inlcuded 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 s*erialNumber*, or of both *messageIdentifier* and s*erialNumber* 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 r*eferenceTimeInfo*, 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.

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_{RRCint}), one for the ciphering of RRC signalling (K_{RRCenc}), one for integrity protection of user data (K_{UPint}) and one for the ciphering of user data (K_{UPenc}). All four AS keys are derived from the K_{gNB} key. The K_{gNB} key is based on the K_{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_{gNB}, K_{RRCint}, K_{RRCenc}, K_{UPint} and K_{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_{gNB}) or the secondary key (S-K_{eNB} or S-K_{gNB}) for a particular DRB. The secondary key is derived from the master key and *sk-Counter*, as defined in 33.501[86]. Whenever there is a need to refresh the secondary key, e.g. upon change of MN with K_{gNB} change or to avoid COUNT wrap around, 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-K_{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

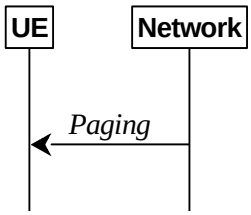

Figure 5.3.2.1-1: Paging

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

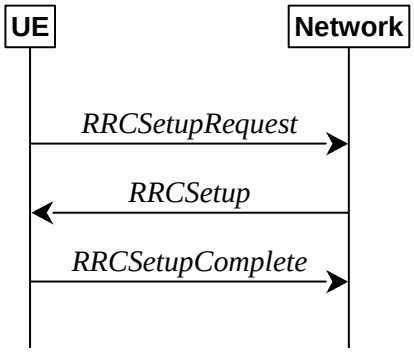

Figure 5.3.3.1-1: RRC connection establishment, successful

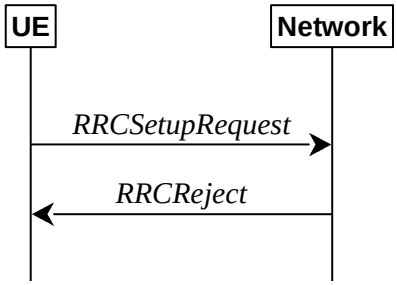

Figure 5.3.3.1-2: RRC connection establishment, network reject

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 5.7.8.4;

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 *npn-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 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 informaton 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, 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 re-selection, to include neighbouring cell measurements for at most the following number of neighbouring cells: 6 intra-frequency and 3 inter-frequency neighbours per frequency as well as 3 inter-RAT neighbours, per frequency/ set of frequencies 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 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 VarConnEsFailReport, 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

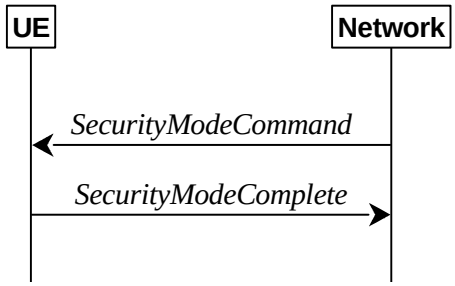

Figure 5.3.4.1-1: Security mode command, successful

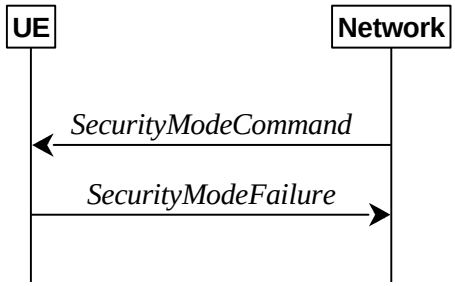

Figure 5.3.4.1-2: Security mode command, failure

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} keyafter 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

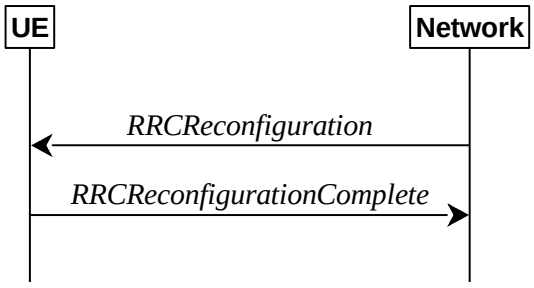

Figure 5.3.5.1-1: RRC reconfiguration, successful

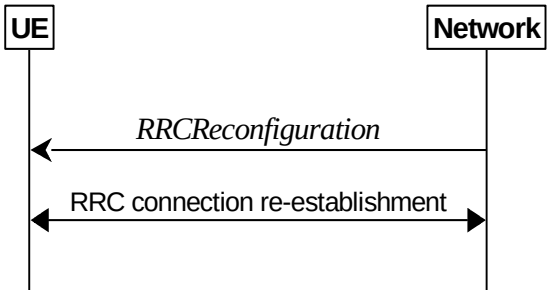

Figure 5.3.5.1-2: RRC reconfiguration, failure

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 and the integrity protection 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 and the integrity protection 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_{gNB} or SRB3, and to reconfigure SDAP for DRBs associated with S-K_{gNB} 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_{RRCenc} 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;

1> if the *RRCReconfiguration* message includes the *sl-ConfigDedicatedEUTRA*:

2> if *sl-V2X-ConfigDedicated* is included in *sl-ConfigDedicatedEUTRA*

3> perform the V2X sidelink communication dedicated configuration procedure as specified in 5.3.10.15a in TS 36.331 [10];

2> if *sl-V2X-SPS-Config* is included in *sl-ConfigDedicatedEUTRA*

3> perform V2X sidelink SPS reconfiguration as specified in 5.3.10.5 in TS 36.331 [10];

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 *RRCConnectionReconfiguration*:

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 informantion 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 SRB3 within *DLInformationTransferMRDC*;

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 *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 *cho-TriggerConfig*:

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 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;

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.

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;

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 s*pCellConfigCommon*;

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 *SCellsToAddModList* 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 s*pCellConfigCommon*;

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*g* 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*, in an *RRCResume* message or 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 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 (KRRCenc and KRRCint) associated with the master key (KgNB);

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_{RRCenc} 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_{RRCint} 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_{RRCenc} 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_{RRCint} 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_{RRCenc} 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 *pdcp-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> 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 KgNB 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.

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 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 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 [47];

2> configure the BAP entity to use the *bap-Address* as this node's BAP address;

2> if defaultUL-BAProutingID 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 [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 IP address.

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 IPaddress indicated in *iab-IP-Address*, corresponding to the *iab-IP-AddressIndex*.

2> if added IP address is *iPv4-Address*:

3> if *f1-C* is included in *iab-IP-Usage 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 *f1-U* is included in *iab-IP-Usage*:

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 *non-F1* is included in *iab-IP-Usage*:

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 *f1-C* is included in *iab-IP-Usage*:

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 *f1-U* is included in *iab-IP-Usage*:

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 *non-F1* is included in *iab-IP-Usage*:

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 *f1-C* is included in *iab-IP-Usage*:

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 *f1-U* is included in *iab-IP-Usage*:

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 *non-F1* is included in *iab-IP-Usage*:

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 prefixs 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 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 *condReconfigAddModList*:

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 cond*ReconfigId* 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> else:

3> keep the stored *condExecutionCond* as the target candidate configuration for this *condReconfigId*;

2> if the entry in *condReconfigToAddModList* includes an *condRRCReconfig*;

2> replace the entry with the value received for this *condReconfigId*;

2> if the entry in *condReconfigToAddModList* does not include an *condRRCReconfig*;

3> keep the stored *condRRCReconfig* as the target candidate configuration 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 rconfiguration execution, as specified in 5.3.5.13.5;

NOTE: Up to 2 *MeasId* can be configured for each *condReconfigId.* The conditional handover 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

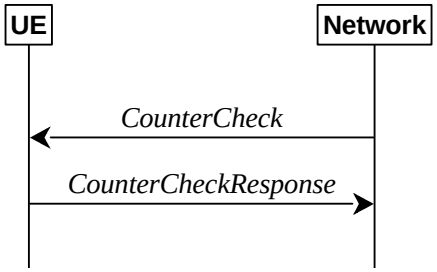

Figure 5.3.6.1-1: Counter check procedure

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

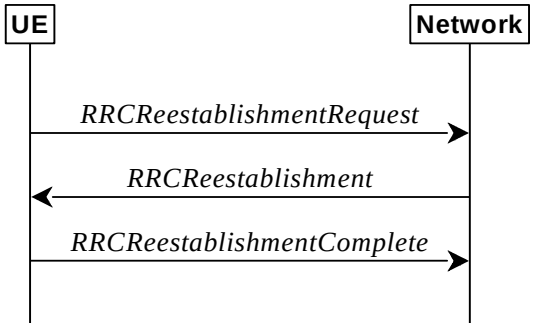

Figure 5.3.7.1-1: RRC connection re-establishment, successful

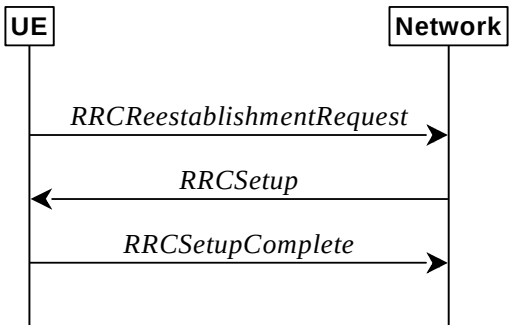

Figure 5.3.7.1-2: RRC re-establishment, fallback to RRC establishment, successful

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> reset MAC;

1> if UE is not configured with *conditionalReconfiguration*:

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;

2> release *overheatingAssistanceConfig*, if configured;

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;

2> release *maxBW-PreferenceConfig* for the MCG, if configured;

2> release *maxCC-PreferenceConfig* for the MCG, if configured;

2> release *maxMIMO-LayerPreferenceConfig* for the MCG, if configured;

2> release *minSchedulingOffsetPreferenceConfig* for the MCG, if configured;

2> release *releasePreferenceConfig*, if configured;

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> stop timer T342, if running;

1> stop timer T345, if running;

1> stop timer T346a associated with the MCG, if running;

1> stop timer T346b associated with the MCG, if running;

1> stop timer T346c associated with the MCG, if running;

1> stop timer T346d associated with the MCG, if running;

1> stop timer T346e associated with the MCG, if running;

1> stop timer T346f, if running;

1> stop timer T350, if running;

1> release *onDemandSIB-Request* if configured, and stop timer T350, if running;

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 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> release *spCellConfig*, if configured;

3> release the MCG SCell(s), if configured;

3> release *delayBudgetReportingConfig*, if configured;

3> release *overheatingAssistanceConfig* , if configured;

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 *drx-PreferenceConfig*, if configured;

3> release *maxBW-PreferenceConfig*, if configured;

3> release *maxCC-PreferenceConfig*, if configured;

3> release *maxMIMO-LayerPreferenceConfig*, if configured;

3> release *minSchedulingOffsetPreferenceConfig*, if configured;

3> release *releasePreferenceConfig*, if configured;

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_{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_{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} and K_{UPenc} keys associated with the previously configured *cipheringAlgorithm*, as specified in TS 33.501 [11];

1> derive the K_{RRCint} and K_{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_{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_{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_{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

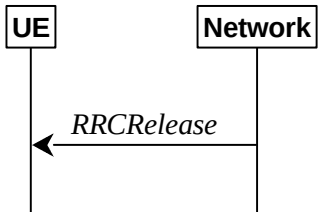

Figure 5.3.8.1-1: RRC connection release, successful

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 PSCell (if configured) and all other parameters configured except for the ones within *ReconfigurationWithSync* of the PCell and *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 while T304 is running:

2> start timer T310 for the sourceSpCell.

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:

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> 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, 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;

4> store the following radio link failure information in the *VarRLF-Report* by setting its fields as follows:

5> clear the information included in *VarRLF-Report*, if any;

5> set the *plmn-IdentityList* to include the list of EPLMNs stored by the UE (i.e. includes the RPLMN);

5> set the *measResultLastServCell* to include the RSRP, RSRQ and the available SINR, of the source PCell based on the available SSB and CSI-RS measurements collected up to the moment the UE detected radio link failure;

5> set the *ssbRLMConfigBitmap* and/or *csi-rsRLMConfigBitmap* in *measResultLastServCell* to include the radio link monitoring configuration of the source PCell;

5> for each of the configured NR frequencies in which measurements are available:

6> if the SS/PBCH block-based measurement quantities are available:

7> 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 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 radio link failure;

8> for each neighbour cell included, include the optional fields that are available;

6> if the CSI-RS based measurement quantities are available:

7> 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;

8> for each neighbour cell included, include the optional fields that are available;

5> for each of the configured EUTRA frequencies in which measurements are available:

6> 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 radio link failure;

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.

5> if detailed location information is available, set the content of *locationInfo* as follows:

6> if available, set the *commonLocationInfo* to include the detailed location information;

6> if available, set the *bt-LocationInfo* in *locationInfo* to include the Bluetooth measurement results, in order of decreasing RSSI for Bluetooth beacons;

6> if available, set the *wlan-LocationInfo* in *locationInfo* to include the WLAN measurement results, in order of decreasing RSSI for WLAN APs;

6> if available, set the *sensor-LocationInfo* in *locationInfo* to include the sensor measurement results;

5> set the *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;

5> if an *RRCReconfiguration* message including the *reconfigurationWithSync* was received before the connection failure:

6> if the last *RRCReconfiguration* message including the *reconfigurationWithSync* concerned an intra NR handover:

7> include the *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;

7> set the *timeConnFailure* to the elapsed time since reception of the last *RRCReconfiguration* message including the *reconfigurationWithSync*;

5> set the connectionFailureType to rlf;

5> set the c-RNTI to the C-RNTI used in the PCell;

5> set the rlf-Cause to the trigger for detecting radio link failure;

5> if the rlf-Cause is set to randomAccessProblem or beamFailureRecoveryFailure:

6> set the *absoluteFrequencyPointA* to indicate the absolute frequency of the reference resource block associated to the random-access resources;

6> set the *locationAndBandwidth* and *subcarrierSpacing* associated to the UL BWP of the random-access resources;

6> set the *msg1-FrequencyStart*, *msg1-FDM* and *msg1-SubcarrierSpacing* associated to the random-access resources;

6> set the parameters associated to individual random-access attempt in the chronological order of attmepts in the *perRAInfoList* as follows:

7> 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 radom-access attempts as follows:

8> set the *ssb-Index* to include the SS/PBCH block index associated to the used random-access resource;

8> set the *numberOfPreamblesSentOnSSB* to indicate the number of successive random access attempts associated to the SS/PBCH block;

8> for each random-access attempt performed on the random-access resource, include the following parameters in the chronological order of the random-access attempt:

9> if contention resolution was not successful as specified in TS 38.321 [6] for the transmitted preamble:

10> set the contentionDetected to true;

9> else:

10> set the contentionDetected to false;

9> 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*:

10> set the dlRSRPAboveThreshold to true;

9> else:

10> set the dlRSRPAboveThreshold to false;

7> 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 radom-access attempts as follows:

8> set the *csi-RS-Index* to include the CSI-RS index associated to the used random-access resource;

8> set the *numberOfPreamblesSentOnCSI-RS* to indicate the number of successive random-access attempts associated to the CSI-RS;

8> for each random-access attempt performed on the random-access resource, include the following parameters in the chronological order of the random-access attempt:

9> if contention resolution was not successful as specified in TS 38.321 [6] for the transmitted preamble:

10> set the contentionDetected to true;

9> else:

10> set the contentionDetected to false;

9> if the CSI-RS RSRP of the CSI-RS corresponding to the random-access resource used in the random-access attempt is above *rsrp-ThresholdCSI-RS*:

10> set the dlRSRPAboveThreshold to true;

9> else:

10> set the dlRSRPAboveThreshold to false;

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; 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 if MCG transmission is not suspended:

3> consider radio link failure to be detected for the SCG, i.e. SCG RLF;

3> initiate the SCG failure information procedure as specified in 5.7.3 to report SCG radio link failure.

2> else:

3> if the UE is in NR-DC:

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

3> else (the UE is in (NG)EN-DC):

4> 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*;

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 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> 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 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, 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 *RRCConnectionReconfiguration* message including *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:

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

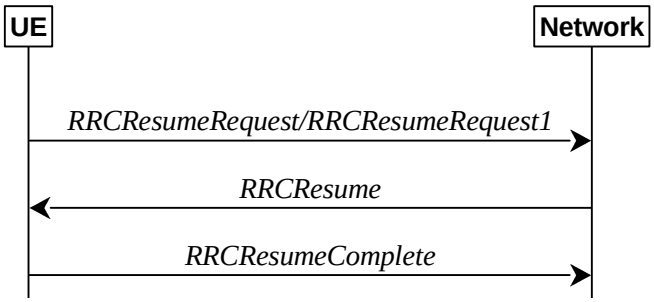

Figure 5.3.13.1-1: RRC connection resume, successful

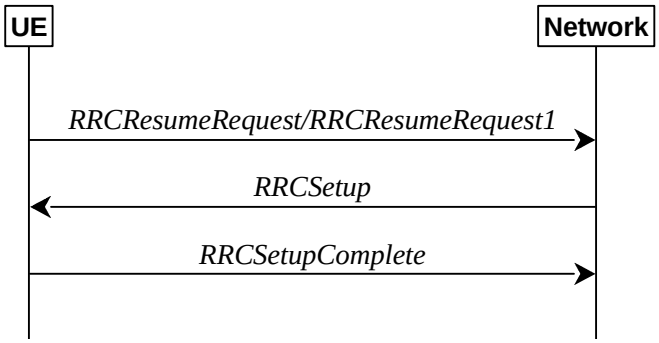

Figure 5.3.13.1-2: RRC connection resume fallback to RRC connection establishment, successful

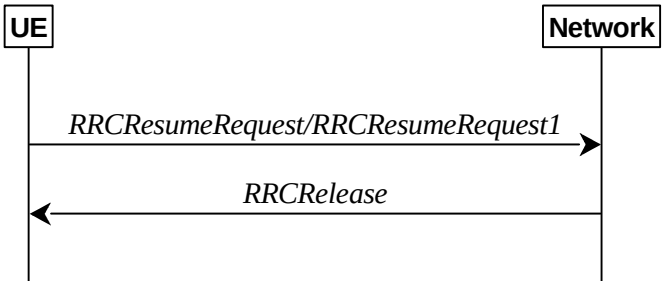

Figure 5.3.13.1-3: RRC connection resume followed by network release, successful

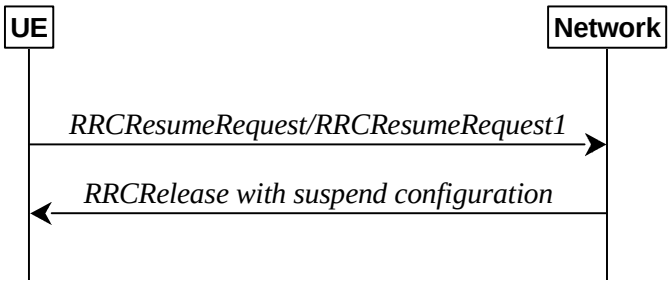

Figure 5.3.13.1-4: RRC connection resume followed by network suspend, successful

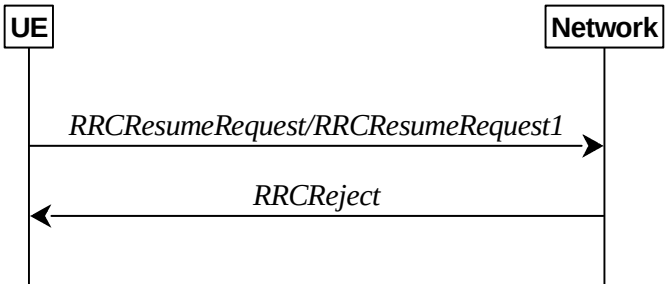

Figure 5.3.13.1-5: RRC connection resume, network reject

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 *npn-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 informantion 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 informaton 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, the cell level and SS/PBCH block level RSRP, and RSRQ, 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 re-selection, to include neighbouring cell measurements for at most the following number of neighbouring cells: 6 intra-frequency and 3 inter-frequency neighbours per frequency as well as 3 inter-RAT neighbours, per frequency/ set of frequencies 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 *VarConnEsFailReport*, 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":

$T390 = (0.7 + 0.6 * rand) * uac\text{-}BarringTime$.

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

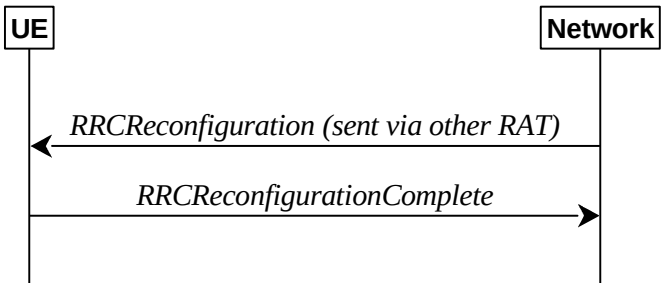

Figure 5.4.2.1-1: Handover to NR, successful

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

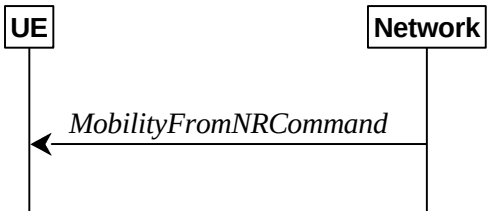

Figure 5.4.3.1-1: Mobility from NR, successful

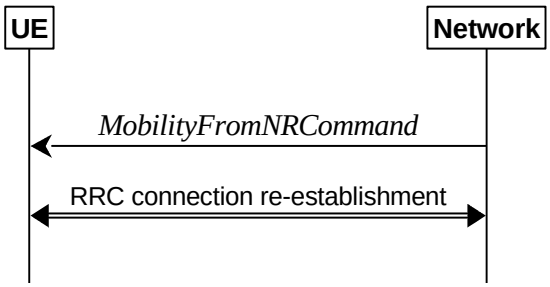

Figure 5.4.3.1-2: Mobility from NR, failure

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> 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_{RRCenc} key, the K_{RRCint} 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 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 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 triggering configuration, each configuration consists of the following:

   - Execution criteria: The criteria that triggers the UE to perform conditional reconfiguration execution.

- RS type: The RS that the UE uses for beam and cell measurement results (SS/PBCH block or CSI-RS) for 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 CLI 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 measurments 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*+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 mod *T* = FLOOR(*gapOffset*/10);

subframe = *gapOffset* mod 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 mod *T* = FLOOR(*gapOffset*/10);

subframe = *gapOffset* mod 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:

SFN mod *T* = FLOOR(*gapOffset*/10);

subframe = *gapOffset* mod 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 *gapUE* is set to *release*:

2> release the per UE measurement gap configuration.

NOTE 1: For *gapFR2* configuration with synchrnonous 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:

SFN mod *T* = (FLOOR (*Offset*/10));

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

subframe = *Offset* mod 10;

else:

subframe = *Offset* or (*Offset* +5);

with *T* = CEIL(*Periodicity*/10).

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 reselecion), 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:

SFN mod *T* = FLOOR(*rmtc-SubframeOffset*/10);

subframe = *rmtc-SubframeOffset* mod 10;

with *T* = *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 and CLI measurement results in RRC_CONNECTED, except for RSSI, 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 only SRS-RSRP or only 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 *SL-PreconfigurationNR* 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*), 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* 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 an 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 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***, ***Ofp***, ***Ocp***, ***Hys***, ***Off*** are expressed in dB.

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: 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.

Thresh1is expressed in the same unit as ***Mp***.

Thresh2 is expressed in the same unit as ***Mn***.

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)

Mp – Hys > Thresh1

Inequality B2-4 (Leaving condition 2)

Mn + Ofn + Ocn + Hys < Thresh2

The variables in the formula are defined as follows:

Mp is the measurement result of the PCell, not taking into account any offsets.

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 inter-RAT neighbour 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).

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).

Mp is expressed in dBm in case of RSRP, or in dB in case of RSRQ and SINR.

Mn is expressed in dBm or dB, depending on the measurement quantity of the inter-RAT neighbour cell.

Ofn, Ocn, Hys are expressed in dB.

Thresh1 is expressed in the same unit as ***Mp***.

Thresh2 is expressed in the same unit as ***Mn***.

5.5.4.10 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)

$Mi - Hys > Thresh$

Inequality I1-2 (Leaving condition)

$Mi + Hys < Thresh$

The variables in the formula are defined as follows:

Mi is the measurement result of the interference, 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. *i1-Threshold* as defined within *reportConfigNR* for this event).

Mi, 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 is 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 is 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 *rssi-Result* to the average of sample value(s) provided by lower layers in the *reportInterval;*

2> set the *channelOccupancy* to the rounded percentage of sample values which are beyond 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 *pdcch-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 *sfn-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 concered NR neighbour cell.

4> set *sfn-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 *sfn-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 avareage 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 *rssi-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-ConfigDedicatedEUTRA* received within the *RRCReconfiguration*:

2> submit the *MeasurementReport* message to lower layers for transmission via SRB1, embedded in LTE RRC message *ULInformationTransferIRAT* as specified TS 36.331 [10], clause 5.6.x;

1> 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

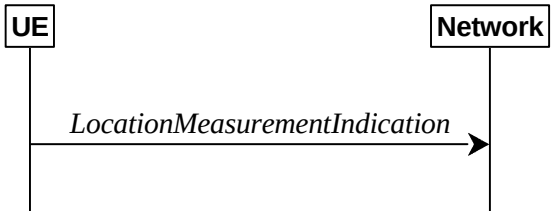

Figure 5.5.5.1-1: Location measurement indication

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

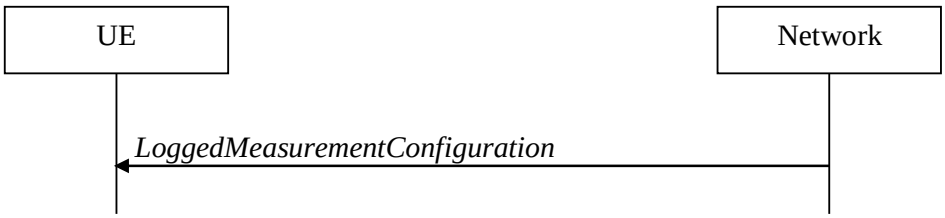

Figure 5.5a.1.1-1: Logged measurement configuration

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*, *loggingInterval* and *areaConfiguration*, if included, in *VarLogMeasConfig*;

1> if the *LoggedMeasurementConfiguration* message includes *plmn-IdentityList*:

2> set *plmn-IdentityList* in *VarLogMeasReport* to include the RPLMN as well as the PLMNs included in *plmn-IdentityList*;

1> else:

2> set *plmn-IdentityList* in *VarLogMeasReport* to include the RPLMN;

1> store the received *absoluteTimeInfo*, *traceReference*, *traceRecordingSessionRef*, and *tce-Id* in *VarLogMeasReport*;

1> store the received *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> store the received *reportType* 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*;*g*;

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 *eventType* 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 *eventL1* 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 seletion state (as specificed 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 *measResultServCell* 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 *measResultServCell* to include the quantities of the cell the UE is camping on;

4> if available, set the *measResultNeighCells*, in order of decreasing ranking-criterion as used for cell re-selection, to include neighbouring cell measurements that became available during the last logging interval for at most the following number of neighbouring cells: 6 intra-frequency and 3 inter-frequency neighbours per frequency as well as 3 inter-RAT neighbours, per frequency/ set of frequencies 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 or as used for evaluation of reporting criteria or for measurement reporting according to 5.5.3 in RRC_CONNECTED, which are performed in accordance with the performance requirements as specified in TS 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.

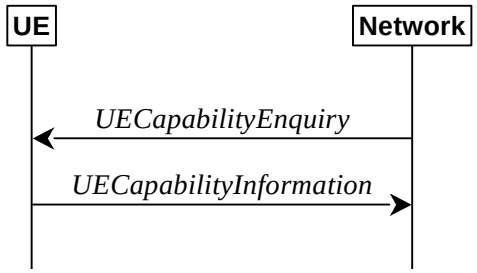

Figure 5.6.1.1-1: UE capability transfer

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-RequestLis*t 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 s*upportedBandCombinationList-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

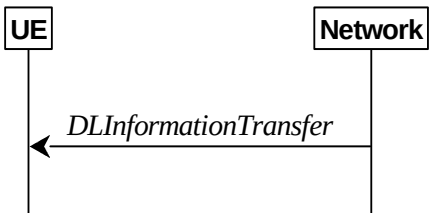

Figure 5.7.1.1-1: DL information transfer

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

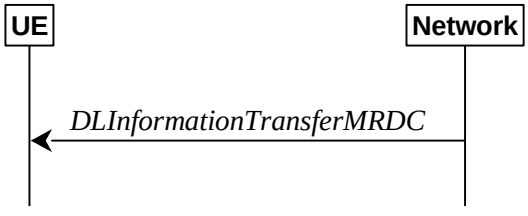

Figure 5.7.1a.1-1: DL information transfer MR-DC

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

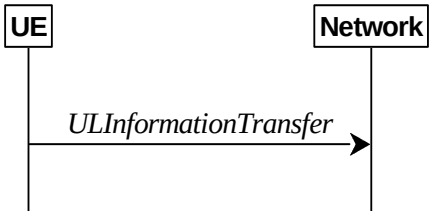

Figure 5.7.2.1-1: UL information transfer

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

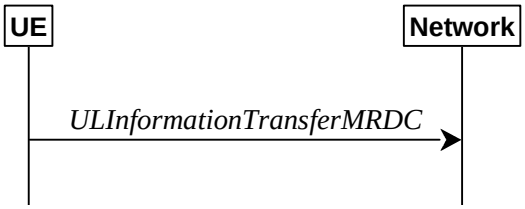

Figure 5.7.2a.1-1: UL information transfer MR-DC

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 tranfer 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

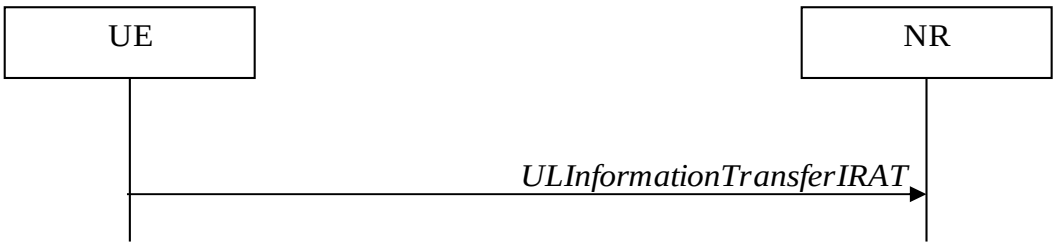

Figure 5.7.2b.1-1: UL transfer of IRAT information

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

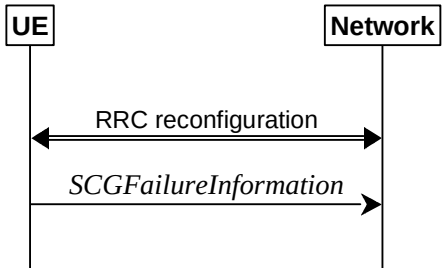

Figure 5.7.3.1-1: SCG failure information

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> 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 the UE initiates transmission of the *SCGFailureInformationNR* message due to the failed beam failure recovery procedure indication from the SCG MAC:

2> set the *failureType* as *other* and set the *failureType-v1610* as *beamFailureRecoveryFailure*;

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> 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 the UE initiates transmission of the *SCGFailureInformation* message due to the failed beam failure recovery procedure indication from the SCG MAC:

2> set the *failureType* as *other* and set the *failureType-v1610* as *beamFailureRecoveryFailure*;

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

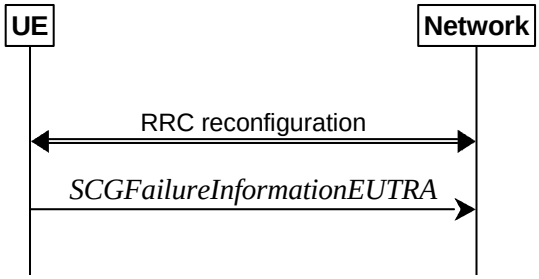

Figure 5.7.3a.1-1: EUTRA SCG failure information

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 EUTRA SCG transmission is not 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

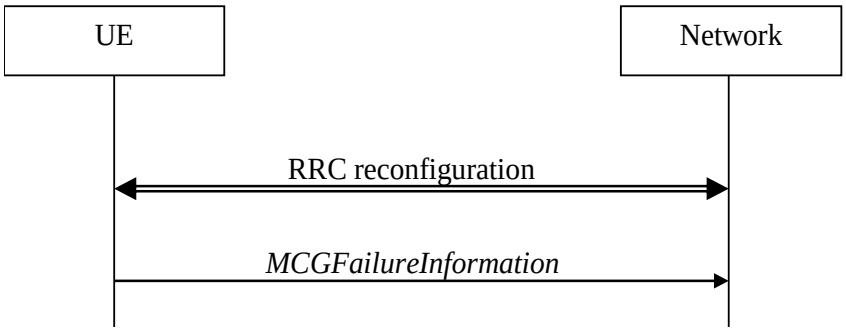

Figure 5.7.3b.1-1: MCG failure information

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> 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 the UE initiates transmission of the *MCGFailureInformation* due to a failed beam failure recovery procedure indication from the MCG MAC:

2> set the *failureType* as *beamFailureRecoveryFailure*;

1> else if connected as an IAB-node and the *MCGFailureInformation* is initiated due to the reception of a BH RLF indication from the MCG BAP entity:

2> set the *failureType* as *bh-RLF*.

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

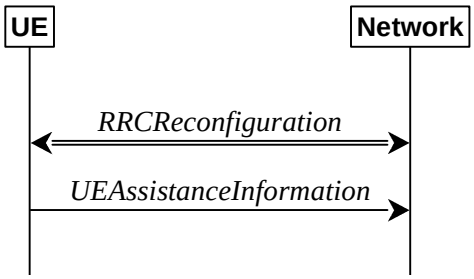

Figure 5.7.4.1-1: UE Assistance Information

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*;

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*;

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*;

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*;

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*;

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;

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;

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:

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:

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:

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;

4> set reducedBW-UL to the maximum aggregated bandwidth the UE desires to have configured across all uplink carriers of FR1;

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;

4> set reducedBW-UL to the maximum aggregated bandwidth the UE desires to have configured across all uplink carriers of FR2;

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:

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;

3> set *reducedCCsUL* to the number of maximum SCells the UE desires to have configured in uplink;

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:

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;

4> set reducedMIMO-LayersFR1-UL to the preferred maximum number of uplink MIMO layers of each FR1 serving cell that the UE operates on;

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;

4> set reducedMIMO-LayersFR2-UL to the preferred maximum number of uplink MIMO layers of each FR2 serving cell that the UE operates on;

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:

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:

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:

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.

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 LTE RRC message *ULInformationTransferIRAT* as specified in TS 36.331 [10], clause 5.6.x;

1> else:

2> submit the *UEAssistanceInformation* message to lower layers for transmission.

The UE shall:

1> 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

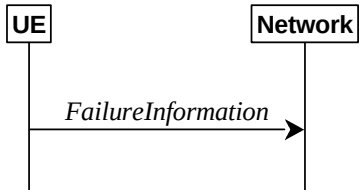

Figure 5.7.5.1-1: Failure information

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 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 *DLDedicatedMessageSegment* message.

5.7.6.3 Reception of *DLDedicatedMessageSegment* by the UE

Upon receiving *DLDedicatedMessageSegment* 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> F or 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*)

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 runing:

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.

2> perform the actions as specified in 5.7.8.1a;

1> else if inter-RAT cell reselection occurs while T331 is runing:

2> stop timer T331;

2> perform the actions as specified in 5.7.8.2a;

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 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

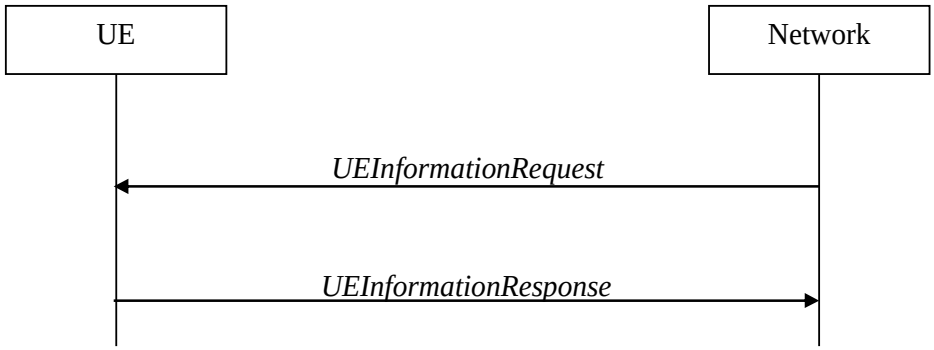

Figure 5.7.10.1-1: UE information procedure

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 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 8 and if the number of PLMN entries in *plmn-IdentityList* stored in *VarRA-Report* is less than *maxPLMN*, then append the following contents associated to the successfully completed random-access procedure as a new entry in the *VarRA-Report*:

2> if the list of EPLMNs has been stored by the UE:

3> if the RPLMN is included in *plmn-IdentityList* stored in *VarRA-Report*:

4> 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*;

3> else:

4> clear the information included in *VarRA-Report*;

4> set the *plmn-IdentityList* to the list of EPLMNs stored by the UE (i.e. includes the RPLMN);

2> else:

3> 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;

2> set the *cellId* to the global cell identity and the tracking area code of the cell in which the random-access procedure was performed;

2> set the *raPurpose* to include the purpose of triggering the random-access procedure;

2> 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*.

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 used in the random-access procedure;

1> set the *msg1-FrequencyStartCFRA*, *msg1-FDMCFRA* and *msg1-SubcarrierSpacingCFRA* associated to the contention free random-access resources 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: 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].

5.7.12 IAB Other Information

5.7.12.1 General

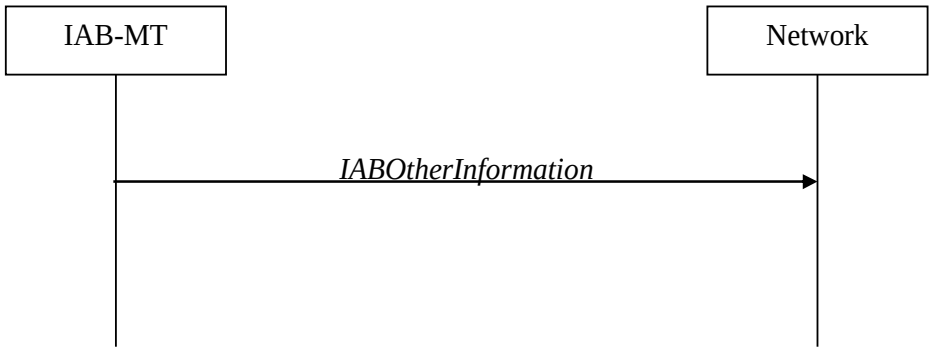

Figure 5.7.12.1-1: IAB Other Information procedure

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 addressse in *all-Traffic-IAB-IP-Address*.

2> if IPv6 addresses or IPv6 address prefixes are reported:

3> IPv6 addreses 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 prefix is reported:

4> include these iPv6-Prefixes in iab-IPv6-PrefixReport, and for this 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-Addres.*

1> submit the *IABOtherInformation* message to lower layers for transmission, upon which the procedure end.5.8Sidelink

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

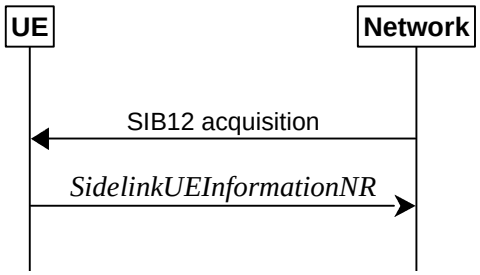

Figure 5.8.3.1-1: Sidelink UE information for NR sidelink communication

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 parameters and QoS profiles(s) related to NR sidelink communication,
- is reporting that a sidelink radio link failure or sidelink RRC reconfiguration failure has been detected.

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(s) 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 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 LTE RRC message *ULInformationTransferIRAT* as specified in TS 36.331 [10], clause 5.6.x;

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

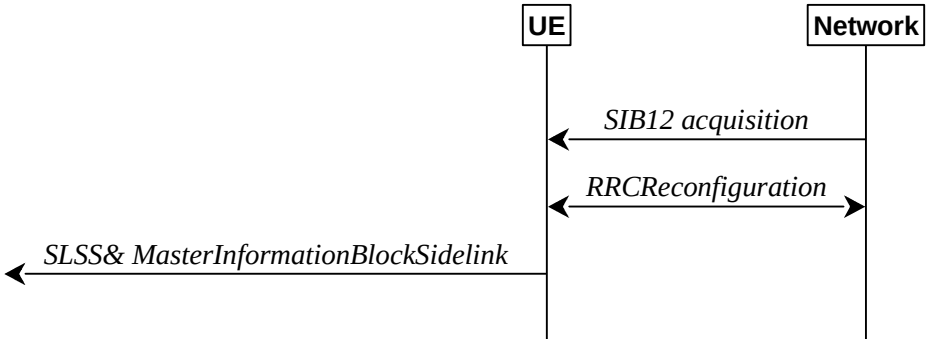

Figure 5.8.5.1-1: Synchronisation information transmission for NR sidelink communication, in (partial) coverage

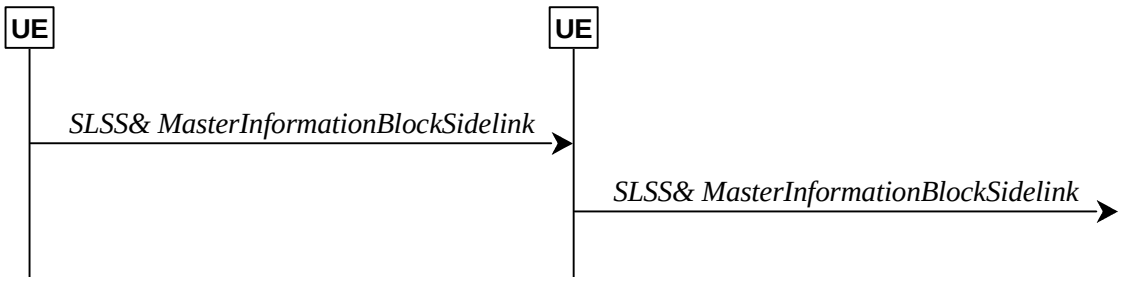

Figure 5.8.5.1-2: Synchronisation information transmission for NR sidelink communication, out of coverage

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 *SL-PreconfigurationNR*; 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 *SL-PreconfigurationNR:*

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 *SL-PreconfigurationNR*:

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> 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];

3> 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 *SL-PreconfigurationNR* corresponding to the concerned frequency;

5.8.5a Sidelink synchronisation information transmission for V2X sidelink communication

5.8.5a.1 General

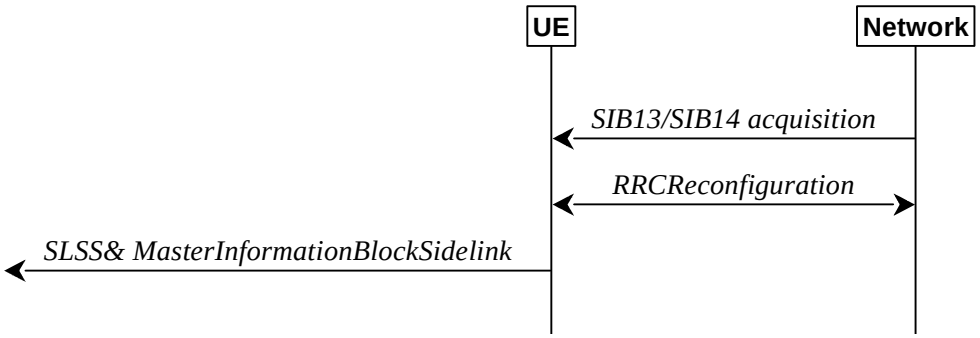

Figure 5.8.5a.1-1: Synchronisation information transmission for V2X sidelink communication, in (partial) coverage

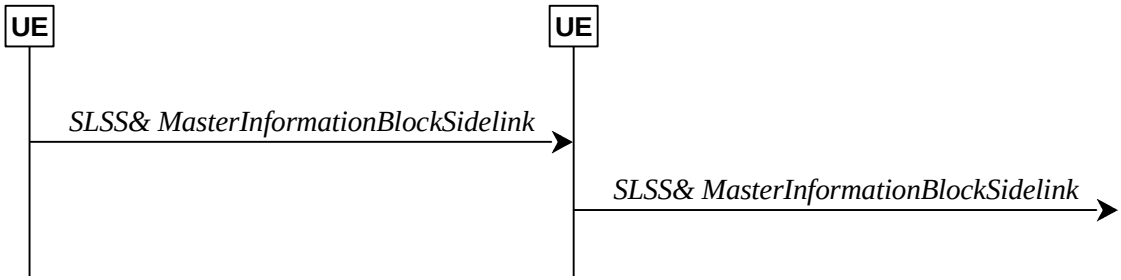

Figure 5.8.5a.1-2: Synchronisation information transmission for V2X sidelink communication, out of coverage

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 *SL-PreconfigurationNR* 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 PSBCHS-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 detecteted 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 theUE 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 PSBCHS-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 38.213 [13];

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 38.213 [13]) 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 38.213 [13]

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 38.213 [13]:

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 38.213 [13]) 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 *SL-PreconfigurationNR* 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 *SL-PreconfigurationNR*, *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

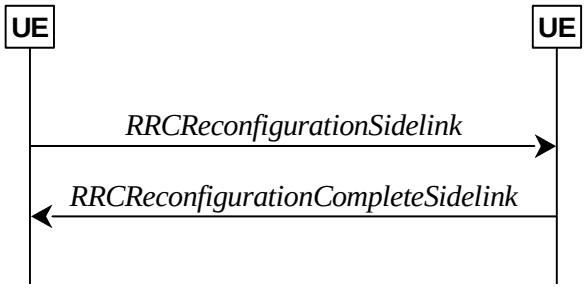

Figure 5.8.9.1.1-1: Sidelink RRC reconfiguration, successful

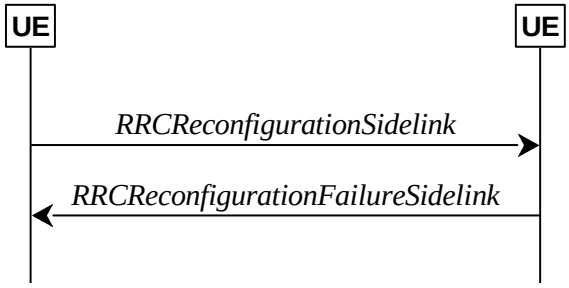

Figure 5.8.9.1.1-2: Sidelink RRC reconfiguration, failure

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 5.8.9.1.5a.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-LatencyBound-CSI-Report*,

NOTE 1: How to set the parameters included in *sl-CSI-RS-Config* and *sl-LatencyBound-CSI-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 5.8.9.1.6;

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-PFI* 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-PFI* included in *sl-MappedQoS-FlowsToAddList* to the corresponding sidelink DRB;

3> if *sl-MappedQoS-FlowsToReleaseList* is included:

4> remove the *SL-PFI* 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 the sidelink QoS flow mapped to the sidelink DRB, which is (re)configured by receiving *RRCReconfigurationSidelink*, has no 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-caluse 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.

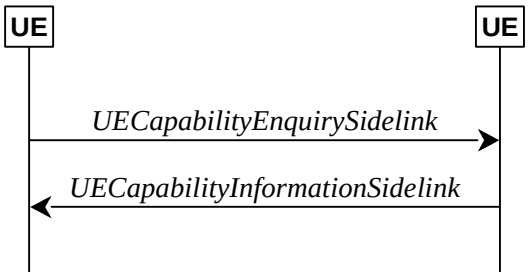

Figure 5.8.9.2.1-1: Sidelink UE capability transfer

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 *ueCapabilityInformationSidelink*;

NOTE: It is up to initiating UE to decide whether *ueCapabilityInformationSidelink* 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 in UE radio access capabilities for sidelink within *ueCapabilityInformationSidelink*;

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 *supportedBandCombinationListSidelink* as many band combinations as possible from the list of "candidate band combinations", starting from the first entry;

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; 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:

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 or sub-clause 5.10.X in TS 36.331 [10];

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 *SL-PreconfigurationNR* 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 *SL-PreconfigurationNR*:

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 *SL-PreconfigurationNR* 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 *SL-PreconfigurationNR* 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 peform 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:

$$DFN = \text{Floor}\ (0.1*(Tcurrent - Tref - OffsetDFN))\ \text{mod}\ 1024$$

$$SubframeNumber = \text{Floor}\ (Tcurrent - Tref - OffsetDFN)\ \text{mod}\ 10$$

$$SlotNumber = \text{Floor}\ ((Tcurrent - \text{Tref} - OffsetDFN)*2^{\mu})\ \text{mod}\ (10*2^{\mu})$$

Where:

Tcurrent is the current UTC time that obtained from GNSS. This value is expressed in milliseconds;

Tref 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;

OffsetDFN is the value *sl-OffsetDFN* if configured, otherwise it is zero. This value is expressed in milliseconds.

μ=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 *Tcurrent* 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

Abbreviation	Meaning
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	*Specified* Used for (configuration) fields, whose field description or procedure **specifies** 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	*Maintain* 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	*No action* (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	*Release* 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 ::=              SEQUENCE {
    field1                          InformationElement1         OPTIONAL,  -- Need M
    field2                          InformationElement2         OPTIONAL,  -- Need R
    nonCriticalExtension            RRCMessage-v1570-IEs        OPTIONAL
}

RRCMessage-1570-IEs ::=         SEQUENCE {
    field3                          InformationElement3         OPTIONAL,  -- Need M
    nonCriticalExtension            RRCMessage-v1640-IEs        OPTIONAL
}

RRCMessage-v1640-IEs ::=        SEQUENCE {
    field4                          InformationElement4         OPTIONAL,  -- Need R
    nonCriticalExtension            SEQUENCE {}                 OPTIONAL
}

InformationElement1 ::=         SEQUENCE {
    field11                         InformationElement11        OPTIONAL,  -- Need M
    field12                         InformationElement12        OPTIONAL,  -- Need R
    ...,
    [[
    field13                         InformationElement13        OPTIONAL,  -- Need R
    field14                         InformationElement14        OPTIONAL   -- Need M
    ]]
}

InformationElement2 ::=         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 not 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 ::=            SEQUENCE {
    message                         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 ::=                  SEQUENCE {
    message                             DL-DCCH-MessageType
}

DL-DCCH-MessageType ::=             CHOICE {
    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 ::=            CHOICE {
    c1                              CHOICE {
        paging                          Paging,
        spare1  NULL
    },
    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 ::=             SEQUENCE {
    message                         UL-CCCH-MessageType
}

UL-CCCH-MessageType ::=         CHOICE {
    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 ::=            SEQUENCE {
    message                         UL-CCCH1-MessageType
```

```
}

UL-CCCH1-MessageType ::=        CHOICE {
    c1                              CHOICE {
        rrcResumeRequest1               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                              CHOICE {
        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                              CHOICE {
            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 ::=                SEQUENCE {
    rrc-TransactionIdentifier       RRC-TransactionIdentifier,
    criticalExtensions              CHOICE {
        counterCheck                    CounterCheck-IEs,
        criticalExtensionsFuture        SEQUENCE {}
    }
}

CounterCheck-IEs ::=            SEQUENCE {
    drb-CountMSB-InfoList           DRB-CountMSB-InfoList,
    lateNonCriticalExtension        OCTET STRING                        OPTIONAL,
    nonCriticalExtension            SEQUENCE {}                         OPTIONAL
}

DRB-CountMSB-InfoList ::=       SEQUENCE (SIZE (1..maxDRB)) OF DRB-CountMSB-Info

DRB-CountMSB-Info ::=           SEQUENCE {
    drb-Identity                    DRB-Identity,
    countMSB-Uplink                 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
```

***CounterCheckResponse-IEs* field descriptions**
drb-CountInfoList Indicates the COUNT values of the DRBs.

***DRB-CountInfo* field descriptions**
count-Downlink Indicates the value of RX_NEXT – 1 (specified in TS 38.323 [5]) associated to this DRB.
count-Uplink 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]).

– *DLDedicatedMessageSegment*

The *DLDedicatedMessageSegment* 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           DLDedicatedMessageSegment-r16-IEs,
        criticalExtensionsFuture                SEQUENCE {}
    }
}

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 *MobilityFromEUTRACommand* 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 an IAB node 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                             CHOICE {
        iab-IP-Request-r16                      SEQUENCE {
            iab-IPv4-AddressNumReq-r16              IAB-IPAddressNumReq-r16             OPTIONAL,
            iab-IPv6-AddressReq-r16                 CHOICE {
                iab-IPv6-AddressNumReq-r16              IAB-IPAddressNumReq-r16,
                iab-IPv6-AddressPrefixReq-r16           IAB-IPAddressPrefixReq-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-IPAddressNumReq-r16 ::=     SEQUENCE {
    all-Traffic-NumReq-r16          INTEGER (1..8)                          OPTIONAL,
    f1-C-Traffic-NumReq-r16         INTEGER (1..8)                          OPTIONAL,
    f1-U-Traffic-NumReq-r16         INTEGER (1..8)                          OPTIONAL,
    non-F1-Traffic-NumReq-r16       INTEGER (1..8)                          OPTIONAL,
    ...
}

IAB-IPAddressPrefixReq-r16 ::=  SEQUENCE {
    all-Traffic-PrefixReq-r16       ENUMERATED {true}                       OPTIONAL,
    f1-C-Traffic-PrefixReq-r16      ENUMERATED {true}                       OPTIONAL,
    f1-U-Traffic-PrefixReq-r16      ENUMERATED {true}                       OPTIONAL,
    non-F1-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,
    f1-C-Traffic-IP-Address-r16     SEQUENCE (SIZE(1..8)) OF IAB-IP-Address-r16     OPTIONAL,
    f1-U-Traffic-IP-Address-r16     SEQUENCE (SIZE(1..8)) OF IAB-IP-Address-r16     OPTIONAL,
    non-F1-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,
    f1-C-Traffic-IP-Address-r16     IAB-IP-Address-r16                      OPTIONAL,
    f1-U-Traffic-IP-Address-r16     IAB-IP-Address-r16                      OPTIONAL,
    non-F1-Traffic-IP-Address-r16   IAB-IP-Address-r16                      OPTIONAL
}
```

```
-- TAG-IABOTHERINFORMATION-STOP
-- ASN1STOP
```

***IABOtherInformation-IEs* field descriptions**
all-Traffic-PrefixReq This field is used to request the IPv6 address prefix for all traffic. The length of allocated IPv6 prefix is fixed to 64.
all-Traffic-NumReq This field is used to request the numbers of IP address for all traffic.
IAB-IP-AddressAndTraffic This field is used to report to IAB-donor-CU the IP addresses per specific usage assigned by OAM for IAB-DU.
IAB-IP-PrefixAndTraffic This field is used to report to IAB-donor-CU the IPv6 prefixes per specific usage assigned by OAM for IAB-DU.
iab-IPv4-AddressNumReq This field is used to request the numbers of IPv4 address per specific usage. The specifc usages include F1-C traffic, F1-U traffic and non-F1 traffic.
iab-IPv6-AddressReq This field is used to request the numbers or the prefix of IPv6 address per specific usage. The specifc usages include F1-C traffic, F1-U traffic and non-F1 traffic.
f1-C-Traffic-PrefixReq This field is used to request the IPv6 address prefix for F1-C traffic. The length of allocated IPv6 prefix is fixed to 64.
f1-C-Traffic-NumReq This field is used to request the numbers of IP address for F1-C traffic.
f1-U-Traffic-PrefixReq This field is used to request the IPv6 address prefix for F1-U traffic. The length of allocated IPv6 prefix is fixed to 64.
f1-U-Traffic-NumReq This field is used to request the numbers of IP address for F1-U traffic.
non-F1-Traffic-PrefixReq This field is used to request the IPv6 address prefix for non-F1 traffic. The length of allocated IPv6 prefix is fixed to 64.
non-F1-Traffic-NumReq 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                                  OCTET STRING (SIZE (1)),
    absoluteTimeInfo-r16                        AbsoluteTimeInfo-r16,
    areaConfiguration-r16                       AreaConfiguration-r16                   OPTIONAL,   --Need R
    plmn-IdentityList-r16                       PLMN-IdentityList2-r16                  OPTIONAL,   --Need R
```

```
    bt-NameList-r16                         SetupRelease {BT-NameList-r16}          OPTIONAL,  --Need M
    wlan-NameList-r16                       SetupRelease {WLAN-NameList-r16}        OPTIONAL,  --Need M
    sensor-NameList-r16                     SetupRelease {Sensor-NameList-r16}      OPTIONAL,  --Need M
    loggingDuration-r16                     LoggingDuration-r16,
    reportType                              CHOICE {
        periodical                              LoggedPeriodicalReportConfig-r16,
        eventTriggered                          LoggedEventTriggerConfig-r16,
        ...
    },
    lateNonCriticalExtension                OCTET STRING                            OPTIONAL,
    nonCriticalExtension                    SEQUENCE {}                             OPTIONAL
}

LoggedPeriodicalReportConfig-r16 ::=        SEQUENCE {
    loggingInterval-r16                         LoggingInterval-r16,
    ...
 }

LoggedEventTriggerConfig-r16 ::=            SEQUENCE {
    eventType-r16                               EventType-r16,
    loggingInterval-r16                         LoggingInterval-r16,
    ...
}

EventType-r16 ::= CHOICE {
    outOfCoverage     NULL,
    eventL1           SEQUENCE {
        l1-Threshold      MeasTriggerQuantity,
        hysteresis        Hysteresis,
        timeToTrigger     TimeToTrigger
    },
    ...
}

-- TAG-LOGGEDMEASUREMENTCONFIGURATION-STOP
-- ASN1STOP
```

LoggedMeasurementConfiguration field descriptions
absoluteTimeInfo Indicates the absolute time in the current cell.
areaConfiguration 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.
eventType 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.
plmn-IdentityList 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.
tce-Id Parameter Trace Collection Entity Id: See TS 32.422 [52].
traceRecordingSessionRef Parameter Trace Recording Session Reference: See TS 32.422 [52].
reportType Parameter configures the type of MDT configuration, specifically Periodic MDT conifguraiton or Event Triggerd 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 ::=          SEQUENCE {
    failureType-r16                   ENUMERATED {t310-Expiry, randomAccessProblem, rlc-MaxNumRetx,
                                                  t312-Expiry-r16, lbt-Failure-r16, beamFailureRecoveryFailure-r16,
                                                  bh-RLF-r16, spare1}                                                 OPTIONAL,
    measResultFreqList-r16            MeasResultList2NR                                                             OPTIONAL,
    measResultFreqListEUTRA-r16       MeasResultList2EUTRA                                                          OPTIONAL,
    measResultSCG-r16                 OCTET STRING (CONTAINING MeasResultSCG-Failure)                               OPTIONAL,
    measResultSCG-EUTRA-r16           OCTET STRING                                                                  OPTIONAL,
    measResultFreqListUTRA-FDD-r16    MeasResultList2UTRA                                                           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 ::=               SEQUENCE {
    criticalExtensions                  CHOICE {
        measurementReport                   MeasurementReport-IEs,
        criticalExtensionsFuture            SEQUENCE {}
    }
}

MeasurementReport-IEs ::=           SEQUENCE {
    measResults                         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 ::=                             SEQUENCE {
    systemFrameNumber                   BIT STRING (SIZE (6)),
    subCarrierSpacingCommon             ENUMERATED {scs15or60, scs30or120},
    ssb-SubcarrierOffset                INTEGER (0..15),
    dmrs-TypeA-Position                 ENUMERATED {pos2, pos3},
    pdcch-ConfigSIB1                    PDCCH-ConfigSIB1,
```

```
    cellBarred                      ENUMERATED {barred, notBarred},
    intraFreqReselection            ENUMERATED {allowed, notAllowed},
    spare                           BIT STRING (SIZE (1))
}

-- TAG-MIB-STOP
-- ASN1STOP
```

***MIB* field descriptions**
cellBarred Value *barred* means that the cell is barred, as defined in TS 38.304 [20]. This field is ignored by IAB-MT.
dmrs-TypeA-Position 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).
intraFreqReselection 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.
pdcch-ConfigSIB1 Determines a common *ControlResourceSet* (CORESET), a common search space and necessary PDCCH parameters. If the field *ssb-SubcarrierOffset* indicates that *SIB1* is absent, the field *pdcch-ConfigSIB1* indicates the frequency positions where the UE may find SS/PBCH block with *SIB1* or the frequency range where the network does not provide SS/PBCH block with *SIB1* (see TS 38.213 [13], clause 13).
ssb-SubcarrierOffset Corresponds to k_{SSB} (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). 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 *SIB1* and that there is hence no CORESET#0 configured in *MIB* (see TS 38.213 [13], clause 13). In this case, the field *pdcch-ConfigSIB1* may indicate the frequency positions where the UE may (not) find a SS/PBCH with a control resource set and search space for *SIB1* (see TS 38.213 [13], clause 13).
subCarrierSpacingCommon Subcarrier spacing for *SIB1*, Msg.2/4 for initial access, paging and broadcast SI-messages. If the UE acquires this *MIB* on an FR1 carrier frequency, the value *scs15or60* corresponds to 15 kHz and the value *scs30or120* corresponds to 30 kHz. If the UE acquires this *MIB* on an FR2 carrier frequency, the value *scs15or60* corresponds to 60 kHz and the value *scs30or120* corresponds to 120 kHz. For operation with shared spectrum channel access (see 37.213 [48]), the subcarrier spacing for *SIB1* is same as that for the corresponding SSB and this IE 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.
systemFrameNumber 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 *MIB* encoding), as defined in clause 7.1 in TS 38.212 [17].

– *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
eutra	TS 36.331 [10] (clause 5.4.2)	*DL-DCCH-Message* including the *RRCConnectionReconfiguration*
utra-fdd	TS 25.331 [45] (clause 10.2.16a)	*Handover TO UTRAN command*

Conditional Presence	Explanation
HO-ToEPCUTRAN	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 ::=                          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 ::=              SEQUENCE {
    rrc-TransactionIdentifier           RRC-TransactionIdentifier,
    criticalExtensions                  CHOICE {
        rrcReestablishment                  RRCReestablishment-IEs,
        criticalExtensionsFuture            SEQUENCE {}
    }
}

RRCReestablishment-IEs ::=          SEQUENCE {
    nextHopChainingCount                NextHopChainingCount,
    lateNonCriticalExtension            OCTET STRING                        OPTIONAL,
    nonCriticalExtension                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 ::=              SEQUENCE {
    rrc-TransactionIdentifier                   RRC-TransactionIdentifier,
    criticalExtensions                          CHOICE {
        rrcReestablishmentComplete                  RRCReestablishmentComplete-IEs,
        criticalExtensionsFuture                    SEQUENCE {}
    }
}

RRCReestablishmentComplete-IEs ::=          SEQUENCE {
    lateNonCriticalExtension                    OCTET STRING                                OPTIONAL,
    nonCriticalExtension                        RRCReestablishmentComplete-v1610-IEs    OPTIONAL
}

RRCReestablishmentComplete-v1610-IEs ::=    SEQUENCE {
    ueMeasurementsAvailable-r16                 UEMeasurementsAvailable-r16     OPTIONAL,
    nonCriticalExtension                        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
```

***ReestabUE-Identity* field descriptions**
physCellId The Physical Cell Identity of the PCell the UE was connected to prior to the failure.

***RRCReestablishmentRequest-IEs* field descriptions**
reestablishmentCause Indicates the failure cause that triggered the re-establishment procedure. gNB is not expected to reject a *RRCReestablishmentRequest* due to unknown cause value being used by the UE.
ue-Identity 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

RRCReconfiguration ::=                  SEQUENCE {
    rrc-TransactionIdentifier               RRC-TransactionIdentifier,
    criticalExtensions                      CHOICE {
        rrcReconfiguration                      RRCReconfiguration-IEs,
        criticalExtensionsFuture                SEQUENCE {}
    }
}

RRCReconfiguration-IEs ::=              SEQUENCE {
    radioBearerConfig                       RadioBearerConfig                                       OPTIONAL, -- Need M
    secondaryCellGroup                      OCTET STRING (CONTAINING CellGroupConfig)               OPTIONAL, -- Cond SCG
    measConfig                              MeasConfig                                              OPTIONAL, -- Need M
    lateNonCriticalExtension                OCTET STRING                                            OPTIONAL,
    nonCriticalExtension                    RRCReconfiguration-v1530-IEs                            OPTIONAL
}

RRCReconfiguration-v1530-IEs ::=            SEQUENCE {
    masterCellGroup                         OCTET STRING (CONTAINING CellGroupConfig)               OPTIONAL, -- Need M
    fullConfig                              ENUMERATED {true}                                       OPTIONAL, -- Cond FullConfig
    dedicatedNAS-MessageList                SEQUENCE (SIZE(1..maxDRB)) OF DedicatedNAS-Message      OPTIONAL, -- Cond nonHO
    masterKeyUpdate                         MasterKeyUpdate                                         OPTIONAL, -- Cond
MasterKeyChange
    dedicatedSIB1-Delivery                  OCTET STRING (CONTAINING SIB1)                          OPTIONAL, -- Need N
    dedicatedSystemInformationDelivery      OCTET STRING (CONTAINING SystemInformation)             OPTIONAL, -- Need N
    otherConfig                             OtherConfig                                             OPTIONAL, -- Need M
    nonCriticalExtension                    RRCReconfiguration-v1540-IEs                            OPTIONAL
}

RRCReconfiguration-v1540-IEs ::=        SEQUENCE {
    otherConfig-v1540                       OtherConfig-v1540                                       OPTIONAL, -- Need M
    nonCriticalExtension                    RRCReconfiguration-v1560-IEs                            OPTIONAL
}

RRCReconfiguration-v1560-IEs ::=         SEQUENCE {
    mrdc-SecondaryCellGroupConfig           SetupRelease { MRDC-SecondaryCellGroupConfig }          OPTIONAL,   -- Need M
    radioBearerConfig2                      OCTET STRING (CONTAINING RadioBearerConfig)             OPTIONAL,   -- Need M
    sk-Counter                              SK-Counter                                              OPTIONAL,   -- Need N
    nonCriticalExtension                    RRCReconfiguration-v1610-IEs                            OPTIONAL
}
RRCReconfiguration-v1610-IEs ::=        SEQUENCE {
    otherConfig-v1610                       OtherConfig-v1610                                     OPTIONAL, -- Need M
    bap-Config-r16                          SetupRelease { BAP-Config-r16 }                       OPTIONAL, -- Need M
    iab-IP-AddressConfigurationList-r16     IAB-IP-AddressConfigurationList-r16                   OPTIONAL, -- Need M
    conditionalReconfiguration-r16          ConditionalReconfiguration-r16                        OPTIONAL, -- Need M
    daps-SourceRelease-r16                  ENUMERATED{true}                                      OPTIONAL, -- Need N
    t316-r16                                SetupRelease {T316-r16}                               OPTIONAL, -- Need M
    needForGapsConfigNR-r16                 SetupRelease {NeedForGapsConfigNR-r16}                OPTIONAL, -- Need M
    onDemandSIB-Request-r16                 SetupRelease { OnDemandSIB-Request-r16 }              OPTIONAL, -- Need M
    dedicatedPosSysInfoDelivery-r16         OCTET STRING (CONTAINING PosSystemInformation-r16-IEs) OPTIONAL, -- Need N
```

```
    sl-ConfigDedicatedNR-r16                SetupRelease {SL-ConfigDedicatedNR-r16}                                 OPTIONAL, -- Need M
    sl-ConfigDedicatedEUTRA-Info-r16        SetupRelease {SL-ConfigDedicatedEUTRA-Info-r16}                         OPTIONAL, -- Need M
    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-BAProutingID-r16              BAP-Routing-ID-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 securityNASC
    ...
}

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
```

***RRCReconfiguration-IEs* field descriptions**
bap-Config
This field is used to configure the BAP entity for IAB nodes.
bap-Address
Indicates the BAP address of an IAB-node.
conditionalReconfiguration
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 *RRCReconfiguration* 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 *masterCellGroup* includes *ReconfigurationWithSync*. For conditional PSCell change, the field is absent if the *secondaryCellGroup* includes *ReconfigurationWithSync*.
daps-SourceRelease
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.
dedicatedNAS-MessageList
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.
dedicatedPosSysInfoDelivery
This field is used to transfer *SIBPos* to the UE in RRC_CONNECTED.
dedicatedSIB1-Delivery
This field is used to transfer *SIB1* to the UE. The field has the same values as the corresponding configuration in *servingCellConfigCommon*.
dedicatedSystemInformationDelivery
This field is used to transfer *SIB6*, *SIB7*, *SIB8* 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.
defaultUL-BAP-routingID
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 *F1-C* and *non-F1* traffic. The *defaultUL-BAP-routinID* can be (re-)configured when IAB-node IP address for *F1-C* traffic changes. This field is mandatory only for IAB-node bootstrapping and change of IP address for IAB-node cases.
defaultUL-BH-RLC-Channel
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 F1-C and non-F1 traffic*. The *defaultUL-BH-RLC-Channel* can be (re-)configured when IAB-node IP address for *F1-C* traffic changes, and the new IP address is anchored at a different IAB-donor-DU. This field is mandatory only for IAB-node bootstrapping and change of IP address for IAB-node cases.
donor-DU-BAP-Address
This field is used to indicate the BAP address of the IAB-donor-DU which anchors the IP address/prefix.
flowControlFeedbackType
This field is only used for IAB-node that support hop-by-hop flow control to configure the type of flow control feedback. Value *perBH-RLC-Channel* indicates that the IAB-node shall provide flow control feedback per BH RLC channel, value *perRoutingID* indicates that the IAB-node shall provide flow control feedback per routing ID, and value *both* indicates that the IAB-node shall provide flow control feedback both per BH RLC channel and per routing ID.
fullConfig
Indicates that the full configuration option is applicable for the *RRCReconfiguration* message for intra-system intra-RAT HO. For inter-RAT HO from E-UTRA to NR, *fullConfig* 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 *RRCReconfiguration* message is transmitted on SRB3, and in an *RRCReconfiguration* message contained in another *RRCReconfiguration* message (or *RRCConnectionReconfiguration* message, see TS 36.331 [10]) transmitted on SRB1.
iab-IP-Address
This field is used to provide the IP address information for IAB-node.
iab-IP-AddressToAddModList
List of IP addresses allocated for IAB-node to be added and modified.
iab-IP-AddressToReleaseList
List of IP address allocated for IAB-node to be released.

iab-IP-Usage This field is used to indicate the usage of the assigned IP address.
iab-donor-DU-BAP-Address This field is used to indicate the BAP address of the IAB-donor-DU where the IP address is anchored.
keySetChangeIndicator Indicates whether UE shall derive a new K_{gNB}. If *reconfigurationWithSync* is included, value *true* 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 *false* 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].
masterCellGroup Configuration of master cell group.
mrdc-ReleaseAndAdd This field indicates that the current SCG configuration is released and a new SCG is added at the same time.
mrdc-SecondaryCellGroup Includes an RRC message for SCG configuration in NR-DC or NE-DC. For NR-DC (nr-SCG), *mrdc-SecondaryCellGroup* contains the *RRCReconfiguration* message as generated (entirely) by SN gNB. In this version of the specification, the RRC message can only include fields *secondaryCellGroup, otherConfig* and *measConfig*. For NE-DC (eutra-SCG), *mrdc-SecondaryCellGroup* includes the E-UTRA *RRCConnectionReconfiguration* message as specified in TS 36.331 [10]. In this version of the specification, the E-UTRA RRC message can only include the field *scg-Configuration*.
nas-Container 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].
needForGapsConfigNR Configuration for the UE to report measurement gap requirement information of NR target bands in the *RRCReconfigurationComplete* and *RRCResumeComplete* message.
nextHopChainingCount Parameter NCC: See TS 33.501 [11]
onDemandSIB-Request 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.
onDemandSIB-RequestProhibitTimer 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.
otherConfig Contains configuration related to other configurations. When configured for the SCG, only fields *drx-PreferenceConfig, maxBW-PreferenceConfig, maxCC-PreferenceConfig, maxMIMO-LayerPreferenceConfig* and *minSchedulingOffsetPreferenceConfig* can be included.
radioBearerConfig Configuration of Radio Bearers (DRBs, SRBs) including SDAP/PDCP. In EN-DC this field may only be present if the *RRCReconfiguration* is transmitted over SRB3.
radioBearerConfig2 Configuration of Radio Bearers (DRBs, SRBs) including SDAP/PDCP. This field can only be used if the UE supports NR-DC or NE-DC.
secondaryCellGroup Configuration of secondary cell group ((NG)EN-DC or NR-DC).
sk-Counter 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 *keyToUse* set to *secondary*, whichever happens first. This field is absent if there is neither any NR SCG nor any RB with *keyToUse* set to *secondary*.
sl-ConfigDedicatedNR This field is used to provide the dedicated configurations for NR sidelink communication.

sl-ConfigDedicatedEUTRA This field includes the E-UTRA *RRCConnectionReconfiguration* as specified in TS 36.331 [10]. In this version of the specification, the E-UTRA *RRCConnectionReconfiguration* can only includes sidelink related fields for V2X sidelink communication.
sl-TimeOffsetEUTRA 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 *ms0dpt75* corresponds to 0.75ms, *ms1* corresponds to 1ms and so on. The network may configures this field only when *sl-ConfigDedicatedEUTRA* is present.
t316 Indicates the value for timer T316 as described in clause 7.1. Value *ms50* corresponds to 50 ms, value *ms100* corresponds to 100 ms and so on. This field can be present only if the UE is configured with split SRB1 or SRB3.

Conditional Presence	Explanation
nonHO	The field is absent in case of reconfiguration with sync within NR or to NR; otherwise it is optionally present, need N.
securityNASC	This field is mandatory present in case of inter system handover. Otherwise the field is optionally present, need N.
MasterKeyChange	This field is mandatory present in case *masterCellGroup* includes *ReconfigurationWithSync* and *RadioBearerConfig* includes *SecurityConfig* with *SecurityAlgorithmConfig*, indicating a change of the AS security algorithms associated to the master key. If *ReconfigurationWithSync* is included for other cases, this field is optionally present, need N. Otherwise the field is absent.
FullConfig	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: - an *RRCReconfiguration* message transmitted on SRB3, - an *RRCReconfiguration* message contained in another *RRCReconfiguration* message (or in an *RRCConnectionReconfiguration* message, see TS 36.331 [10]) transmitted on SRB1 - an *RRCReconfiguration* message contained in another *RRCReconfiguration* message (or in an *RRCConnectionReconfiguration* message, see TS 36.331 [10]) which is contained in *DLInformationTransferMRDC* transmitted on SRB3 (as a response to *ULInformationTransferMRDC* including an *MCGFailureInformation*) - in an *RRCReconfiguration* message contained in an *RRCResume* message (or in an *RRCConnectionResume* message, see TS 36.331 [10]). 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 ::=              SEQUENCE {
    rrc-TransactionIdentifier                   RRC-TransactionIdentifier,
    criticalExtensions                          CHOICE {
        rrcReconfigurationComplete                  RRCReconfigurationComplete-IEs,
        criticalExtensionsFuture                    SEQUENCE {}
    }
}

RRCReconfigurationComplete-IEs ::=          SEQUENCE {
    lateNonCriticalExtension                    OCTET STRING                                    OPTIONAL,
    nonCriticalExtension                        RRCReconfigurationComplete-v1530-IEs            OPTIONAL
}

RRCReconfigurationComplete-v1530-IEs ::=    SEQUENCE {
    uplinkTxDirectCurrentList                   UplinkTxDirectCurrentList                       OPTIONAL,
    nonCriticalExtension                        RRCReconfigurationComplete-v1560-IEs            OPTIONAL
}

RRCReconfigurationComplete-v1560-IEs ::=    SEQUENCE {
    scg-Response                                CHOICE {
        nr-SCG-Response                             OCTET STRING (CONTAINING RRCReconfigurationComplete),
        eutra-SCG-Response                          OCTET STRING
    }                                                                                               OPTIONAL,
    nonCriticalExtension                        RRCReconfigurationComplete-v1610-IEs            OPTIONAL
}

RRCReconfigurationComplete-v1610-IEs ::=    SEQUENCE {
    ueMeasurementsAvailable-r16                 UEMeasurementsAvailable-r16                     OPTIONAL,
    needForGapsInfoNR-r16                       NeedForGapsInfoNR-r16                           OPTIONAL,
    nonCriticalExtension                        SEQUENCE {}                                     OPTIONAL
}

-- TAG-RRCRECONFIGURATIONCOMPLETE-STOP
-- ASN1STOP
```

***RRCReconfigurationComplete-IEs* field descriptions**
needForGapsInfoNR This field is used to indicate the measurement gap requirement information of the UE for NR target bands.
scg-Response In case of NR-DC (*nr-SCG-Response*), this field includes the *RRCReconfigurationComplete* message. In case of NE-DC (*eutra-SCG-Response*), this field includes the E-UTRA *RRCConnectionReconfigurationComplete* message as specified in TS 36.331 [10].
uplinkTxDirectCurrentList The Tx Direct Current locations for the configured serving cells and BWPs if requested by the NW (see *reportUplinkTxDirectCurrent* in *CellGroupConfig*).

– *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 ::=                       SEQUENCE {
    criticalExtensions                  CHOICE {
        rrcReject                           RRCReject-IEs,
        criticalExtensionsFuture            SEQUENCE {}
    }
}

RRCReject-IEs ::=                   SEQUENCE {
    waitTime                            RejectWaitTime                                  OPTIONAL,   -- Need N
    lateNonCriticalExtension            OCTET STRING                                    OPTIONAL,
    nonCriticalExtension                SEQUENCE{}                                      OPTIONAL
}

-- TAG-RRCREJECT-STOP
-- ASN1STOP
```

RRCReject-IEs field descriptions
waitTime   Wait time value in seconds. The field is always included.

– *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 ::=                      SEQUENCE {
    rrc-TransactionIdentifier           RRC-TransactionIdentifier,
    criticalExtensions                  CHOICE {
        rrcRelease                          RRCRelease-IEs,
        criticalExtensionsFuture            SEQUENCE {}
    }
}

RRCRelease-IEs ::=                  SEQUENCE {
    redirectedCarrierInfo               RedirectedCarrierInfo                                       OPTIONAL,   -- Need N
    cellReselectionPriorities           CellReselectionPriorities                                   OPTIONAL,   -- Need R
    suspendConfig                       SuspendConfig                                               OPTIONAL,   -- Need R
    deprioritisationReq                 SEQUENCE {
        deprioritisationType                ENUMERATED {frequency, nr},
        deprioritisationTimer               ENUMERATED {min5, min10, min15, min30}
    }                                                                                               OPTIONAL,   -- Need N
    lateNonCriticalExtension            OCTET STRING                                            OPTIONAL,
    nonCriticalExtension                RRCRelease-v1540-IEs                                    OPTIONAL
}

RRCRelease-v1540-IEs ::=            SEQUENCE {
    waitTime                            RejectWaitTime              OPTIONAL, -- Need N
    nonCriticalExtension                RRCRelease-v1610-IEs        OPTIONAL
}

RRCRelease-v1610-IEs ::=            SEQUENCE {
    voiceFallbackIndication-r16         ENUMERATED {true}                           OPTIONAL, -- Need N
    measIdleConfig-r16                  SetupRelease {MeasIdleConfigDedicated-r16}  OPTIONAL, -- Need M
    nonCriticalExtension                SEQUENCE {}                                 OPTIONAL
}

RedirectedCarrierInfo ::=           CHOICE {
    nr                                  CarrierInfoNR,
    eutra                               RedirectedCarrierInfo-EUTRA,
    ...
}

RedirectedCarrierInfo-EUTRA ::=     SEQUENCE {
    eutraFrequency                      ARFCN-ValueEUTRA,
    cnType                              ENUMERATED {epc,fiveGC}                             OPTIONAL    -- Need N
}

CarrierInfoNR ::=                   SEQUENCE {
    carrierFreq                         ARFCN-ValueNR,
    ssbSubcarrierSpacing                SubcarrierSpacing,
    smtc                                SSB-MTC                                         OPTIONAL,       -- Need S
```

```
    ...
}

SuspendConfig ::=                   SEQUENCE {
    fullI-RNTI                          I-RNTI-Value,
    shortI-RNTI                         ShortI-RNTI-Value,
    ran-PagingCycle                     PagingCycle,
    ran-NotificationAreaInfo            RAN-NotificationAreaInfo                                    OPTIONAL,   -- Need M
    t380                                PeriodicRNAU-TimerValue                                     OPTIONAL,   -- Need R
    nextHopChainingCount                NextHopChainingCount,
    ...
}


PeriodicRNAU-TimerValue ::=         ENUMERATED { min5, min10, min20, min30, min60, min120, min360, min720}


CellReselectionPriorities ::=       SEQUENCE {
    freqPriorityListEUTRA               FreqPriorityListEUTRA                                       OPTIONAL,       -- Need M
    freqPriorityListNR                  FreqPriorityListNR                                          OPTIONAL,       -- Need M
    t320                                ENUMERATED {min5, min10, min20, min30, min60, min120, min180, spare1}   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                         ARFCN-ValueEUTRA,
    cellReselectionPriority             CellReselectionPriority,
    cellReselectionSubPriority          CellReselectionSubPriority                                  OPTIONAL        -- Need R
}

FreqPriorityNR ::=                  SEQUENCE {
    carrierFreq                         ARFCN-ValueNR,
    cellReselectionPriority             CellReselectionPriority,
    cellReselectionSubPriority          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
```

***RRCRelease-IEs* field descriptions**
cnType Indicate that the UE is redirected to EPC or 5GC.
deprioritisationReq Indicates whether the current frequency or RAT is to be de-prioritised.
deprioritisationTimer Indicates the period for which either the current carrier frequency or NR is deprioritised. Value *minN* corresponds to N minutes.
measIdleConfig Indicates measurement configuration to be stored and used by the UE while in RRC_IDLE or RRC_INACTIVE.
suspendConfig Indicates configuration for the RRC_INACTIVE state. The network does not configure *suspendConfig* when the network redirect the UE to an inter-RAT carrier frequency or if the UE is configured with a DAPS bearer.
redirectedCarrierInfo 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, *redirectedCarrierInfo* is not included in an *RRCRelease* message with *suspendConfig* if this message is in response to an *RRCResumeRequest* or an *RRCResumeRequest1* which is triggered by the NAS layer.
voiceFallbackIndication Indicates the RRC release is triggered by EPS fallback for IMS voice as specified in TS 23.502 [43].

***CarrierInfoNR* field descriptions**
carrierFreq Indicates the redirected NR frequency.
ssbSubcarrierSpacing 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.
smtc 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 SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing.

***RAN-NotificationAreaInfo* field descriptions**
cellList A list of cells configured as RAN area.
ran-AreaConfigList A list of RAN area codes or RA code(s) as RAN area.

***PLMN-RAN-AreaConfig* field descriptions**
plmn-Identity PLMN Identity to which the cells in *ran-Area* belong. If the field is absent the UE uses the ID of the registered PLMN.
ran-AreaCodeList The total number of RAN-AreaCodes of all PLMNs does not exceed 32.
ran-Area 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.

***PLMN-RAN-AreaCell* field descriptions**
plmn-Identity PLMN Identity to which the cells in *ran-AreaCells* belong. If the field is absent the UE uses the ID of the registered PLMN.
ran-AreaCells The total number of cells of all PLMNs does not exceed 32.

***SuspendConfig* field descriptions**
ran-NotificationAreaInfo Network ensures that the UE in RRC_INACTIVE always has a valid *ran-NotificationAreaInfo*.
ran-PagingCycle Refers to the UE specific cycle for RAN-initiated paging. Value *rf32* corresponds to 32 radio frames, value *rf64* corresponds to 64 radio frames and so on.
t380 Refers to the timer that triggers the periodic RNAU procedure in UE. Value *min5* corresponds to 5 minutes, value *min10* 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 ::=                       SEQUENCE {
    rrc-TransactionIdentifier           RRC-TransactionIdentifier,
    criticalExtensions                  CHOICE {
        rrcResume                           RRCResume-IEs,
        criticalExtensionsFuture            SEQUENCE {}
    }
}

RRCResume-IEs ::=                   SEQUENCE {
    radioBearerConfig                   RadioBearerConfig                                   OPTIONAL, -- Need M
    masterCellGroup                     OCTET STRING (CONTAINING CellGroupConfig)           OPTIONAL, -- Need M
    measConfig                          MeasConfig                                          OPTIONAL, -- Need M
    fullConfig                          ENUMERATED {true}                                   OPTIONAL, -- Need N

    lateNonCriticalExtension            OCTET STRING                                        OPTIONAL,
    nonCriticalExtension                RRCResume-v1560-IEs                                 OPTIONAL
}

RRCResume-v1560-IEs ::=             SEQUENCE {
    radioBearerConfig2                  OCTET STRING (CONTAINING RadioBearerConfig)         OPTIONAL, -- Need M
    sk-Counter                          SK-Counter                                          OPTIONAL, -- Need N
    nonCriticalExtension                RRCResume-v1610-IEs                                 OPTIONAL
}

RRCResume-v1610-IEs ::=             SEQUENCE {
    idleModeMeasurementReq-r16          ENUMERATED {true}                                   OPTIONAL, -- Need N
    restoreMCG-SCells-r16               ENUMERATED {true}                                   OPTIONAL, -- Need N
    restoreSCG-r16                      ENUMERATED {true}                                   OPTIONAL, -- Need N
    mrdc-SecondaryCellGroup-r16         CHOICE {
        nr-SCG-r16                          OCTET STRING (CONTAINING RRCReconfiguration),
        eutra-SCG-r16                       OCTET STRING
    }                                                                                       OPTIONAL, -- Cond RestoreSCG
    needForGapsConfigNR-r16             SetupRelease {NeedForGapsConfigNR-r16}              OPTIONAL, -- Need M
    nonCriticalExtension                SEQUENCE{}                                          OPTIONAL
}

-- TAG-RRCRESUME-STOP
-- ASN1STOP
```

***RRCResume-IEs* field descriptions**
idleModeMeasurementReq This field indicates that the UE shall report the idle/inactive measurements to the network in the *RRCResumeComplete* message
masterCellGroup Configuration of the master cell group.
mrdc-SecondaryCellGroup Includes an RRC message for SCG configuration in NR-DC or NE-DC. For NR-DC (*nr-SCG*), *mrdc-SecondaryCellGroup* contains the *RRCReconfiguration* message as generated (entirely) by SN gNB. In this version of the specification, the RRC message only includes fields *secondaryCellGroup*, with at least *reconfigurationWithSync,* and *measConfig*. For NE-DC (*eutra-SCG*), *mrdc-SecondaryCellGroup* includes the E-UTRA *RRCConnectionReconfiguration* message as specified in TS 36.331 [10]. In this version of the specification, the E-UTRA RRC message only include the field *scg-Configuration* with at least *mobilityControlInfoSCG*.
needForGapsConfigNR Configuration for the UE to report measurement gap requirement information of NR target bands in the *RRCReconfigurationComplete* and *RRCResumeComplete* message.
radioBearerConfig Configuration of Radio Bearers (DRBs, SRBs) including SDAP/PDCP.
radioBearerConfig2 Configuration of Radio Bearers (DRBs, SRBs) including SDAP/PDCP. This field can only be used if the UE supports NR-DC or NE-DC.
restoreMCG-SCells Indicates that the UE shall restore the MCG SCells from the UE Inactive AS Context, if stored.
restoreSCG Indicates that the UE shall restore the SCG configurations from the UE Inactive AS Context, if stored.
sk-Counter A counter used to derive S-K_{gNB} or S-K_{eNB} based on the newly derived K_{gNB} during RRC Resume. The field is only included when there is one or more RB with *keyToUse* set to *secondary*.

Conditional Presence	Explanation
RestoreSCG	The field is mandatory present if *restoreSCG* 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 ::=                   SEQUENCE {
    rrc-TransactionIdentifier               RRC-TransactionIdentifier,
    criticalExtensions                      CHOICE {
        rrcResumeComplete                       RRCResumeComplete-IEs,
        criticalExtensionsFuture                SEQUENCE {}
    }
}

RRCResumeComplete-IEs ::=               SEQUENCE {
    dedicatedNAS-Message                    DedicatedNAS-Message                                    OPTIONAL,
    selectedPLMN-Identity                   INTEGER (1..maxPLMN)                                    OPTIONAL,
    uplinkTxDirectCurrentList               UplinkTxDirectCurrentList                               OPTIONAL,
    lateNonCriticalExtension                OCTET STRING                                            OPTIONAL,
    nonCriticalExtension                    RRCResumeComplete-v1610-IEs                             OPTIONAL
}

RRCResumeComplete-v1610-IEs ::=         SEQUENCE {
    idleMeasAvailable-r16                   ENUMERATED {true}                                       OPTIONAL,
    measResultIdleEUTRA-r16                 MeasResultIdleEUTRA-r16                                 OPTIONAL,
    measResultIdleNR-r16                    MeasResultIdleNR-r16                                    OPTIONAL,
    scg-Response-r16                         CHOICE {
        nr-SCG-Response                         OCTET STRING (CONTAINING RRCReconfigurationComplete),
        eutra-SCG-Response                      OCTET STRING
    }                                                                                               OPTIONAL,
    ueMeasurementsAvailable-r16             UEMeasurementsAvailable-r16                             OPTIONAL,
    mobilityHistoryAvail-r16                ENUMERATED {true}                                       OPTIONAL,
    mobilityState-r16                       ENUMERATED {normal, medium, high, spare}                OPTIONAL,
    needForGapsInfoNR-r16                   NeedForGapsInfoNR-r16                                   OPTIONAL,
    nonCriticalExtension                    SEQUENCE{}                                              OPTIONAL
}

-- TAG-RRCRESUMECOMPLETE-STOP
-- ASN1STOP
```

***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 *npn-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 ::=                        SEQUENCE {
    rrc-TransactionIdentifier           RRC-TransactionIdentifier,
    criticalExtensions                  CHOICE {
        rrcSetup                            RRCSetup-IEs,
        criticalExtensionsFuture            SEQUENCE {}
    }
}

RRCSetup-IEs ::=                    SEQUENCE {
    radioBearerConfig                   RadioBearerConfig,
    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))
    }                                                                                   OPTIONAL,
    lateNonCriticalExtension            OCTET STRING                                    OPTIONAL,
    nonCriticalExtension                RRCSetupComplete-v1610-IEs                      OPTIONAL
}

RRCSetupComplete-v1610-IEs ::=      SEQUENCE {
    iab-NodeIndication-r16              ENUMERATED {true}                               OPTIONAL,
    idleMeasAvailable-r16               ENUMERATED {true}                               OPTIONAL,
    ueMeasurementsAvailable-r16         UEMeasurementsAvailable-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
```

***RRCSetupComplete-IEs* field descriptions**
guami-Type This field is used to indicate whether the GUAMI included is native (derived from native 5G-GUTI) or mapped (from EPS, derived from EPS GUTI) as specified in TS 24.501 [23].
iab-NodeIndication- This field is used to indicate that the connection is being established by an IAB-node [2].
idleMeasAvailable Indication that the UE has idle/inactive measurement report available.
mobilityState 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 *medium* and *high* when being in Medium-mobility and High-mobility states respectively. Otherwise the UE indicates the value *normal*.
ng-5G-S-TMSI-Part2 The leftmost 9 bits of 5G-S-TMSI.
registeredAMF This field is used to transfer the GUAMI of the AMF where the UE is registered, as provided by upper layers, see TS 23.003 [21].
selectedPLMN-Identity Index of the PLMN or SNPN selected by the UE from the *plmn-IdentityList* or *npn-IdentityInfoList* fields included in SIB1.

– *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
}

RRCSetupRequest-IEs ::=           SEQUENCE {
    ue-Identity                       InitialUE-Identity,
    establishmentCause                EstablishmentCause,
    spare                             BIT STRING (SIZE (1))
}

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 {}
        }
    }
}

RRCSystemInfoRequest-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
```

***RRCSystemInfoRequest-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 ::=           SEQUENCE {
    failureReportSCG                        FailureReportSCG                    OPTIONAL,
    nonCriticalExtension                    SCGFailureInformation-v1590-IEs     OPTIONAL
}

SCGFailureInformation-v1590-IEs ::=      SEQUENCE {
    lateNonCriticalExtension              OCTET STRING                        OPTIONAL,
    nonCriticalExtension                  SEQUENCE {}                         OPTIONAL
}

FailureReportSCG ::=                     SEQUENCE {
    failureType                                 ENUMERATED {
                                                        t310-Expiry, randomAccessProblem,
                                                        rlc-MaxNumRetx,
                                                        synchReconfigFailureSCG, scg-ReconfigFailure,
                                                        srb3-IntegrityFailure, other-r16, spare1},
    measResultFreqList                       MeasResultFreqList                                     OPTIONAL,
    measResultSCG-Failure                   OCTET STRING (CONTAINING MeasResultSCG-Failure)              OPTIONAL,
    ...,
    [[
    locationInfo-r16                        LocationInfo-r16            OPTIONAL,
   failureType-v1610                      ENUMERATED {scg-lbtFailure-r16, beamFailureRecoveryFailure-r16, t312-Expiry-r16, bh-RLF-r16,
                                                      spare4, spare3, spare2, spare1}                    OPTIONAL
    ]]
}

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 ::=              SEQUENCE {
    criticalExtensions                              CHOICE {
        scgFailureInformationEUTRA                     SCGFailureInformationEUTRA-IEs,
        criticalExtensionsFuture                        SEQUENCE {}
    }
}

SCGFailureInformationEUTRA-IEs ::=          SEQUENCE {
    failureReportSCG-EUTRA                          FailureReportSCG-EUTRA                      OPTIONAL,
    nonCriticalExtension                             SCGFailureInformationEUTRA-v1590-IEs                                  OPTIONAL
}

SCGFailureInformationEUTRA-v1590-IEs ::=  SEQUENCE {
    lateNonCriticalExtension                OCTET STRING           OPTIONAL,
    nonCriticalExtension                             SEQUENCE {}                OPTIONAL
}

FailureReportSCG-EUTRA ::=                      SEQUENCE {
    failureType                                      ENUMERATED {
                                                           t313-Expiry, randomAccessProblem,
                                                           rlc-MaxNumRetx, scg-ChangeFailure,
                                                           scg-lbtFailure-r16, beamFailureRecoveryFailure-r16,
                                                       t312-Expiry-r16, spare},
    measResultFreqListMRDC                           MeasResultFreqListFailMRDC                                    OPTIONAL,
    measResultSCG-FailureMRDC                       OCTET STRING                                                  OPTIONAL,
    ...,
    [[
    locationInfo-r16                                 LocationInfo-r16                                              OPTIONAL
    ]]
}

MeasResultFreqListFailMRDC ::=      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 ::=             SEQUENCE {
    rrc-TransactionIdentifier           RRC-TransactionIdentifier,
    criticalExtensions                  CHOICE {
        securityModeCommand                 SecurityModeCommand-IEs,
        criticalExtensionsFuture            SEQUENCE {}
    }
}

SecurityModeCommand-IEs ::=         SEQUENCE {
    securityConfigSMC                   SecurityConfigSMC,

    lateNonCriticalExtension            OCTET STRING                                    OPTIONAL,
    nonCriticalExtension                SEQUENCE{}                                      OPTIONAL
}

SecurityConfigSMC ::=               SEQUENCE {
    securityAlgorithmConfig             SecurityAlgorithmConfig,
    ...
}

-- 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 ::=            SEQUENCE {
    rrc-TransactionIdentifier           RRC-TransactionIdentifier,
    criticalExtensions                  CHOICE {
        securityModeComplete                SecurityModeComplete-IEs,
        criticalExtensionsFuture            SEQUENCE {}
    }
}

SecurityModeComplete-IEs ::=        SEQUENCE {
    lateNonCriticalExtension            OCTET STRING                                    OPTIONAL,
    nonCriticalExtension                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 ::=             SEQUENCE {
    rrc-TransactionIdentifier           RRC-TransactionIdentifier,
    criticalExtensions                  CHOICE {
        securityModeFailure                 SecurityModeFailure-IEs,
        criticalExtensionsFuture            SEQUENCE {}
    }
}

SecurityModeFailure-IEs ::=         SEQUENCE {
    lateNonCriticalExtension            OCTET STRING                                    OPTIONAL,
    nonCriticalExtension                SEQUENCE{}                                      OPTIONAL
}

-- TAG-SECURITYMODEFAILURE-STOP
-- ASN1STOP
```

– *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
    }                                                                               OPTIONAL,   -- Cond Standalone
    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
        }                                                                                                       OPTIONAL    -- Need S
    }                                                                                                       OPTIONAL,   -- Need R
    useFullResumeID                     ENUMERATED {true}                                                   OPTIONAL,   -- Need R
    lateNonCriticalExtension            OCTET STRING                                                        OPTIONAL,
    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
```

***SIB1* field descriptions**
cellSelectionInfo Parameters for cell selection related to the serving cell.
eCallOverIMS-Support 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.
idleModeMeasurementsEUTRA 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.
idleModeMeasurementsNR 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.
ims-EmergencySupport 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.
q-QualMin Parameter "$Q_{qualmin}$" in TS 38.304 [20], applicable for serving cell. If the field is absent, the UE applies the (default) value of negative infinity for $Q_{qualmin}$.
q-QualMinOffset Parameter "$Q_{qualminoffset}$" in TS 38.304 [20]. Actual value $Q_{qualminoffset}$ = field value [dB]. If the field is absent, the UE applies the (default) value of 0 dB for $Q_{qualminoffset}$. Affects the minimum required quality level in the cell.
q-RxLevMin Parameter "$Q_{rxlevmin}$" in TS 38.304 [20], applicable for serving cell.
q-RxLevMinOffset Parameter "$Q_{rxlevminoffset}$" in TS 38.304 [20]. Actual value $Q_{rxlevminoffset}$ = field value * 2 [dB]. If absent, the UE applies the (default) value of 0 dB for $Q_{rxlevminoffset}$. Affects the minimum required Rx level in the cell.
q-RxLevMinSUL Parameter "$Q_{rxlevmin}$" in TS 38.304 [20], applicable for serving cell.
servingCellConfigCommon Configuration of the serving cell.
uac-AccessCategory1-SelectionAssistanceInfo Information used to determine whether Access Category 1 applies to the UE, as defined in TS 22.261 [25].
uac-BarringForCommon Common access control parameters for each access category. Common values are used for all PLMNs, unless overwritten by the PLMN specific configuration provided in *uac-BarringPerPLMN-List*. The parameters are specified by providing an index to the set of configurations (*uac-BarringInfoSetList*). UE behaviour upon absence of this field is specified in clause 5.3.14.2.
ue-TimersAndConstants Timer and constant values to be used by the UE. The cell operating as PCell always provides this field.
useFullResumeID Indicates which resume identifier and Resume request message should be used. UE uses *fullI-RNTI* and *RRCResumeRequest1* if the field is present, or *shortI-RNTI* and *RRCResumeRequest* if the field is absent.

Conditional Presence	Explanation
Standalone	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          SidelinkUEInformationNR-r16-IEs,
        criticalExtensionsFuture             SEQUENCE {}
    }
}

SidelinkUEInformationNR-r16-IEs ::=     SEQUENCE {
    sl-RxInterestedFreqList-r16             SL-InterestedFreqList-r16           OPTIONAL,
    sl-TxResourceReqList-r16                SL-TxResourceReqList-r16            OPTIONAL,
    sl-FailureList-r16                      SL-FailureList-r16                  OPTIONAL,
    lateNonCriticalExtension                OCTET STRING                        OPTIONAL,
    nonCriticalExtension                    SEQUENCE {}                         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-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-FlowIdentity-r16,
    sl-QoS-Profile-r16                      SL-QoS-Profile-r16                                                          OPTIONAL
}
```

```
SL-RLC-ModeIndication-r16 ::=          SEQUENCE {
    sl-Mode-r16                            CHOICE  {
        sl-AM-Mode-r16                         NULL,
        sl-UM-Mode-r16                         NULL
    },
    sl-QoS-InfoList-r16                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 Paramters to request the transmisison resouces for NR sidelink communication to the network in the Sidelink UE Information report.

***SL-TxResourceReq* field descriptions**
sl-CapabilityInformationSidelink Includes the *UECapabilityInformationSidelink* message (which can be also included in *ueCapabilityInformationSidelink-r16* in *UECapabilityEnquirySidelink* from peer UE) received from the peer UE.
sl-CastType Indicates the cast type for the correponding destination for which to request the resource.
sl-DestinationIdentity Indicates the destination for which the TX resource request and allocation from the network are concerned.
sl-QoS-InfoList Includes the QoS profile of the sidelink QoS flow as specified in TS 23.287 [55]
sl-QoS-FlowIdentity 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.
sl-RLC-ModeIndication 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 sl-QoS-FlowIdentity.
sl-TxInterestedFreqList 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 *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. In this relase, only one entry can be included in the list.
sl-TypeTxSyncList 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 *sl-TxInterestedFreqList*, i.e. one for each carrier freqeuncy included in *sl-TxInterestedFreqList*.

***SL-Failure* field descriptions**
sl-DestinationIdentity Indicates the destination for which the SL failure is reporting for unicast.
sl-Failure Indicates the sidelink RLF (value *rlf*) for the associated destination for unicast, when the sidelink RLF is detected. Indicates the sidelink AS configuration failure (value *configFailure*) for the associated destination for unicast, in case of PC5-RRC AS configuration failure by receiving *RRCReconfigurationFailureSidelink*.

– *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 ::=               SEQUENCE {
    criticalExtensions                  CHOICE {
        systemInformation                   SystemInformation-IEs,
        criticalExtensionsFuture-r16    CHOICE {
            posSystemInformation-r16        PosSystemInformation-r16-IEs,
            criticalExtensionsFuture        SEQUENCE {}
        }
    }
}

SystemInformation-IEs ::=           SEQUENCE {
    sib-TypeAndInfo                     SEQUENCE (SIZE (1..maxSIB)) OF CHOICE {
        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 ::=                  SEQUENCE {
    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 {sl1, sl2, sl4, sl6}             OPTIONAL,
        preferredK0-SCS-30kHz-r16             ENUMERATED {sl1, sl2, sl4, sl6}             OPTIONAL,
        preferredK0-SCS-60kHz-r16             ENUMERATED {sl2, sl4, sl8, sl12}            OPTIONAL,
        preferredK0-SCS-120kHz-r16            ENUMERATED {sl2, sl4, sl8, sl12}            OPTIONAL
    }                                                                                   OPTIONAL,
    preferredK2-r16                       SEQUENCE {
        preferredK2-SCS-15kHz-r16             ENUMERATED {sl1, sl2, sl4, sl6}           OPTIONAL,
        preferredK2-SCS-30kHz-r16             ENUMERATED {sl1, sl2, sl4, sl6}           OPTIONAL,
        preferredK2-SCS-60kHz-r16             ENUMERATED {sl2, sl4, sl8, sl12}          OPTIONAL,
        preferredK2-SCS-120kHz-r16            ENUMERATED {sl2, sl4, sl8, sl12}          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
```

***UEAssistanceInformation* field descriptions**
affectedCarrierFreqList Indicates a list of NR carrier frequencies that are affected by IDC problem.
affectedCarrierFreqCombList Indicates a list of NR carrier frequencie combinations that are affected by IDC problems due to Inter-Modulation Distortion and harmonics from NR when configured with UL CA.
delayBudgetReport Indicates the UE-preferred adjustment to connected mode DRX.
interferenceDirection Indicates the direction of IDC interference. Value *nr* indicates that only NR is victim of IDC interference, value *other* indicates that only another radio is victim of IDC interference and value *both* 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]).
messageSize 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.
minSchedulingOffsetPreference Indicates the UE's preferences on *minimumSchedulingOffset* of cross-slot scheduling for power saving.
preferredDRX-InactivityTimer Indicates the UE's preferred DRX inactivity timer length for power saving. Value in ms (milliSecond). *ms0* corresponds to 0, *ms1* corresponds to 1 ms, *ms2* corresponds to 2 ms, and so on. If the field is absent from the *DRX-Preference* IE, it is interpreted as the UE having no preference for the DRX inactivity timer.
preferredDRX-LongCycle Indicates the UE's preferred long DRX cycle length for power saving. Value in ms. *ms10* corresponds to 10ms, *ms20* corresponds to 20 ms, *ms32* corresponds to 32 ms, and so on. If *preferredDRX-ShortCycle* is provided, the value of *preferredDRX-LongCycle* shall be a multiple of the *preferredDRX-ShortCycle* value. If the field is absent from the *DRX-Preference* IE, it is interpreted as the UE having no preference for the long DRX cycle.
preferredDRX-ShortCycle Indicates the UE's preferred short DRX cycle length for power saving. Value in ms. *ms2* corresponds to 2ms, *ms3* corresponds to 3 ms, *ms4* corresponds to 4 ms, and so on. If the field is absent from the *DRX-Preference* IE, it is interpreted as the UE having no preference for the short DRX cycle.
preferredDRX-ShortCycleTimer Indicates the UE's preferred short DRX cycle timer for power saving. Value in multiples of *preferredDRX-ShortCycle*. A value of 1 corresponds to *preferredDRX-ShortCycle*, a value of 2 corresponds to 2 * *preferredDRX-ShortCycle* and so on. If the field is absent from the *DRX-Preference* IE, it is interpreted as the UE having no preference for the short DRX cycle timer.
preferredK0 Indicates the UE's preferred value of *k0* (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. *sl1* corresponds to 1 slot, *sl2* corresponds to 2 slots, *sl4* 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 *k0* for cross-slot scheduling for that subcarrier spacing. If the field is absent from the *MinSchedulingOffsetPreference* IE, it is interpreted as the UE having no preference on *k0* for cross-slot scheduling.
preferredK2 Indicates the UE's preferred value of *k2* (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. *sl1* corresponds to 1 slot, *sl2* corresponds to 2 slots, *sl4* 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 *k2* for cross-slot scheduling for that subcarrier spacing. If the field is absent from the *MinSchedulingOffsetPreference* IE, it is interpreted as the UE having no preference on *k2* for cross-slot scheduling.
preferredRRC-State Indicates the UE's preferred RRC state. The value *idle* is indicated if the UE prefers to be released from RRC_CONNECTED and transition to RRC_IDLE. The value *inactive* is indicated if the UE prefers to be released from RRC_CONNECTED and transition to RRC_INACTIVE. The value *connected* is indicated if the UE prefers to revert an earlier indication to leave RRC_CONNECTED state. The value *outOfConnected* is indicated if the UE prefers to be released from RRC_CONNECTED and has no preferred RRC state to transition to. The value *connected* can only be indicated if the UE is configured with *connectedReporting*.

***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.

***UEAssistanceInformation* field descriptions**
reducedMIMO-LayersFR2-DL 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.
reducedMIMO-LayersFR2-UL 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.
referenceTimeInfoPreference Indicates whether the UE prefers being provisioned with the timing information specified in the IE *ReferenceTimeInfo*.
sl-QoS-FlowIdentity 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.
sl-UE-AssistanceInformationNR indicates the traffic characteristic of sidelink logical channel(s) that are setup for NR sidelink communication,
timingOffset 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.
trafficPeriodicity This field indicates the estimated data arrival periodicity in a SL logical channel. Value ms20 corresponds to 20 ms, ms50 corresponds to 50 ms and so on.
type1 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 *ms40* corresponds to 40 milliseconds, *msMinus40* corresponds to -40 milliseconds and so on.
victimSystemType Indicate the list of victim system types to which IDC interference is caused from NR when configured with UL CA. Value *gps*, *glonass*, *bds*, *galileo* and *navIC* indicates the type of GNSS. Value *wlan* indicates WLAN and value *bluetooth* indicates Bluetooth.

– *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* information element**

```
-- ASN1START
-- TAG-UECAPABILITYENQUIRY-START
```

```
UECapabilityEnquiry ::=             SEQUENCE {
    rrc-TransactionIdentifier           RRC-TransactionIdentifier,
    criticalExtensions                  CHOICE {
        ueCapabilityEnquiry                 UECapabilityEnquiry-IEs,
        criticalExtensionsFuture            SEQUENCE {}
    }
}

UECapabilityEnquiry-IEs ::=         SEQUENCE {
    ue-CapabilityRAT-RequestList        UE-CapabilityRAT-RequestList,
    lateNonCriticalExtension            OCTET STRING                                                OPTIONAL,
    ue-CapabilityEnquiryExt             OCTET STRING (CONTAINING UECapabilityEnquiry-v1560-IEs)      OPTIONAL
}

UECapabilityEnquiry-v1560-IEs ::=   SEQUENCE {
    capabilityRequestFilterCommon       UE-CapabilityRequestFilterCommon                            OPTIONAL, -- Need N
    nonCriticalExtension                UECapabilityEnquiry-v1610-IEs                               OPTIONAL
}

UECapabilityEnquiry-v1610-IEs ::=   SEQUENCE {
    rrc-SegAllowed-r16                    ENUMERATED {enabled}          OPTIONAL, -- Need N
    nonCriticalExtension                SEQUENCE {}                   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 information element

```
-- ASN1START
-- TAG-UECAPABILITYINFORMATION-START

UECapabilityInformation ::=         SEQUENCE {
    rrc-TransactionIdentifier           RRC-TransactionIdentifier,
    criticalExtensions                  CHOICE {
        ueCapabilityInformation             UECapabilityInformation-IEs,
        criticalExtensionsFuture            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
```

***UEInformationRequest-IEs* field descriptions**
connEstFailReportReq This field is used to indicate whether the UE shall report information about the connection failure.
idleModeMeasurementReq This field indicates that the UE shall report the idle/inactive measurement information, if available, to the network in the *UEInformationResponse* message.
logMeasReportReq This field is used to indicate whether the UE shall report information about logged measurements.
mobilityHistoryReportReq This field is used to indicate whether the UE shall report information about mobility history information.
ra-ReportReq This field is used to indicate whether the UE shall report information about the random access procedure.
rlf-ReportReq This field is used to indicate whether the UE shall report information about the radio link failure.

– *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 ::=       SEQUENCE {
    rrc-TransactionIdentifier           RRC-TransactionIdentifier,
    criticalExtensions                  CHOICE {
        ueInformationResponse-r16           UEInformationResponse-r16-IEs,
        criticalExtensionsFuture            SEQUENCE {}
    }
}

UEInformationResponse-r16-IEs ::=   SEQUENCE {
    measResultIdleEUTRA-r16             MeasResultIdleEUTRA-r16             OPTIONAL,
    measResultIdleNR-r16                MeasResultIdleNR-r16                OPTIONAL,
    logMeasReport-r16                   LogMeasReport-r16                   OPTIONAL,
    connEstFailReport-r16               ConnEstFailReport-r16               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 ::=               SEQUENCE {
    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 ::=                 SEQUENCE {
    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)
    }                                                                       OPTIONAL
}
```

```
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                            CGI-Info-Logging-r16,
    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
        }                                                                   OPTIONAL,
        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 MeasResultListLoggingNR-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
        }                                                                             OPTIONAL
    }
}

TimeSinceFailure-r16 ::= INTEGER (0..172800)

MobilityHistoryReport-r16 ::= VisitedCellInfoList-r16

TimeUntilReconnection-16 ::= INTEGER (0..172800)
```

```
-- TAG-UEINFORMATIONRESPONSE-STOP
-- ASN1STOP
```

***UEInformationResponse-IEs* field descriptions**
logMeasReport This field is used to provide the measurement results stored by the UE associated to logged MDT.
measResultIdleEUTRA EUTRA measurement results performed during RRC_INACTIVE or RRC_IDLE.
measResultIdleNR NR measurement results performed during RRC_INACTIVE or RRC_IDLE.
ra-Report This field is used to provide the list of RA reports that is stored by the UE for the past upto *maxRAReport-r16* number of successful random access procedues.
rlf-Report This field is used to indicated the RLF report related contents.

***LogMeasReport* field descriptions**
absoluteTimeStamp Indicates the absolute time when the logged measurement configuration logging is provided, as indicated by E-UTRAN within *absoluteTimeInfo*.
logMeasResultListBT This field refers to the Bluetooth measurement results.
logMeasResultListWLAN This field refers to the WLAN measurement results.
measResultServCell This field refers to the log measurement results taken in the Serving cell.
relativeTimeStamp Indicates the time of logging measurement results, measured relative to the *absoluteTimeStamp*. Value in seconds.
tce-Id Parameter Trace Collection Entity Id: See TS 32.422 [52].
timeStamp Includes time stamps for the waypoints that describe planned locations for the UE.
traceRecordingSessionRef Parameter Trace Recording Session Reference: See TS 32.422 [52].

***ConnEstFailReport* field descriptions**
measResultFailedCell This field refers to the last measurement results taken in the cell, where connection establishment failure or connection resume failure happened.
measResultNeighCells This field refers to the neighbour cell measurements when connection establishment failure or connection resume failure happened.
numberOfConnFail 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.
numberOfPreamblesSent This field is used to indicate the number of random access preambles that were transmitted.
maxTxPowerReached This field is used to indicate whether or not the maximum power level was used for the last transmitted preamble.
timeSinceFailure 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.

***RA-Report* field descriptions**
absoluteFrequencyPointA
This field indicates the absolute frequency position of the reference resource block (Common RB 0).
cellID
This field indicates the CGI of the cell in which the associated random access procedure was performed.
contentionDetected
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 *ra-Purpose* is set to *requestForOtherSI*.
csi-RS-Index
This field is used to indicate the CSI-RS index corresponding to the random access attempt.
dlRSRPAboveThreshold
This field is used to indicate whether the DL beam (SSB) quality associated to the random access attempt was above or below the threshold (*rsrp-ThresholdSSB* in *beamFailureRecoveryConfig* in UL BWP configuration of UL BWP selected for random access procedure initiated for beam failure recovery; Otherwise, *rsrp-ThresholdSSB* in *rach-ConfigCommon* in UL BWP configuration of UL BWP selected for random access procedure.
locationAndBandwidth
Frequency domain location and bandwidth of the bandwidth part associated to the random-access resources used by the UE.
numberOfPreamblesSentOnCSI-RS
This field is used to indicate the total number of successive RA preambles that were transmitted on the corresponding CSI-RS.
numberOfPreamblesSentOnSSB
This field is used to indicate the total number of successive RA preambles that were transmitted on the corresponding SSB/PBCH block.
perRAAttemptInfoList
This field provides detailed information about a random access attempt.
perRAInfoList
This field provides detailed information about each of the random access attempts in the chronological order of the random access attempts.
perRACSI-RSInfoList
This field provides detailed information about the successive random acess attempts associated to the same CSI-RS.
perRASSBInfoList
This field provides detailed information about the successive random access attempts associated to the same SS/PBCH block.
raPurpose
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 *beamFailureRecovery* is used in case of beam failure recovery failure in the SpCell [3]. The indicator *reconfigurationWithSync* is used if the UE executes a reconfiguration with sync. The indicator *ulUnSynchronized* is used if the random access procedure is initiated in a serving cell by DL or UL data arrival during RRC_CONNECTED when the timeAlignmentTimer is not running in the TAG of the concerned serving cell or by a PDCCH order [3]. The indicator *schedulingRequestFailure* is used in case of SR failures [3]. The indicator *noSRPUCCHResourceAvailable* is used when the UE has no valid SR PUCCH resources configured [3]. The indicator *requestForOtherSI* is used for MSG1 based on demand SI request.
ra-InformationCommon
This field is used to indicate the common random-access related information between *RA-report* and *RLF-report*. For RA report, this field is mandatory presented. For *RLF-report*, this field is optionally included when c*onnectionFailureType* is set to 'hof' or when *connectionFailureType* is set to 'rlf' and the *rlf-Cause* equals to 'randomAccessProblem' or 'beamRecoveryFailure'; otherwise this field is absent.
ssb-Index
This field is used to indicate the SS/PBCH index of the SS/PBCH block corresponding to the random access attempt.
ssbRSRPQualityIndicator
This field is used to indicate the SS/PBCH RSRP of the SS/PBCH block corresponding to the random access attempt is above *rsrp-ThresholdSSB* or not.
subcarrierSpacing
Subcarrier spacing used in the BWP associated to the random-access resources used by the UE.

***RLF-Report* field descriptions**
connectionFailureType This field is used to indicate whether the connection failure is due to radio link failure or handover failure.
csi-rsRLMConfigBitmap This field is used to indicate the CSI-RS indexes that are also part of the RLM configurations.
c-RNTI 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.
failedPCellId 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 *nrFailedPCellId* is included and for the handover from NR to EUTRA *eutraFailedPCellId* is included. The UE sets the ARFCN according to the frequency band used for transmission/ reception when the failure occurred.
failedPCellId-EUTRA 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.
measResultLastServCell This field refers to the last measurement results taken in the PCell, where radio link failure or handover failure happened.
measResultListEUTRA This field refers to the last measurement results taken in the neighboring EUTRA Cells, when the radio link failure or handover failure happened.
measResultListNR This field refers to the last measurement results taken in the neighboring NR Cells, when the radio link failure or handover failure happened.
measResultServCell This field refers to the log measurement results taken in the Serving cell.
measResult-RLF-Report-EUTRA Includes the E-UTRA *RLF-Report-r9* IE as specified in TS 36.331 [10].
noSuitableCellFound This field is set by the UE when the T311 expires.
previousPCellId This field is used to indicate the source PCell of the last handover (source PCell when the last *RRCReconfiguration* message including *reconfigurationWithSync* was received). For intra-NR handover *nrPreviousCell* is included and for the handover from EUTRA to NR *eutraPreviousCell* is included.
reconnectCellId 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 *nrReconnectCellID* is included and if the UE comes back to RRC CONNECTED in an LTE cell then *eutraReconnectCellID* is included
reestablishmentCellId This field is used to indicate the cell in which the re-establishment attempt was made after connection failure.
rlf-Cause 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 *connectionFailureType* is set to '*hof*'), the UE is allowed to set this field to any value.
ssbRLMConfigBitmap This field is used to indicate the SS/PBCH block indexes that are also part of the RLM configurations.
timeConnFailure 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.
timeSinceFailure 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.

timeUntilReconnection
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.

– *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-MessageSegmentTypeIndicates 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 ::=           SEQUENCE {
    criticalExtensions                  CHOICE {
        ulInformationTransfer               ULInformationTransfer-IEs,
        criticalExtensionsFuture            SEQUENCE {}
    }
}

ULInformationTransfer-IEs ::=       SEQUENCE {
    dedicatedNAS-Message                DedicatedNAS-Message                OPTIONAL,
    lateNonCriticalExtension            OCTET STRING                        OPTIONAL,
    nonCriticalExtension                SEQUENCE {}                         OPTIONAL
}

-- TAG-ULINFORMATIONTRANSFER-STOP
-- ASN1STOP
```

– *ULInformationTransferIRAT*

The *ULInformationTransferIRAT* message is used for the uplink transfer of information terminated at NR MCG but specified by anoher 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 ::=             SEQUENCE {
    criticalExtensions                              CHOICE {
        c1                                                CHOICE {
            ulInformationTransferIRAT-r16                 ULInformationTransferIRAT-r16-IEs,
            spare3 NULL, spare2 NULL, spare1 NULL
        },
        criticalExtensionsFuture                    SEQUENCE {}
    }
}

ULInformationTransferIRAT-r16-IEs ::=       SEQUENCE {
    ul-DCCH-MessageEUTRA-r16                      OCTET STRING             OPTIONAL,
    lateNonCriticalExtension                      OCTET STRING             OPTIONAL,
    nonCriticalExtension                            SEQUENCE {}             OPTIONAL
}

-- TAG-ULINFORMATIONTRANSFERIRAT-STOP
-- ASN1STOP
```

ULInformationTransferIRAT field descriptions
ul-DCCH-MessageEUTRA   Includes the *UL-DCCH-Message* as defined in TS 38.331 [82]. In this version of the specification, the field is only used to transfer the LTE RRC *MeasurementReport*, LTE RRC *SidelinkUEInformation* and the LTE 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 ::=               SEQUENCE {
    criticalExtensions                          CHOICE {
        c1                                          CHOICE {
            ulInformationTransferMRDC                   ULInformationTransferMRDC-IEs,
            spare3 NULL, spare2 NULL, spare1 NULL
        },
        criticalExtensionsFuture            SEQUENCE {}
    }
}

ULInformationTransferMRDC-IEs::=            SEQUENCE {
    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, 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
        smtc                                SSB-MTC                                     OPTIONAL,       -- Need S
        ss-RSSI-Measurement                 SS-RSSI-Measurement                         OPTIONAL,       -- Need R
        ssb-ToMeasure                       SSB-ToMeasure                               OPTIONAL,       -- Need S
        deriveSSB-IndexFromCell             BOOLEAN,
        ...,
        [[
        t-ReselectionNR-SF                  SpeedStateScaleFactors                      OPTIONAL        -- Need N
        ]],
        [[
        smtc2-LP-r16                        SSB-MTC2-LP-r16                             OPTIONAL,        -- Need R
        ssb-PositionQCL-Common-r16          SSB-PositionQCL-Relation-r16                OPTIONAL         -- Cond SharedSpectrum
        ]]
    },
    ...,
    [[
    relaxedMeasurement-r16              SEQUENCE {
        lowMobilityEvaluation-r16           SEQUENCE {
            s-SearchDeltaP-r16                  ENUMERATED {
                                                    dB3, dB6, dB9, dB12, dB15,
                                                    spare3, spare2, spare1},
            t-SearchDeltaP-r16                  ENUMERATED {
                                                    s5, s10, s20, s30, s60, s120, s180,
                                                    s240, s300, spare7, spare6, spare5,
                                                    spare4, spare3, spare2, spare1}
        }                                                                               OPTIONAL,       -- Need R
        cellEdgeEvaluation-r16              SEQUENCE {
            s-SearchThresholdP-r16              ReselectionThreshold,
            s-SearchThresholdQ-r16              ReselectionThresholdQ                   OPTIONAL        -- Need R
        }                                                                               OPTIONAL,       -- Need R
        combineRelaxedMeasCondition-r16     ENUMERATED {true}                           OPTIONAL,       -- Need R
        highPriorityMeasRelax-r16           ENUMERATED {true}                           OPTIONAL        -- Need R
    }                                                                                   OPTIONAL        -- Need R
    ]]
}

RangeToBestCell    ::= Q-OffsetRange

-- TAG-SIB2-STOP
-- ASN1STOP
```

***SIB2* field descriptions**
absThreshSS-BlocksConsolidation
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].
cellEdgeEvaluation
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).
cellReselectionInfoCommon
Cell re-selection information common for intra-frequency, inter-frequency and/ or inter-RAT cell re-selection.
cellReselectionServingFreqInfo
Information common for non-intra-frequency cell re-selection i.e. cell re-selection to inter-frequency and inter-RAT cells.
combineRelaxedMeasCondition
When both *lowMobilityEvalutation* and *cellEdgeEvalutation* 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)
deriveSSB-IndexFromCell
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 *true*, the UE assumes SFN and frame boundary alignment across cells on the serving frequency as specified in TS 38.133 [14].
frequencyBandList
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.
highPriorityMeasRelax
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 "$T_{higher\_priority\_search}$" (see TS 38.133 [14], clause 4.2.2.7).
intraFreqCellReselectionInfo
Cell re-selection information common for intra-frequency cells.
lowMobilityEvaluation
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).
nrofSS-BlocksToAverage
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-Max
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 *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].
q-Hyst
Parameter "Q_{hyst}" in TS 38.304 [20], Value in dB. Value *dB1* corresponds to 1 dB, *dB2* corresponds to 2 dB and so on.
q-HystSF
Parameter "Speed dependent ScalingFactor for Qhyst" in TS 38.304 [20]. The *sf-Medium* and *sf-High* concern the additional hysteresis to be applied, in Medium and High Mobility state respectively, to Qhyst as defined in TS 38.304 [20]. In dB. Value *dB-6* corresponds to -6dB, *dB-4* corresponds to -4dB and so on.
q-QualMin
Parameter "$Q_{qualmin}$" 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 $Q_{qualmin}$.
q-RxLevMin
Parameter "$Q_{rxlevmin}$" in TS 38.304 [20], applicable for intra-frequency neighbour cells.
q-RxLevMinSUL
Parameter "$Q_{rxlevmin}$" in TS 38.304 [20], applicable for intra-frequency neighbour cells.
rangeToBestCell
Parameter "rangeToBestCell" in TS 38.304 [20]. The network configures only non-negative (in dB) values.
relaxedMeasurement
Configuration to allow relaxation of RRM measurement requirements for cell reselection (see TS 38.304 [20], clause 5.2.4.X).

***SIB2* field descriptions**
s-IntraSearchP Parameter "$S_{IntraSearchP}$" in TS 38.304 [20].
s-IntraSearchQ Parameter "$S_{IntraSearchQ}$" in TS 38.304 [20]. If the field is absent, the UE applies the (default) value of 0 dB for $S_{IntraSearchQ}$.
s-NonIntraSearchP Parameter "$S_{nonIntraSearchP}$" in TS 38.304 [20]. If this field is absent, the UE applies the (default) value of infinity for $S_{nonIntraSearchP}$.
s-NonIntraSearchQ Parameter "$S_{nonIntraSearchQ}$" in TS 38.304 [20]. If the field is absent, the UE applies the (default) value of 0 dB for $S_{nonIntraSearchQ}$.
s-SearchDeltaP Parameter "$S_{SearchDeltaP}$" in TS 38.304 [20]. Value dB3 corresponds to 3 dB, dB6 corresponds to 6 dB and so on.
s-SearchThresholdP Parameter "$S_{SearchThresholdP}$" in TS 38.304 [20]. The network configures *s-SearchThresholdP* to be less than or equal to *s-IntraSearchP* and *s-NonIntraSearchP*.
s-SearchThresholdQ Parameter "$S_{SearchThresholdQ}$" in TS 38.304 [20]. The network configures *s-SearchThresholdQ* to be less than or equal to *s-IntraSearchQ* and *s-NonIntraSearchQ*.
smtc Measurement timing configuration for intra-frequency measurement. If this field is absent, the UE assumes that SSB periodicity is 5 ms for the intra-frequnecy cells.
smtc2-LP-r16 Measurement timing configuration for intra-frequency neighbour cells with a Long Periodicity (LP) indicated by periodicity in *smtc2-LP-r16*. The timing offset and duration are equal to the offset and duration indicated in *smtc* in *intraFreqCellReselectionInfo*. The periodicity in *smtc2-LP-r16* can only be set to a value strictly larger than the periodicity in *smtc* in *intraFreqCellReselectionInfo* (e.g. if *smtc* indicates sf20 the Long Periodicity can only be set to sf40, sf80 or sf160, if *smtc* indicates sf160, *smtc2-LP-r16* cannot be configured). The *pci-List*, if present, includes the physical cell identities of the intra-frequency neighbour cells with Long Periodicity. If *smtc2-LP-r16* is absent, the UE assumes that there are no intra-frequency neighbour cells with a Long Periodicity.
ssb-PositionQCL-Common Indicates the QCL relationship between SS/PBCH blocks for intra-frequency neighbor cells as specified in TS 38.213 [13], clause 4.1.
ssb-ToMeasure 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.
t-ReselectionNR Parameter "$T_{reselectionNR}$" in TS 38.304 [20].
t-ReselectionNR-SF Parameter "Speed dependent ScalingFactor for $T_{reselectionNR}$" in TS 38.304 [20]. If the field is absent, the UE behaviour is specified in TS 38.304 [20].
threshServingLowP Parameter "$Thresh_{Serving, LowP}$" in TS 38.304 [20].
threshServingLowQ Parameter "$Thresh_{Serving, LowQ}$" in TS 38.304 [20].
t-SearchDeltaP Parameter "$T_{SearchDeltaP}$" in TS 38.304 [20]. Value in seconds. Value *s5* means 5 seconds, value *s10* means 10 seconds and so on.

Conditional Presence	Explanation
SharedSpectrum	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 ::=                            SEQUENCE {
    intraFreqNeighCellList              IntraFreqNeighCellList                                  OPTIONAL,   -- Need R
    intraFreqBlackCellList              IntraFreqBlackCellList                                  OPTIONAL,   -- Need R
    lateNonCriticalExtension            OCTET STRING                                            OPTIONAL,
    ...,
    [[
    intraFreqNeighCellList-v1610        IntraFreqNeighCellList-v1610                            OPTIONAL,   -- Need R
    intraFreqWhiteCellList-r16          IntraFreqWhiteCellList-r16                              OPTIONAL,   -- Cond SharedSpectrum2
    intraFreqCAG-CellList-r16           SEQUENCE (SIZE (1..maxPLMN)) OF IntraFreqCAG-CellPerPLMN-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-CellPerPLMN-r16 ::=    SEQUENCE {
    plmn-IdentityIndex-r16              INTEGER (1..maxPLMN),
    cag-CellList-r16                    SEQUENCE (SIZE (1..maxCAG-Cell-r16)) OF PCI-Range
}

-- TAG-SIB3-STOP
-- ASN1STOP
```

***SIB3* field descriptions**
intraFreqBlackCellList List of blacklisted intra-frequency neighbouring cells.
intraFreqCAG-CellList List of intra-frequency neighbouring CAG cells (as defined in TS 38.304 [20]) per PLMN.
intraFreqNeighCellList List of intra-frequency neighbouring cells with specific cell re-selection parameters. If *intraFreqNeighCellList-v1610* is present, it shall contain the same number of entries, listed in the same order as in *intraFreqNeighCellList* (without suffix).
intraFreqWhiteCellList List of whitelisted intra-frequency neighbouring cells, see TS 38.304 [20], clause 5.2.4.
q-OffsetCell Parameter "$Qoffset_{s,n}$" in TS 38.304 [20].
q-QualMinOffsetCell Parameter "$Q_{qualminoffsetcell}$" in TS 38.304 [20]. Actual value $Q_{qualminoffsetcell}$ = field value [dB].
q-RxLevMinOffsetCell Parameter "$Q_{rxlevminoffsetcell}$" in TS 38.304 [20]. Actual value $Q_{rxlevminoffsetcell}$ = field value * 2 [dB].
q-RxLevMinOffsetCellSUL Parameter "$Q_{rxlevminoffsetcellSUL}$" in TS 38.304 [20]. Actual value $Q_{rxlevminoffsetcellSUL}$ = field value * 2 [dB].
ssb-PositionQCL 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 *ssb-PositionQCL-Common* in *SIB2* for the indicated cell.

Conditional Presence	Explanation
SharedSpectrum2	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 only for inter-frequency cell re-selection i.e. information about other NR frequencies and inter-frequency neighbouring cells relevant for cell re-selection. The IE includes cell re-selection parameters common for a frequency as well as cell specific re-selection parameters.

***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-CellList-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

    ...
}
```

```
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-CellList-r16 ::=       SEQUENCE {
    plmn-IdentityIndex-r16              INTEGER (1..maxPLMN),
    cag-CellList-r16                    SEQUENCE (SIZE (1..maxCAG-Cell-r16)) OF PCI-Range
}

-- TAG-SIB4-STOP
-- ASN1STOP
```

***SIB4* field descriptions**
absThreshSS-BlocksConsolidation 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].
deriveSSB-IndexFromCell 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].
dl-CarrierFreq 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].
frequencyBandList Indicates the list of frequency bands for which the NR cell reselection parameters apply.
interFreqBlackCellList List of blacklisted inter-frequency neighbouring cells.
interFreqCAG-CellList List of inter-frequency neighbouring CAG cells (as defined in TS 38.304 [20] per PLMN.
interFreqCarrierFreqList List of neighbouring carrier frequencies and frequency specific cell re-selection information. If *iinterFreqCarrierFreqList-v1610* is present, it shall contain the same number of entries, listed in the same order as in *interFreqCarrierFreqList* (without suffix).
interFreqNeighCellList List of inter-frequency neighbouring cells with specific cell re-selection parameters. If *interFreqNeighCellList-v1610* is present, it shall contain the same number of entries, listed in the same order as in *interFreqNeighCellList* (without suffix).
interFreqWhiteCellList List of whitelisted inter-frequency neighbouring cells, see TS 38.304 [20], clause 5.2.4.
nrofSS-BlocksToAverage 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-Max 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 *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].
q-OffsetCell Parameter "$Qoffset_{s,n}$" in TS 38.304 [20].
q-OffsetFreq Parameter "$Qoffset_{frequency}$" in TS 38.304 [20].
q-QualMin Parameter "$Q_{qualmin}$" in TS 38.304 [20]. If the field is absent, the UE applies the (default) value of negative infinity for $Q_{qualmin}$.
q-QualMinOffsetCell Parameter "$Q_{qualminoffsetcell}$" in TS 38.304 [20]. Actual value $Q_{qualminoffsetcell}$ = field value [dB].
q-RxLevMin Parameter "$Q_{rxlevmin}$" in TS 38.304 [20].
q-RxLevMinOffsetCell Parameter "$Q_{rxlevminoffsetcell}$" in TS 38.304 [20]. Actual value $Q_{rxlevminoffsetcell}$ = field value * 2 [dB].
q-RxLevMinOffsetCellSUL Parameter "$Q_{rxlevminoffsetcellSUL}$" in TS 38.304 [20]. Actual value $Q_{rxlevminoffsetcellSUL}$ = field value * 2 [dB].
q-RxLevMinSUL Parameter "$Q_{rxlevmin}$" in TS 38.304 [20].
smtc Measurement timing configuration for inter-frequency measurement. If this field is absent, the UE assumes that SSB periodicity is 5 ms in this frequency.

***SIB4* field descriptions**
smtc2-LP-r16 Measurement timing configuration for inter-frequency neighbour cells with a Long Periodicity (LP) indicated by periodicity in *smtc2-LP-r16*. The timing offset and duration are equal to the offset and duration indicated in *smtc* in *InterFreqCarrierFreqInfo*. The periodicity in *smtc2-LP-r16* can only be set to a value strictly larger than the periodicity in *smtc* in *InterFreqCarrierFreqInfo* (e.g. if *smtc* indicates sf20 the Long Periodicity can only be set to sf40, sf80 or sf160, if *smtc* indicates sf160, *smtc2-LP-r16* cannot be configured). The *pci-List*, if present, includes the physical cell identities of the inter-frequency neighbour cells with Long Periodicity. If *smtc2-LP-r16* is absent, the UE assumes that there are no inter-frequency neighbour cells with a Long Periodicity.
ssb-PositionQCL 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 *ssb-PositionQCL-Common* in *SIB4* for the indicated cell.
ssb-PositionQCL-Common Indicates the QCL relationship between SS/PBCH blocks for inter-frequency neighbor cells as specified in TS 38.213 [13], clause 4.1.
ssb-ToMeasure 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.
ssbSubcarrierSpacing Subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable.
threshX-HighP Parameter "$Thresh_{X, HighP}$" in TS 38.304 [20].
threshX-HighQ Parameter "$Thresh_{X, HighQ}$" in TS 38.304 [20].
threshX-LowP Parameter "$Thresh_{X, LowP}$" in TS 38.304 [20].
threshX-LowQ Parameter "$Thresh_{X, LowQ}$" in TS 38.304 [20].
t-ReselectionNR Parameter "$Treselection_{NR}$" in TS 38.304 [20].
t-ReselectionNR-SF Parameter "Speed dependent ScalingFactor for $Treselection_{NR}$" in TS 38.304 [20]. If the field is absent, the UE behaviour is specified in TS 38.304 [20].

Conditional Presence	Explanation
Mandatory	The field is mandatory present in SIB4.
RSRQ	The field is mandatory present if *threshServingLowQ* is present in *SIB2*; otherwise it is absent.
SharedSpectrum	This field is mandatory present if this inter-frequency operates with shared spectrum channel access. Otherwise, it is absent, Need R.
SharedSpectrum2	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 ::=                            SEQUENCE {
    carrierFreqListEUTRA                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
```

***SIB5* field descriptions**
carrierFreqListEUTRA List of carrier frequencies of E-UTRA. If the *carrierFreqListEUTRA-v1610* is present, it shall contain the same number of entries, listed in the same order as in the *carrierFreqListEUTRA* (without suffix).
dummy This field is not used in the specification. If received it shall be ignored by the UE.
eutra-BlackCellList List of blacklisted E-UTRA neighbouring cells.
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* values, as defined in TS 36.101 [22], table 6.2.4-1, for the frequency bands in *eutra-multiBandInfoList*
highSpeedEUTRACarrier 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.
p-MaxEUTRA The maximum allowed transmission power in dBm on the (uplink) carrier frequency, see TS 36.304 [27].
q-QualMin Parameter "$Q_{qualmin}$" in TS 36.304 [27]. Actual value $Q_{qualmin}$ = field value [dB].
q-QualMinOffsetCell Parameter "$Q_{qualminoffsetcell}$" in TS 38.304 [20]. Actual value $Q_{qualminoffsetcell}$ = field value [dB].
q-RxLevMin Parameter "$Q_{rxlevmin}$" in TS 36.304 [27]. Actual value $Q_{rxlevmin}$ = field value * 2 [dBm].
q-RxLevMinOffsetCell Parameter "$Q_{rxlevminoffsetcell}$" in TS 38.304 [20]. Actual value $Q_{rxlevminoffsetcell}$ = field value * 2 [dB].
t-ReselectionEUTRA Parameter "$Treselection_{EUTRA}$" in TS 38.304 [20].
threshX-High Parameter "$Thresh_{X, HighP}$" in TS 38.304 [20].
threshX-HighQ Parameter "$Thresh_{X, HighQ}$" in TS 38.304 [20].
threshX-Low Parameter "$Thresh_{X, LowP}$" in TS 38.304 [20].
threshX-LowQ Parameter "$Thresh_{X, LowQ}$" in TS 38.304 [20].
t-ReselectionEUTRA-SF Parameter "Speed dependent ScalingFactor for $Treselection_{EUTRA}$" 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 *threshServingLowQ* is present in *SIB2*; otherwise it is absent.

– *SIB6*

SIB6 contains an ETWS primary notification.

SIB6 information element

```
-- ASN1START
-- TAG-SIB6-START

SIB6 ::=                            SEQUENCE {
    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 ::=                            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))                     OPTIONAL,   -- Cond Segment1
    lateNonCriticalExtension            OCTET STRING                                OPTIONAL,
    ...
}
```

```
-- TAG-SIB7-STOP
-- ASN1STOP
```

***SIB7* field descriptions**
dataCodingScheme Identifies the alphabet/coding and the language applied variations of an ETWS notification.
messageIdentifier Identifies the source and type of ETWS notification.
serialNumber Identifies variations of an ETWS notification.
warningMessageSegment Carries a segment of the Warning Message Contents IE.
warningMessageSegmentNumber 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.
warningMessageSegmentType 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 *SIB7*, 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))                     OPTIONAL,   -- Cond Segment1
    warningAreaCoordinatesSegment   OCTET STRING                                OPTIONAL,   -- Need R
    lateNonCriticalExtension        OCTET STRING                                OPTIONAL,
    ...
}

-- TAG-SIB8-STOP
-- ASN1STOP
```

***SIB8* field descriptions**
dataCodingScheme Identifies the alphabet/coding and the language applied variations of a CMAS notification.
messageIdentifier Identifies the source and type of CMAS notification.
serialNumber Identifies variations of a CMAS notification.
warningAreaCoordinatesSegment 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 *warningAreaCoordinatesSegment* is equivalent to the first octet of Warning Area Coordinates IE defined in and encoded according to TS 23.041 [29] and so on.
warningMessageSegment Carries a segment, with one or more octets, of the *Warning Message Contents* IE defined in TS 38.413 [42]. The first octet of the *Warning Message Contents* IE is equivalent to the first octet of the *CB data* IE defined in and encoded according to TS 23.041 [29], clause 9.4.2.2.5, and so on.
warningMessageSegmentNumber 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.
warningMessageSegmentType 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.

Conditional Presence	Explanation
Segment1	The field is mandatory present in the first segment of *SIB8*, 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 ::=                            SEQUENCE {
    timeInfo                            SEQUENCE {
        timeInfoUTC                         INTEGER (0..549755813887),
        dayLightSavingTime                  BIT STRING (SIZE (2))               OPTIONAL,   -- Need R
        leapSeconds                         INTEGER (-127..128)                 OPTIONAL,   -- Need R
        localTimeOffset                     INTEGER (-63..64)                   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.

ASN1START
TAG-SIB10-START

***SIB10* information element**

```
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
```

***SIB10* field descriptions**
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
```

***SIB11* field descriptions**
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
```

***SIB12* field descriptions**
segmentContainer This field includes a segment of the encoded SIB12-IEs. 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.
segmentNumber This field identifies the sequence number of a segment of *SIB12-IEs*. A segment number of zero corresponds to the first segment, A segment number of one corresponds to the second segment, and so on.
segmentType This field indicates whether the included segment is the last segment or not.
sl-CSI-Acquisition This field indicates whether CSI reporting is enabled in sidelink unicast. If not set, SL CSI reporting is disabled.
sl-EUTRA-AnchorCarrierFreqList This field indicates the EUTRA anchor carrier frequency list, which can provide the NR sidelink communication configurations.
sl-FreqInfoList 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.
sl-maxNumConsecutiveDTX 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.
sl-MeasConfigCommon This field indicates the measurement configurations (e.g. RSRP) for NR sidelink communication.
sl-NR-AnchorCarrierFreqList This field indicates the NR anchor carrier frequency list, which can provide the NR sidelink communication configurations.
sl-OffsetDFN 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.
sl-RadioBearerConfigList This field indicates one or multiple sidelink radio bearer configurations.
sl-RLC-BearerConfigList This field indicates one or multiple sidelink RLC bearer configurations.
sl-SSB-PriorityNR This field indicates the priority of NR sidelink SSB transmission and reception.

– *SIB13*

SIB13 contains configurations of V2X sidelink communication defined in TS 36.331 [10].

***SIB13* information element**

```
-- ASN1START
-- TAG-SIB13-START

SIB13-r16 ::=                       SEQUENCE {
    sl-V2X-ConfigCommon-r16             OCTET STRING,
    sl-Bandwidth-r16                    OCTET STRING,
    tdd-Config-r16                      OCTET STRING,
    lateNonCriticalExtension            OCTET STRING                        OPTIONAL,
    ...
```

```
}

-- TAG-SIB13-STOP
-- ASN1STOP
```

***SIB13* field descriptions**
sl-Bandwidth This field includes the ul-Bandwidth in E-UTRA SystemInformationBlockType2 message as specified in TS 36.331 [10].
sl-V2X-ConfigCommon This field includes the E-UTRA SystemInformationBlockType21 message as specified in TS 36.331 [10].
tdd-Config 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
```

***SIB14* field descriptions**
sl-V2X-ConfigCommonExt 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
```

***PosSI-SchedulingInfo* field descriptions**
areaScope Indicates that a posSIB is area specific. If the field is absent, the posSIB is cell specific.
encrypted The presence of this field indicates that the *pos-sib-type* is encrypted as specified in TS 37.355 [49].
gnss-id 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])
posSI-BroadcastStatus Indicates if the SI message is being broadcasted or not.
posSI-RequestConfig Configuration of Msg1 resources that the UE uses for requesting SI-messages for which *posSI-BroadcastStatus* is set to notBroadcasting.
posSI-RequestConfigSUL Configuration of Msg1 resources that the UE uses for requesting SI-messages for which *posSI-BroadcastStatus* is set to notBroadcasting.
pos-SIB-MappingInfo List of the posSIBs mapped to this *SystemInformation* message.
posSibType The positioning SIB type is defined in TS 37.355 [49].
posSi-Periodicity Periodicity of the SI-message in radio frames, such that rf8 denotes 8 radio frames, rf16 denotes 16 radio frames, and so on.
offsetToSI-Used This field, if present indicates that the SI messages in *pos-SchedulingInfoList* are scheduled with an offset of 8 radio frames compared to SI messages in *schedulingInfoList*. *offsetToSI-Used* may be present only if the shortest configured SI message periodicity for SI messages in *schedulingInfoList* is 80ms.
sbas-ID 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 *posSI-BroadcastStatus* is set to *notBroadcasting* for any SI-message included in *PosSchedulingInfo*. 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 *posSI-BroadcastStatus* is set to *notBroadcasting* for any SI-message included in *PosSchedulingInfo*. 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**
assistanceDataSIB-Element Parameter *AssistanceDataSIBelement* 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 *AvailabiltyCombinationsPerCell* is used to configure the AvailabiltyCombinations 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.
availabiltyCombinationId   This ID is used in the DCI Format 2_5 payload to dynamically select this *AvailabilityCombination*, see TS 38.213 [13], clause 14.

***AvailabilityCombinationsPerCell* field descriptions**
iabDuCellId-AI The ID of the IAB-DU cell for which the *availabilityCombinations* are applicable.
positionInDC-AI The (starting) position (bit) of the AvailabilitytCombinationId (AI-Index) for the indicated IAB-DU cell (*iabDuCellId-AI*) 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
```

***AvailabilityIndicator* field descriptions**
ai-RNTI Used by an IAB-MT for detection of DCI format 2_5 indicating DU-IA to an IAB-DU's cells.
availableCombToAddModList A list of *availabilityCombinations* to add for the IAB-DU's cells. (see TS 38.213 [13], clause 14).
availableCombToReleaseList A list of *availabilityCombinations* to release for the IAB-DU's cells. (see TS 38.213 [13], clause 14).
dci-PayloadSizeAI 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-Routing-ID-r16::=        SEQUENCE{
    bap-Address-r16             BIT STRING (SIZE (10)),
    bap-PathId-r16              BIT STRING (SIZE (10))
}

-- TAG-BAPROUTINGID-STOP
-- ASN1STOP
```

***BAP-Routing-ID* 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 ::=       SEQUENCE {
    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
```

***BeamFailureRecoveryConfig* field descriptions**
beamFailureRecoveryTimer Timer for beam failure recovery timer. Upon expiration of the timer the UE does not use CFRA for BFR. Value in ms. Value *ms10* corresponds to 10 ms, value *ms20* corresponds to 20 ms, and so on.
candidateBeamRSList, candidateBeamRSListExt-v1610 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 *candidateBeamRSList* (without suffix) and all elements of *candidateBeamRSListExt-v1610*. The network configures these reference signals to be within the linked DL BWP (i.e., within the DL BWP with the same *bwp-Id*) of the UL BWP in which the *BeamFailureRecoveryConfig* is provided.
msg1-SubcarrierSpacing 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.
rsrp-ThresholdSSB 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).
ra-prioritization Parameters which apply for prioritized random access procedure for BFR (see TS 38.321 [3], clause 5.1.1).
ra-PrioritizationTwoStep Parameters which apply for prioritized 2-step random access procedure for BFR (see TS 38.321 [3], clause 5.1.1).
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.
rach-ConfigBFR Configuration of contention free random access occasions for BFR.
recoverySearchSpaceId 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 *bwp-Id*) of the UL BWP in which the *BeamFailureRecoveryConfig* 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.
rootSequenceIndex-BFR PRACH root sequence index (see TS 38.211 [16], clause 6.3.3.1) for beam failure recovery.
ssb-perRACH-Occasion Number of SSBs per RACH occasion for CF-BFR, see TS 38.213 [13], clause 8.1.

***BFR-CSIRS-Resource* field descriptions**
csi-RS The ID of a *NZP-CSI-RS-Resource* configured in the *CSI-MeasConfig* of this serving cell. This reference signal determines a candidate beam for beam failure recovery (BFR).
ra-OccasionList 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 *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. If the field is absent the UE uses the RA occasion associated with the SSB that is QCLed with this CSI-RS.
ra-PreambleIndex 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.

***BFR-SSB-Resource* field descriptions**
ra-PreambleIndex The preamble index that the UE shall use when performing BFR upon selecting the candidate beams identified by this SSB.
ssb 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
```

***BeamFailureRecoverySCellConfig* field descriptions**
candidateBeamConfig Indicates the resource (i.e. SSB or CSI-RS) defining this beam resource.
candidateBeamRSSCellList 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.
rsrp-ThresholdBFR 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.
servingCellId If the field is absent, the RS belongs to the serving cell in which this *BeamFailureSCellRecoveryConfig* 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**
betaOffsetACK-Index1 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.
betaOffsetACK-Index2 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.
betaOffsetACK-Index3 Above 11 bits HARQ-ACK (see TS 38.213 [13], clause 9.3). When the field is absent the UE applies the value 11.
betaOffsetCSI-Part1-Index1 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.
betaOffsetCSI-Part1-Index2 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.
betaOffsetCSI-Part2-Index1 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.
betaOffsetCSI-Part2-Index2 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-BH-RLCCHANNELCONFIG-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-BH-RLCCHANNELCONFIG-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
LCH-Setup	This field is mandatory present upon creation of a new logical channel for a BH RLC channel. It is optionally present, Need M, otherwise.
LCH-SetupOnly	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-BH-LOGICALCHANNELIDENTITY-START

BH-LogicalChannelIdentity-r16 ::=    CHOICE {
    bh-LogicalChannelIdentity-r16        LogicalChannelIdentity,
    bh-LogicalChannelIdentityExt-r16     BH-LogicalChannelIdentity-Ext-r16
}

-- TAG-BH-LOGICALCHANNELIDENTITY-STOP
-- ASN1STOP
```

***BH-LogicalChannelIdentity* field descriptions**
bh-LogicalChannelIdentity ID used for the MAC logical channel.
bh-LogicalChannelIdentityExt ID used for the MAC logical channel.

– *BH-LogicalChannelIdentity-Ext*

The IE *BH-LogicalChannelIdentity-Ext* is used to identify one backhaul logical channel (*BH-RLC-ChannelConfig*) and the corresponding RLC configuration (*RLC-Config*).

BH-LogicalChannelIdentity information element

```
-- ASN1START
-- TAG-BH-LOGICALCHANNELIDENTITY-Ext-START

BH-LogicalChannelIdentity-Ext-r16 ::=   INTEGER (33.. maxLC-ID-Iab-r16)

-- TAG-BH-LOGICALCHANNELIDENTITY-Ext-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.

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 ::=                      SEQUENCE {
```

```
    periodicBSR-Timer                   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}                OPTIONAL, -- Need R
    ...
}

-- 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 ::=                             SEQUENCE {
    locationAndBandwidth                INTEGER (0..37949),
    subcarrierSpacing                   SubcarrierSpacing,
    cyclicPrefix                        ENUMERATED { extended }                                  OPTIONAL    -- Need R
}


-- TAG-BWP-STOP
-- ASN1STOP
```

***BWP* field descriptions**
cyclicPrefix 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)
locationAndBandwidth 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 N_{BWP}^{size}=275. The first PRB is a PRB determined by *subcarrierSpacing* of this BWP and *offsetToCarrier* (configured in *SCS-SpecificCarrier* contained within *FrequencyInfoDL* / *FrequencyInfoUL* / *FrequencyInfoUL-SIB* / *FrequencyInfoDL-SIB* within *ServingCellConfigCommon* / *ServingCellConfigCommonSIB*) corresponding to this subcarrier spacing. In case of TDD, a BWP-pair (UL BWP and DL BWP with the same *bwp-Id*) must have the same center frequency (see TS 38.213 [13], clause 12)
subcarrierSpacing 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 *kHz15* corresponds to μ=0, value *kHz30* corresponds to μ=1, 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 *subCarrierSpacingCommon* in *MIB* of the same serving cell.

– *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-Id,
    bwp-Common                          BWP-DownlinkCommon                                  OPTIONAL,   -- Cond SetupOtherBWP
    bwp-Dedicated                       BWP-DownlinkDedicated                               OPTIONAL,   -- Cond SetupOtherBWP
    ...
}

-- TAG-BWP-DOWNLINK-STOP
-- ASN1STOP
```

***BWP-Downlink* 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
SetupOtherBWP	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 ::=              SEQUENCE {
    genericParameters                   BWP,
    pdcch-ConfigCommon                  SetupRelease { PDCCH-ConfigCommon }                                 OPTIONAL,   -- Need M
    pdsch-ConfigCommon                  SetupRelease { PDSCH-ConfigCommon }                                 OPTIONAL,   -- Need M
    ...
}

-- TAG-BWP-DOWNLINKCOMMON-STOP
-- ASN1STOP
```

***BWP-DownlinkCommon* field descriptions**
pdcch-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 ::=           SEQUENCE {
    pdcch-Config                        SetupRelease { PDCCH-Config }                                   OPTIONAL,   -- Need M
    pdsch-Config                        SetupRelease { PDSCH-Config }                                   OPTIONAL,   -- Need M
    sps-Config                          SetupRelease { SPS-Config }                                     OPTIONAL,   -- Need M
    radioLinkMonitoringConfig           SetupRelease { RadioLinkMonitoringConfig }                      OPTIONAL,   -- Need M
    ...,
    [[
    sps-ConfigToAddModList-r16          SPS-ConfigToAddModList-r16                                      OPTIONAL,   -- Need N
    sps-ConfigToReleaseList-r16         SPS-ConfigToReleaseList-r16                                     OPTIONAL,   -- Need N
    sps-ConfigDeactivationStateList-r16 SPS-ConfigDeactivationStateList-r16                             OPTIONAL,   -- Need R
    beamFailureRecoverySCellConfig-r16  SetupRelease {BeamFailureRecoverySCellConfig-r16}               OPTIONAL,   -- Cond SCellOnly
```

```
    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
```

***BWP-DownlinkDedicated* field descriptions**
beamFailureRecoverySCellConfig Configuration of candidate RS for beam failure recovery in SCells.
pdcch-Config UE specific PDCCH configuration for one BWP.
pdsch-Config UE specific PDSCH configuration for one BWP.
sps-Config UE specific SPS (Semi-Persistent Scheduling) configuration for one BWP. Except for reconfiguration with sync, the NW does not reconfigure *sps-Config* when there is an active configured downlink assignment (see TS 38.321 [3]). However, the NW may release the *sps-Config* at any time. This field cannot be configured simultaneously with *sps-ConfigToAddModList.*
sps-ConfigDeactivationStateList 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 *harq-CodebookID*.
sps-ConfigToAddModList 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]). However, the NW may release a SPS configuration at any time.
sps-ConfigToReleaseList Indicates a list of one or more DL SPS configurations to be released.
radioLinkMonitoringConfig 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 *RadioLinkMonitoringConfig*.
sl-PDCCH-Config Indicates the UE specific PDCCH configurations for receiving the SL grants (via SL-RNTI or SL-CS-RNTI) for NR sidelink communication**.**
sl-V2X-PDCCH-Config Indicates the UE specific PDCCH configurations for receiving SL grants (i.e. sidelink SPS) for V2X sidelink communication**.**

Conditional Presence	Explanation
ScellOnly	The field is optionally present, Need M, in the *BWP-DownlinkDedicated* 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-Id,
    bwp-Common                          BWP-UplinkCommon                                    OPTIONAL,   -- Cond SetupOtherBWP
    bwp-Dedicated                       BWP-UplinkDedicated                                 OPTIONAL,   -- Cond SetupOtherBWP
    ...
}

-- TAG-BWP-UPLINK-STOP
-- ASN1STOP
```

***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
SetupOtherBWP	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 ::=                SEQUENCE {
    genericParameters                   BWP,
    rach-ConfigCommon                   SetupRelease { RACH-ConfigCommon }                                  OPTIONAL,   -- Need M
    pusch-ConfigCommon                  SetupRelease { PUSCH-ConfigCommon }                                 OPTIONAL,   -- Need M
    pucch-ConfigCommon                  SetupRelease { PUCCH-ConfigCommon }                                 OPTIONAL,   -- Need M
    ...,
    [[
    rach-ConfigCommonIAB-r16            SetupRelease { RACH-ConfigCommon }                                  OPTIONAL,   -- Need M
    useInterlacePUCCH-PUSCH-r16         ENUMERATED {enabled}                                                OPTIONAL,   -- Need R
    msgA-ConfigCommon-r16               SetupRelease { MsgA-ConfigCommon-r16 }                              OPTIONAL    -- Cond SpCellOnly2
    ]]
}

-- TAG-BWP-UPLINKCOMMON-STOP
-- ASN1STOP
```

BWP-UplinkCommon field descriptions
msgA-ConfigCommon   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 *msgA-ConfigCommon* only for UL BWPs if the linked DL BWPs (same bwp-Id as UL-BWP) are the initial DL BWPs or DL BWPs containing the SSB associated to the initial BL BWP
pucch-ConfigCommon   Cell specific parameters for the PUCCH of this BWP.
pusch-ConfigCommon   Cell specific parameters for the PUSCH of this BWP.
rach-ConfigCommon   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 *RACH-ConfigCommon*) only for UL BWPs if the linked DL BWPs (same *bwp-Id* as UL-BWP) are the initial DL BWPs or DL BWPs containing the SSB associated to the initial DL BWP. The network configures *rach-ConfigCommon*, whenever it configures contention free random access (for reconfiguration with sync or for beam failure recovery).
rach-ConfigCommonIAB   Configuration of cell specific random access parameters for the IAB-MT. The IAB specific IAB RACH configuration is used by IAB-MT, if configured.
useInterlacePUCCH-PUSCH   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
SpCellOnly2	The field is optionally present, Need M, in the *BWP-UplinkCommon* 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
```

***BWP-UplinkDedicated* field descriptions**
beamFailureRecoveryConfig
Configuration of beam failure recovery. If *supplementaryUplink* is present, the field is present only in one of the uplink carriers, either UL or SUL.
configuredGrantConfig
A *Configured-Grant* of *type1* or *type2*. It may be configured for UL or SUL but in case of *type1* not for both at a time. Except for reconfiguration with sync, the NW does not reconfigure *configuredGrantConfig* when there is an active configured uplink grant Type 2 (see TS 38.321 [3]). However, the NW may release the *configuredGrantConfig* at any time. This field cannot be configured simultanesouly with *configuredGrantConfigToAddModList.*
configuredGrantConfigToAddModList
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]). However, the NW may release a configured grant configuration at any time.
configuredGrantConfigToReleaseList
Indicates a list of one or more UL Configured Grant configurations to be released.
configuredGrantConfigType2DeactivationStateList
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].
cp-ExtensionC2, cp-ExtensionC3
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 *cp-ExtensionC2* and *cp-ExtensionC3*. For 30 kHz SCS, {1..28} are valid for *cp-ExtensionC2* and {2..28} are valid for *cp-ExtensionC3.* For 60 kHz SCS, {2..28} are valid for *cp-ExtensionC2* and {3..28} are valid for *cp-ExtensionC3*.
lbt-FailureRecoveryConfig
Configures parameters used for detection of consistent uplink LBT failures for operation with shared spectrum channel access, as specified in TS 38.321 [3].
pucch-Config
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 *PUCCH-Config* 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 *PUCCH-Config* (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 *pucch-Config* in an *RRCReconfiguration* with *reconfigurationWithSync* (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 *pucch-Config* 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.
pucch-ConfigurationList
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 *PUCCH-Config* within the *pucch-ConfigurationList* if configured.
pusch-Config
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 *PUSCH-Config* 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.
sl-PUCCH-Config
Indicates the UE specific PUCCH configurations used for the HARQ-ACK feedback reporting for NR sidelink communication.
srs-Config
Uplink sounding reference signal configuration.
useInterlacePUCCH-PUSCH
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).

Conditional Presence	Explanation
SpCellOnly	The field is optionally present, Need M, in the *BWP-UplinkDedicated* of an SpCell. It is absent otherwise.

– *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
```

***CellAccessRelatedInfo* field descriptions**
cellReservedForFutureUse 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.
cellReservedForOtherUse 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.

npn-IdentityInfoList
The *npn-IdentityInfoList* is used to configure a set of *NPN-IdentityInfo* 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 *plmn -IdentityList*), PNI-NPNs (identified by a PLMN identity and a CAG-ID), and SNPNs (identified by a PLMN identity and a NID) together in the *PLMN-IdentityInfoList* and *NPN-IdentityInfoList* does not exceed 12, except for the NPN-only cells. In case of NPN-only cells the *PLMN-IdentityList* contains a single element that does not count to the limit of 12. The NPN index is defined as *B+c1+c2+…+c(n-1)+d1+d2+…+d(m-1)+e(i)* for the NPN identity included in the *n*-th entry of *NPN-IdentityInfoList* and in the *m*-th entry of *NPN-Identitylist* within that *npn-IdentityInfoList* entry, and the *i*-th entry of its corresponding *NPN-Identity*, where
- *B* is the index used for the last PLMN in the *PLMN-IdentittyInfoList*; in NPN-only cells *B* is considered 0;
- *c(j)* is the number of NPN index values used in the *j*-th *NPN-IdentityInfoList* entry;
- *d(k)* is the number of NPN index values used in the *k*-th *npn-IdentityList* entry within the *n*-th *NPN-IdentityInfoList* entry;
- e(i) is
  - *i* if the *n*-th entry of *NPN-IdentityInfoList* entry is for SNPN(s);
  - 1 if the *n*-th entry of *NPN-IdentityInfoList* entry is for PNI-NPN(s).

plmn-IdentityList The *plmn-IdentityList* is used to configure a set of *PLMN-IdentityInfoList* 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 *PLMN-IdentityInfoList*. The PLMN index is defined as *b1+b2+…+b(n-1)+i* for the PLMN included at the *n*-th entry of *PLMN-IdentityInfoList* and the *i*-th entry of its corresponding *PLMN-IdentityInfo*, where *b(j)* is the number of *PLMN-Identity* entries in each *PLMN-IdentityInfo*, respectively.

– *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-eutra-epc             PLMN-IdentityList-EUTRA-EPC,
    trackingAreaCode-eutra-epc              BIT STRING (SIZE (16)),
    cellIdentity-eutra-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
    f1c-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
    ]]
}

-- Serving cell specific MAC and PHY parameters for a SpCell:
SpCellConfig ::=                    SEQUENCE {
    servCellIndex                   ServCellIndex                                           OPTIONAL,   -- Cond SCG
    reconfigurationWithSync         ReconfigurationWithSync                                 OPTIONAL,   -- Cond ReconfWithSync
    rlf-TimersAndConstants          SetupRelease { RLF-TimersAndConstants }                 OPTIONAL,   -- Need M
    rlmInSyncOutOfSyncThreshold     ENUMERATED {n1}                                         OPTIONAL,   -- Need S
    spCellConfigDedicated           ServingCellConfig                                       OPTIONAL,   -- Need M
    ...
}

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
    }                                                                                       OPTIONAL,   -- Need N
    ...,
    [[
    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-mode1, semi-static-mode2, dynamic }
}

SCellConfig ::=                     SEQUENCE {
```

```
    sCellIndex                          SCellIndex,
    sCellConfigCommon                   ServingCellConfigCommon                 OPTIONAL,   -- Cond SCellAdd
    sCellConfigDedicated                ServingCellConfig                       OPTIONAL,   -- Cond SCellAddMod
    ...,
    [[
    smtc                                SSB-MTC                                 OPTIONAL    -- Need S
    ]],
    [[
    sCellState-r16                  ENUMERATED {activated}                      OPTIONAL,   -- Cond SCellAddSync
    secondaryDRX-GroupConfig-r16    ENUMERATED {true}                           OPTIONAL    -- Cond DRX-Config2
    ]]}

-- TAG-CELLGROUPCONFIG-STOP
-- ASN1STOP
```

***CellGroupConfig* field descriptions**
bap-Address BAP address of the parent node in cell group.
bh-RLC-ChannelToAddModList Configuration of the backhaul RLC entities and the corresponding MAC Logical Channels to be added and modified.
bh-RLC-ChannelToReleaseList List of the backhaul RLC entities and the corresponding MAC Logical Channels to be released.
f1c-TransferPath The F1-C transfer path that an EN-DC IAB-MT should use for transferring F1-C packets to the 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.
mac-CellGroupConfig MAC parameters applicable for the entire cell group.
rlc-BearerToAddModList Configuration of the MAC Logical Channel, the corresponding RLC entities and association with radio bearers.
reportUplinkTxDirectCurrent 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 *CellGroupConfig* when provided as part of *RRCSetup* message. If UE is configured with SUL carrier, UE reports both UL and SUL Direct Current locations.
rlmInSyncOutOfSyncThreshold BLER threshold pair index for IS/OOS indication generation, see TS 38.133 [14], table 8.1.1-1. *n1* 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.
sCellState Indicates whether the SCell shall be considered to be in activated state upon SCell configuration.
sCellToAddModList List of secondary serving cells (SCells) to be added or modified.
sCellToReleaseList List of secondary serving cells (SCells) to be released.
secondaryDRX-GroupConfig 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.
simultaneousTCI-UpdateList1, simultaneousTCI-UpdateList2 List of serving cells which can be updated simultaneously for TCI relation with a MAC CE. The *simultaneousTCI-UpdateList1* and *simultaneousTCI-UpdateList2* shall not contain same serving cells. Network should not configure serving cells that are configured with CORESETPoolID=1 in these lists.
simultaneousSpatial-UpdatedList1, simultaneousSpatial-UpdatedList2 List of serving cells which can be updated simultaneously for spatial relation with a MAC CE. The *simultaneousSpatial-UpdatedList1* and *simultaneousSpatial-UpdatedList2* shall not contain same serving cells. Network should not configure serving cells that are configured with CORESETPoolID=1 in these lists.
spCellConfig Parameters for the SpCell of this cell group (PCell of MCG or PSCell of SCG).
uplinkTxSwitchingOption Indicates which option is configured for dynamic UL Tx switching for inter-band UL CA or EN-DC. The field is set to *switchedUL* if network configures option 1 as specified in TS 38.214 [19], or *dualUL* 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 EN-DC case where UE supports dynamic UL Tx switching.

***DAPS-Configuration* field descriptions**
p-DAPS-Source The maximum total transmit power to be used by the UE in the source cell group during DAPS handover.
p-DAPS-Target The maximum total transmit power to be used by the UE in the target cell group during DAPS handover.
uplinkPowerSharingDAPS-Mode Indicates the uplink power sharing mode that the UE uses in DAPS handover (see TS 38.213 [13]).

***ReconfigurationWithSync* field descriptions**
rach-ConfigDedicated 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 *firstActiveUplinkBWP* (see *UplinkConfig*).
smtc The SSB periodicity/offset/duration configuration of target cell for NR PSCell change, NR PCell change and NR PSCell addition. The network sets the *periodicityAndOffset* to indicate the same periodicity as *ssb-periodicityServingCell* in *spCellConfigCommon*. For case of NR PCell change and NR PSell addition, the *smtc* 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 *measObjectNR* having the same SSB frequency and subcarrier spacing, as configured before the reception of the RRC message.

***SCellConfig* field descriptions**
smtc The SSB periodicity/offset/duration configuration of target cell for NR SCell addition. The network sets the *periodicityAndOffset* to indicate the same periodicity as *ssb-periodicityServingCell* in *sCellConfigCommon*. The *smtc* 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 *measObjectNR* having the same SSB frequency and subcarrier spacing, as configured before the reception of the RRC message.

***SpCellConfig* field descriptions**
reconfigurationWithSync Parameters for the synchronous reconfiguration to the target SpCell.
rlf-TimersAndConstants Timers and constants for detecting and triggering cell-level radio link failure. For the SCG, *rlf-TimersAndConstants* can only be set to *setup* and is always included at SCG addition.
servCellIndex Serving cell ID of a PSCell. The PCell of the Master Cell Group uses ID = 0.

Conditional Presence	Explanation
BWP-Reconfig	The field is optionally present, Need N, if the BWPs are reconfigured or if serving cells are added or removed. Otherwise it is absent.
DRX-Config2	The field is optionally present, Need N, if *drx-ConfigSecondaryGroup* is configured. It is absent otherwise.

ReconfWithSync	The field is mandatory present in the *RRCReconfiguration* message:
	- in each configured *CellGroupConfig* for which the SpCell changes,
	  - in the *masterCellGroup* at change of AS security key derived from K_{gNB},
	  - in the *secondaryCellGroup* at:
	  - PSCell addition,
	  - SCG resume with NR-DC or (NG)EN-DC,
	  - update of required SI for PSCell,
	  - change of AS security key derived from S-K_{gNB} while the UE is configured with at least one radio bearer with *keyToUse* set to *secondary* and that is not released by this *RRCReconfiguration* message,
	Otherwise, it is optionally present, need M. The field is absent in the *masterCellGroup* in *RRCResume* and *RRCSetup* messages and is absent in the *masterCellGroup* in *RRCReconfiguration* messages if source configuration is not released during DAPS handover.

SCellAdd	The field is mandatory present upon SCell addition; otherwise it is absent, Need M.
SCellAddMod	The field is mandatory present upon SCell addition; otherwise it is optionally present, need M.
SCellAddSync	The field is optionally present, Need N, in case of SCell addition, reconfiguration with sync, and resuming an RRC connection. It is absent otherwise.
SCG	The field is mandatory present in an *SpCellConfig* 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 ::=                         INTEGER (0.. maxSecondaryCellGroups)

-- TAG-CELLGROUPID-STOP
-- ASN1STOP
```

– *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 ::=                       SEQUENCE {
    cgi-info-EPC                            SEQUENCE {
            cgi-info-EPC-legacy                 CellAccessRelatedInfo-EUTRA-EPC,
            cgi-info-EPC-list                   SEQUENCE (SIZE (1..maxPLMN)) OF CellAccessRelatedInfo-EUTRA-EPC          OPTIONAL
    }                                                                                                                    OPTIONAL,
    cgi-info-5GC                            SEQUENCE (SIZE (1..maxPLMN)) OF CellAccessRelatedInfo-EUTRA-5GC          OPTIONAL,
    freqBandIndicator                       FreqBandIndicatorEUTRA,
    multiBandInfoList                       MultiBandInfoListEUTRA                                                   OPTIONAL,
    freqBandIndicatorPriority               ENUMERATED {true}                                                        OPTIONAL
}

-- 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 ::=        SEQUENCE {
    plmn-Identity-eutra-5gc         PLMN-Identity                           OPTIONAL,
    trackingAreaCode-eutra-5gc      TrackingAreaCode                        OPTIONAL,
    cellIdentity-eutra-5gc          BIT STRING (SIZE (28))                  OPTIONAL,
    plmn-Identity-eutra-epc         PLMN-Identity                           OPTIONAL,
    trackingAreaCode-eutra-epc      BIT STRING (SIZE (16))                  OPTIONAL,
    cellIdentity-eutra-epc          BIT STRING (SIZE (28))                  OPTIONAL
}

-- TAG-CGI-INFOEUTRALOGGING-STOP
-- ASN1STOP
```

***CGI-InfoEUTRALogging* field descriptions**
cellIdentity-eutra-epc, cellIdentity-eutra-5GC Unambiguously identify a cell within the context of the PLMN. It belongs the first *PLMN-IdentityInfo* IE of *PLMN-IdentityInfoList* in *SIB1*.
plmn-Identity-eutra-epc, plmn-Identity-eutra-5GC 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-eutra-epc, trackingAreaCode-eutra-5gc Indicates Tracking Area Code to which the cell indicated by *cellIdentity-eutra-epc, cellIdentity-eutra-5GC* belongs.

– *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 ::=                  SEQUENCE {
    plmn-IdentityInfoList             PLMN-IdentityInfoList             OPTIONAL,
    frequencyBandList                 MultiFrequencyBandListNR          OPTIONAL,
    noSIB1                            SEQUENCE {
        ssb-SubcarrierOffset              INTEGER (0..15),
        pdcch-ConfigSIB1                  PDCCH-ConfigSIB1
    }                                                                   OPTIONAL,
    ...,
    [[
    npn-IdentityInfoList-r16          NPN-IdentityInfoList-r16          OPTIONAL
    ]]
}

-- TAG-CGI-INFO-NR-STOP
-- ASN1STOP
```

***CGI-InfoNR* field descriptions**
noSIB1 Contains *ssb-SubcarrierOffset* and *pdcch-ConfigSIB1* fields acquired by the UE from *MIB* of the cell for which report CGI procedure was requested by the network in case *SIB1* was not broadcast by the cell.

– *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 ::=                                  SEQUENCE {
    codebookType                                        CHOICE {
        type1                                               SEQUENCE {
            subType                                             CHOICE {
                typeI-SinglePanel                                   SEQUENCE {
                    nrOfAntennaPorts                                    CHOICE {
                        two                                                 SEQUENCE {
                            twoTX-CodebookSubsetRestriction                     BIT STRING (SIZE (6))
                        },
                        moreThanTwo                                         SEQUENCE {
                            n1-n2                                               CHOICE {
                                two-one-TypeI-SinglePanel-Restriction               BIT STRING (SIZE (8)),
                                two-two-TypeI-SinglePanel-Restriction               BIT STRING (SIZE (64)),
                                four-one-TypeI-SinglePanel-Restriction              BIT STRING (SIZE (16)),
                                three-two-TypeI-SinglePanel-Restriction             BIT STRING (SIZE (96)),
                                six-one-TypeI-SinglePanel-Restriction               BIT STRING (SIZE (24)),
                                four-two-TypeI-SinglePanel-Restriction              BIT STRING (SIZE (128)),
                                eight-one-TypeI-SinglePanel-Restriction             BIT STRING (SIZE (32)),
                                four-three-TypeI-SinglePanel-Restriction            BIT STRING (SIZE (192)),
                                six-two-TypeI-SinglePanel-Restriction               BIT STRING (SIZE (192)),
                                twelve-one-TypeI-SinglePanel-Restriction            BIT STRING (SIZE (48)),
                                four-four-TypeI-SinglePanel-Restriction             BIT STRING (SIZE (256)),
                                eight-two-TypeI-SinglePanel-Restriction             BIT STRING (SIZE (256)),
                                sixteen-one-TypeI-SinglePanel-Restriction           BIT STRING (SIZE (64))
                            },
                            typeI-SinglePanel-codebookSubsetRestriction-i2      BIT STRING (SIZE (16))      OPTIONAL    -- Need R
                        }
                    },
                    typeI-SinglePanel-ri-Restriction                    BIT STRING (SIZE (8))
                },
                typeI-MultiPanel                                    SEQUENCE {
                    ng-n1-n2                                            CHOICE {
                        two-two-one-TypeI-MultiPanel-Restriction            BIT STRING (SIZE (8)),
                        two-four-one-TypeI-MultiPanel-Restriction           BIT STRING (SIZE (16)),
                        four-two-one-TypeI-MultiPanel-Restriction           BIT STRING (SIZE (8)),
                        two-two-two-TypeI-MultiPanel-Restriction            BIT STRING (SIZE (64)),
                        two-eight-one-TypeI-MultiPanel-Restriction          BIT STRING (SIZE (32)),
                        four-four-one-TypeI-MultiPanel-Restriction          BIT STRING (SIZE (16)),
                        two-four-two-TypeI-MultiPanel-Restriction           BIT STRING (SIZE (128)),
                        four-two-two-TypeI-MultiPanel-Restriction           BIT STRING (SIZE (64))
                    },
                    ri-Restriction                          BIT STRING (SIZE (4))
                }
            },
            codebookMode                                        INTEGER (1..2)

        },
        type2                                   SEQUENCE {
            subType                                 CHOICE {
```

```
                typeII                                  SEQUENCE {
                    n1-n2-codebookSubsetRestriction         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
```

***CodebookConfig* field descriptions**
codebookMode CodebookMode as specified in TS 38.214 [19], clause 5.2.2.2.2.
codebookType CodebookType including possibly sub-types and the corresponding parameters for each (see TS 38.214 [19], clause 5.2.2.2).
n1-n2-codebookSubsetRestriction 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 CEIL(log2(nchoosek(O1*O2,4)))+8*n1*n2 where nchoosek(a,b) = a!/(b!(a-b)!).
n1-n2 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).
ng-n1-n2 Codebook subset restriction for Type I Multi-panel codebook (see TS 38.214 [19], clause 5.2.2.2.2).
numberOfBeams Number of beams, L, used for linear combination.
numberOfPMI-SubbandsPerCQI-Subband Field indicates how PMI subbands are defined per CQI subband according to TS 38.214 [19], clause 5.2.2.2.5,
paramCombination Field describes supported parameter combination (L, p_v, β)as specified in TS 38.214.
phaseAlphabetSize The size of the PSK alphabet, QPSK or 8-PSK.
portSelectionSamplingSize The size of the port selection codebook (parameter d), see TS 38.214 [19] clause 5.2.2.2.6.
ri-Restriction Restriction for RI for *TypeI-MultiPanel-RI-Restriction* (see TS 38.214 [19], clause 5.2.2.2.2).
subbandAmplitude If subband amplitude reporting is activated (*true*).
twoTX-CodebookSubsetRestriction Codebook subset restriction for 2TX codebook (see TS 38.214 [19] clause 5.2.2.2.1).
typeI-SinglePanel-codebookSubsetRestriction-i2 i2 codebook subset restriction for Type I Single-panel codebook used when *reportQuantity* is CRI/Ri/i1/CQI (see TS 38.214 [19] clause 5.2.2.2.1).
typeI-SinglePanel-ri-Restriction Restriction for RI for *TypeI-SinglePanel-RI-Restriction* (see TS 38.214 [19], clause 5.2.2.2.1).
typeII-PortSelectionRI-Restriction Restriction for RI for *TypeII-PortSelection-RI-Restriction* (see TS 38.214 [19], clauses 5.2.2.2.4 and 5.2.2.2.6).
typeII-RI-Restriction Restriction for RI for *TypeII-RI-Restriction* (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 (MeasId's) 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*.

Conditional Presence	Explanation
condReconfigAdd	The field is mandatory present when a *condReconfigId* 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 PCell
    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
```

ConditionalReconfiguration field descriptions
attemptCondReconfig 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.
condReconfigToAddModList List of the configuration of candidate SpCells to be added or modified for CHO or CPC.
condReconfigToRemoveList List of the configuration of candidate SpCells to be removed.

Conditional Presence	Explanation
PCell	The field is optional present, need N, if *conditionalReconfiguration* 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
        ]]
    }                                                                                                       OPTIONAL,   -- Need R
    ...,
    [[
    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-List
    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
```

***ConfiguredGrantConfig* field descriptions**
antennaPort 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.
autonomousTx If this field is present, the Configured Grant configuration is configured with autonomous transmission, see TS 38.321 [3].
betaOffsetCG-UCI Beta offset for CG-UCI in CG-PUSCH, see TS 38.213 [13], clause 9.3
cg-COT-SharingList 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.
cg-COT-SharingOffset 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 14*n, where n is the signaled value for *cg-COT-SharingOffset*. Applicable when *ul-toDL-COT-SharingED-Threshold-r16* is not configured (see 37.213 [48], clause 4.1.3).
cg-DMRS-Configuration DMRS configuration (see TS 38.214 [19], clause 6.1.2.3).
cg-minDFI-Delay 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 10.3). The following minimum duration values are supported, depending on the configured subcarrier spacing [symbols]: 15 kHz: 7, m*14, where m = {1, 2, 3, 4} 30 kHz: 7, m*14, where m = {1, 2, 3, 4, 5, 6, 7, 8} 60 kHz: 7, m*14, where m = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16}
cg-nrofPUSCH-InSlot 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).
cg-nrofSlots 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).
cg-RetransmissionTimer Indicates the initial value of the configured retransmission timer (see TS 38.321 [3]) in multiples of *periodicity*. The value of *cg-RetransmissionTimer* is always less than the value of *configuredGrantTimer.* This field is always configured for operation with shared spectrum channel access together with *harq-ProcID-Offset*. This field is not configured for operation in licensed spectrum or simultaneously with *harq-ProcID-Offset2.*
cg-UCI-Multiplexing 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).
configuredGrantConfigIndex Indicates the index of the Configured Grant configurations within the BWP.
configuredGrantConfigIndexMAC Indicates the index of the Configured Grant configurations within the MAC entity.
configuredGrantTimer Indicates the initial value of the configured grant timer (see TS 38.321 [3]) in multiples of periodicity. When *cg-RetransmissonTimer* is configured, if HARQ processes are shared among different configured grants on the same BWP, *configuredGrantTimer* is set to the same value for all of configurations on this BWP.
dmrs-SeqInitialization The network configures this field if *transformPrecoder* is disabled. Otherwise the field is absent.
frequencyDomainAllocation Indicates the frequency domain resource allocation, see TS 38.214 [19], clause 6.1.2, and TS 38.212 [17], clause 7.3.1).

frequencyHopping
The value *intraSlot* enables 'Intra-slot frequency hopping' and the value *interSlot* enables 'Inter-slot frequency hopping'. If the field is absent, frequency hopping is not configured. The field *frequencyHopping* applies to configured grant for 'pusch-RepTypeA' (see TS 38.214 [19], clause 6.3.1).

frequencyHoppingOffset
Frequency hopping offset used when frequency hopping is enabled (see TS 38.214 [19], clause 6.1.2 and clause 6.3).

frequencyHoppingPUSCH-RepTypeB
Indicates the frequency hopping scheme for Type 1 CG when *pusch-RepTypeIndicator* is set to 'pusch-RepTypeB' (see TS 38.214 [19], clause 6.1). The value *interRepetition* enables 'Inter-repetition frequency hopping', and the value *interSlot* enables 'Inter-slot frequency hopping'. If the field is absent, the frequency hopping is not enabled for Type 1 CG.

harq-ProcID-Offset
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 [*harq-procID-offset, ..,* (*harq-procID-offset + nrofHARQ-Processes* – 1)].

harq-ProcID-Offset2
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.

mcs-Table
Indicates the MCS table the UE shall use for PUSCH without transform precoding. If the field is absent the UE applies the value *qam64*.

mcs-TableTransformPrecoder
Indicates the MCS table the UE shall use for PUSCH with transform precoding. If the field is absent the UE applies the value *qam64*.

mcsAndTBS
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.

nrofHARQ-Processes
The number of HARQ processes configured. It applies for both Type 1 and Type 2. See TS 38.321 [3], clause 5.4.1.

p0-PUSCH-Alpha
Index of the *P0-PUSCH-AlphaSet* to be used for this configuration.

periodicity
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*14, where n={1, 2, 4, 5, 8, 10, 16, 20, 32, 40, 64, 80, 128, 160, 320, 640}
30 kHz: 2, 7, n*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*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*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*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}

periodicityExt
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 *periodicity* is ignored.
The following periodicites are supported depending on the configured subcarrier spacing [symbols]:
15 kHz: *periodicityExt**14, where *periodicityExt* has a value between 1 and 640.
30 kHz: *periodicityExt**14, where *periodicityExt* has a value between 1 and 1280.
60 kHz with normal CP: *periodicityExt**14, where *periodicityExt* has a value between 1 and 2560.
60 kHz with ECP: *periodicityExt**12, where *periodicityExt* has a value between 1 and 2560.
120 kHz: *periodicityExt**14, where *periodicityExt* has a value between 1 and 5120.

phy-PriorityIndex
Indicates the PHY priority of CG PUSCH at least for PHY-layer collision handling. Value *p0* indicates low priority and value *p1* indicates high priority.

powerControlLoopToUse
Closed control loop to apply (see TS 38.213 [13], clause 7.1.1).

pusch-RepTypeIndicator 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 *pusch-RepTypeA* enables the 'PUSCH repetition type A' and the value *pusch-RepTypeB* enables the 'PUSCH repetition type B' (see TS 38.214 [19], clause 6.1.2.3).
rbg-Size Selection between configuration 1 and configuration 2 for RBG size for PUSCH. The UE does not apply this field if *resourceAllocation* is set to *resourceAllocationType1*. Otherwise, the UE applies the value *config1* when the field is absent. Note: *rbg-Size* is used when the *transformPrecoder* parameter is disabled.
repK-RV 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 *repK* is set to *n2*, *n4* or *n8*. This field is not configured when *cg-RetransmissionTimer* is configured. Otherwise, the field is absent.
repK The number of repetitions of K.
resourceAllocation Configuration of resource allocation type 0 and resource allocation type 1. For Type 1 UL data transmission without grant, *resourceAllocation* should be *resourceAllocationType0* or *resourceAllocationType1*.
rrc-ConfiguredUplinkGrant 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.
srs-ResourceIndicator Indicates the SRS resource to be used.
startingFromRV0 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.
timeDomainAllocation 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.
timeDomainOffset Offset related to the reference SFN indicated by *timeReferenceSFN*, see TS 38.321 [3], clause 5.8.2.
timeReferenceSFN 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 *timeReferenceSFN* is not present, the reference SFN is 0.
transformPrecoder Enables or disables transform precoding for *type1* and *type2*. If the field is absent, the UE enables or disables transform precoding in accordance with the field *msg3-transformPrecoder* in *RACH-ConfigCommon*, see TS 38.214 [19], clause 6.1.3.
uci-OnPUSCH Selection between and configuration of dynamic and semi-static beta-offset. For Type 1 UL data transmission without grant, *uci-OnPUSCH* should be set to *semiStatic.*

***CG-COT-Sharing* field descriptions**
channelAccessPriority 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).
duration Indicates the number of DL transmission slots within UE initiated COT (see 37.213 [48], clause 4.1.3).
offset 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).

***CG-StartingOffsets* field descriptions**
cg-StartingFullBW-InsideCOT 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).
cg-StartingFullBW-OutsideCOT 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).
cg-StartingPartialBW-InsideCOT 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).
cg-StartingPartialBW-OutsideCOT 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).

Conditional Presence	Explanation
LCH-BasedPrioritization	This fiels is optionally present, Need R, if *lch-BasedPrioritization* is configured in the MAC entity. It is absent otherwise.
RepTypeB	The field is optionally present if pusch-RepTypeIndicator is set to pusch-RepTypeB, Need S, and absent otherwise.
CG-List	The field is mandatory present when included in *configuredGrantConfigToAddModList-r16*, otherwise the field is absent.

– *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-CONNESTFAILURECONTROL-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-CONNESTFAILURECONTROL-STOP
-- ASN1STOP
```

ConnEstFailureControl field descriptions
connEstFailCount Number of times that the UE detects T300 expiry on the same cell before applying *connEstFailOffset*.
connEstFailOffset Parameter "$Qoffset_{temp}$" in TS 38.304 [20]. If the field is absent, the value of infinity shall be used for "$Qoffset_{temp}$".
connEstFailOffsetValidity Amount of time that the UE applies *connEstFailOffset* 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 ::=              SEQUENCE {
    controlResourceSetId                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-PresentForDCI-Format1-2-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
```

***ControlResourceSet* field descriptions**
cce-REG-MappingType 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).
controlResourceSetId Identifies the instance of the *ControlResourceSet* IE. Value 0 identifies the common CORESET configured in *MIB* and in *ServingCellConfigCommon* (*controlResourceSetZero*) and is hence not used here in the *ControlResourceSet* IE. Other values identify CORESETs configured by dedicated signalling or in *SIB1*. The *controlResourceSetId* is unique among the BWPs of a serving cell. If the field *controlResourceSetId-v1610* is present, the UE shall ignore the *controlResourceSetId* field (without suffix).
coresetPoolIndex 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.
duration Contiguous time duration of the CORESET in number of symbols (see TS 38.211 [16], clause 7.3.2.2).
frequencyDomainResources Frequency domain resources for the CORESET. Each bit corresponds a group of 6 RBs, with grouping starting from the first RB group (see TS 38.213 [13], clause 10.1) in the BWP. 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).
interleaverSize Interleaver-size (see TS 38.211 [16], clause 7.3.2.2).
pdcch-DMRS-ScramblingID 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 *physCellId* configured for this serving cell.
precoderGranularity Precoder granularity in frequency domain (see TS 38.211 [16], clauses 7.3.2.2 and 7.4.1.3.2).
rb-Offset 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.
reg-BundleSize 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).
shiftIndex When the field is absent the UE applies the value of the *physCellId*configured for this serving cell (see TS 38.211 [16], clause 7.3.2.2).
tci-PresentInDCI 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 *ControlResourceSet* used for cross carrier scheduling in the scheduling cell (see TS 38.214 [19], clause 5.1.5).
tci-PresentForDCI-Format1-2 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).
tci-StatesPDCCH-ToAddList A subset of the TCI states defined in pdsch-Config included in the *BWP-DownlinkDedicated* corresponding to the serving cell and to the DL BWP to which the *ControlResourceSet* 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 *maxNrofTCI-StatesPDCCH* entries.

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 {                  -- Cross carrier scheduling: scheduling cell
            cif-Presence                            BOOLEAN
        },
        other                                   SEQUENCE {                  -- Cross carrier scheduling: scheduled cell
            schedulingCellId                        ServCellIndex,
            cif-InSchedulingCell                    INTEGER (1..7)
        }
    },
    ...,
    [[
    carrierIndicatorSize                SEQUENCE {
        carrierIndicatorSizeForDCI-Format1-2-r16        INTEGER (0..3),
        carrierIndicatorSizeForDCI-Format0-2-r16        INTEGER (0..3)
                                                                                    OPTIONAL  -- Cond CIF-PRESENCE
    }
    ]]
}

-- TAG-CrossCarrierSchedulingConfig-STOP
-- ASN1STOP
```

***CrossCarrierSchedulingConfig* field descriptions**
carrierIndicatorSizeForDCI-Format0-2, carrierIndicatorSizeForDCI-Format1-2 Configures the number of bits for the field of carrier indicator in PDCCH DCI format 0_2/1_2. The field *carrierIndicatorSizeForDCI-Format0-2* refers to DCI format 0_2 and the field *carrierIndicatorSizeForDCI-Format1-2* 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].
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
CIF-PRESENCE	The field is mandatory present if the *cif-Presence* is set to *true*. 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
```

***CSI-AssociatedReportConfigInfo* field descriptions**
csi-IM-ResourcesForInterference *CSI-IM-ResourceSet* for interference measurement. Entry number in csi-IM-ResourceSetList in the CSI-ResourceConfig indicated by *csi-IM-ResourcesForInterference* in the *CSI-ReportConfig* indicated by *reportConfigId* 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 *nzp-CSI-RS-ResourcesforChannel*.
csi-SSB-ResourceSet CSI-SSB-ResourceSet for channel measurements. Entry number in *csi-SSB-ResourceSetList* in the *CSI-ResourceConfig* indicated by *resourcesForChannelMeasurement* in the *CSI-ReportConfig* indicated by *reportConfigId* above (value 1 corresponds to the first entry, value 2 to the second entry, and so on).
nzp-CSI-RS-ResourcesForInterference *NZP-CSI-RS-ResourceSet* for interference measurement. Entry number in *nzp-CSI-RS-ResourceSetList* in the *CSI-ResourceConfig* indicated by *nzp-CSI-RS-ResourcesForInterference* in the *CSI-ReportConfig* indicated by *reportConfigId* above (value 1 corresponds to the first entry, value 2 to the second entry, and so on).
qcl-info List of references to TCI-States for providing the QCL source and QCL type for each *NZP-CSI-RS-Resource* listed in *nzp-CSI-RS-Resources* of the *NZP-CSI-RS-ResourceSet* indicated by *nzp-CSI-RS-ResourcesforChannel*. Each *TCI-StateId* refers to the *TCI-State* which has this value for *tci-StateId* and is defined in *tci-StatesToAddModList* in the *PDSCH-Config* included in the *BWP-Downlink* corresponding to the serving cell and to the DL BWP to which the *resourcesForChannelMeasurement* (in the *CSI-ReportConfig* indicated by *reportConfigId* above) belong to. First entry in *qcl-info-forChannel* corresponds to first entry in *nzp-CSI-RS-Resources* of that *NZP-CSI-RS-ResourceSet*, second entry in *qcl-info-forChannel* corresponds to second entry in *nzp-CSI-RS-Resources*, and so on (see TS 38.214 [19], clause 5.2.1.5.1)
reportConfigId The *reportConfigId* of one of the *CSI-ReportConfigToAddMod* configured in *CSI-MeasConfig*
resourceSet *NZP-CSI-RS-ResourceSet* for channel measurements. Entry number in *nzp-CSI-RS-ResourceSetList* in the *CSI-ResourceConfig* indicated by *resourcesForChannelMeasurement* in the *CSI-ReportConfig* indicated by *reportConfigId* above (value 1 corresponds to the first entry, value 2 to thesecond entry, and so on).

Conditional Presence	Explanation
Aperiodic	The field is mandatory present if the *NZP-CSI-RS-Resources* in the associated *resourceSet* have the resourceType aperiodic. The field is absent otherwise.
CSI-IM-ForInterference	This field is mandatory present if the *CSI-ReportConfig* identified by *reportConfigId* is configured with *csi-IM-ResourcesForInterference*; otherwise it is absent.
NZP-CSI-RS-ForInterference	This field is mandatory present if the *CSI-ReportConfig* identified by *reportConfigId* is configured with *nzp-CSI-RS-ResourcesForInterference*; 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 ::=                 SEQUENCE {
    csi-IM-ResourceId                   CSI-IM-ResourceId,
    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)
        }
    }                                                                       OPTIONAL,   -- Need M
    freqBand                            CSI-FrequencyOccupation             OPTIONAL,   -- Need M
    periodicityAndOffset                CSI-ResourcePeriodicityAndOffset    OPTIONAL,   -- Cond PeriodicOrSemiPersistent
    ...
}

-- TAG-CSI-IM-RESOURCE-STOP
-- ASN1STOP
```

***CSI-IM-Resource* field descriptions**
csi-IM-ResourceElementPattern The resource element pattern (Pattern0 (2,2) or Pattern1 (4,1)) with corresponding parameters (see TS 38.214 [19], clause 5.2.2.4)
freqBand Frequency-occupancy of CSI-IM (see TS 38.214 [19], clause 5.2.2.4)
periodicityAndOffset 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.
subcarrierLocation-p0 OFDM subcarrier occupancy of the CSI-IM resource for Pattern0 (see TS 38.214 [19], clause 5.2.2.4)
subcarrierLocation-p1 OFDM subcarrier occupancy of the CSI-IM resource for Pattern1 (see TS 38.214 [19], clause 5.2.2.4)
symbolLocation-p0 OFDM symbol location of the CSI-IM resource for Pattern0 (see TS 38.214 [19], clause 5.2.2.4)
symbolLocation-p1 OFDM symbol location of the CSI-IM resource for Pattern1 (see TS 38.214 [19], clause 5.2.2.4)

Conditional Presence	Explanation
PeriodicOrSemiPersistent	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 ::=              SEQUENCE {
    csi-IM-ResourceSetId                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-ResourceSet*s.

***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
```

```
                                                                                                    OPTIONAL, -- Need N
    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 M
    aperiodicTriggerStateList           SetupRelease { CSI-AperiodicTriggerStateList }              OPTIONAL, -- Need M
    semiPersistentOnPUSCH-TriggerStateList    SetupRelease { CSI-SemiPersistentOnPUSCH-TriggerStateList }  OPTIONAL, -- Need M
    ...,
    [[
    reportTriggerSizeForDCI-Format0-2-r16       INTEGER (0..6)                                      OPTIONAL -- Need R
    ]]
}

-- TAG-CSI-MEASCONFIG-STOP
-- ASN1STOP
```

***CSI-MeasConfig* field descriptions**
aperiodicTriggerStateList 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).
csi-IM-ResourceSetToAddModList Pool of *CSI-IM-ResourceSet* which can be referred to from *CSI-ResourceConfig* or from MAC CEs.
csi-IM-ResourceToAddModList Pool of *CSI-IM-Resource* which can be referred to from *CSI-IM-ResourceSet*.
csi-ReportConfigToAddModList Configured CSI report settings as specified in TS 38.214 [19] clause 5.2.1.1.
csi-ResourceConfigToAddModList Configured CSI resource settings as specified in TS 38.214 [19] clause 5.2.1.2.
csi-SSB-ResourceSetToAddModList Pool of CSI-SSB-ResourceSet which can be referred to from *CSI-ResourceConfig*.
nzp-CSI-RS-ResourceSetToAddModList Pool of *NZP-CSI-RS-ResourceSet* which can be referred to from *CSI-ResourceConfig* or from MAC CEs.
nzp-CSI-RS-ResourceToAddModList Pool of *NZP-CSI-RS-Resource* which can be referred to from *NZP-CSI-RS-ResourceSet*.
reportTriggerSize, reportTriggerSizeForDCI-Format0-2 Size of CSI request field in DCI (bits) (see TS 38.214 [19], clause 5.2.1.5.1). The field *reportTriggerSize* applies to DCI format 0_1 and the field *reportTriggerSizeForDCI-Format0-2* 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 ::=                SEQUENCE {
    reportConfigId                          CSI-ReportConfigId,
    carrier                                 ServCellIndex                   OPTIONAL,   -- Need S
    resourcesForChannelMeasurement          CSI-ResourceConfigId,
    csi-IM-ResourcesForInterference         CSI-ResourceConfigId            OPTIONAL,   -- Need R
    nzp-CSI-RS-ResourcesForInterference     CSI-ResourceConfigId            OPTIONAL,   -- Need R
    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 {sl5, sl10, sl20, sl40, sl80, sl160, sl320},
            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-i1                               NULL,
        cri-RI-i1-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 {sl4, sl8, sl16}
}                                                                                                   OPTIONAL    -- Need R
]],
[[
semiPersistentOnPUSCH-v1610                 SEQUENCE {
    reportSlotOffsetListForDCI-Format0-2-r16    SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32)
                                                                                                    OPTIONAL,    -- Need R
    reportSlotOffsetListForDCI-Format0-1-r16    SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32)
                                                                                                    OPTIONAL     -- Need R
}                                                                                                   OPTIONAL,    -- Need R
aperiodic-v1610                 SEQUENCE {
    reportSlotOffsetListForDCI-Format0-2-r16  SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32)
                                                                                                    OPTIONAL,    -- Need R
    reportSlotOffsetListForDCI-Format0-1-r16  SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32)
                                                                                                    OPTIONAL     -- Need R
}                                                                                                   OPTIONAL,    -- Need R
reportQuantity-r16                      CHOICE {
   cri-SINR-r16                             NULL,
```

```
       ssb-Index-SINR-r16                       NULL
    }                                                                   OPTIONAL,   -- Need R
    codebookConfig-r16                      CodebookConfig-r16          OPTIONAL    -- Need R
    ]]
}

CSI-ReportPperiodicityAndOffset ::=  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               BWP-Id,
    pucch-Resource                      PUCCH-ResourceId
}

PortIndexFor8Ranks ::=              CHOICE {
    portIndex8                          SEQUENCE{
        rank1-8                             PortIndex8                  OPTIONAL,   -- Need R
        rank2-8                             SEQUENCE(SIZE(2)) OF PortIndex8 OPTIONAL,   -- Need R
        rank3-8                             SEQUENCE(SIZE(3)) OF PortIndex8 OPTIONAL,   -- Need R
        rank4-8                             SEQUENCE(SIZE(4)) OF PortIndex8 OPTIONAL,   -- Need R
        rank5-8                             SEQUENCE(SIZE(5)) OF PortIndex8 OPTIONAL,   -- Need R
        rank6-8                             SEQUENCE(SIZE(6)) OF PortIndex8 OPTIONAL,   -- Need R
        rank7-8                             SEQUENCE(SIZE(7)) OF PortIndex8 OPTIONAL,   -- Need R
        rank8-8                             SEQUENCE(SIZE(8)) OF PortIndex8 OPTIONAL    -- Need R
    },
    portIndex4                          SEQUENCE{
        rank1-4                             PortIndex4                  OPTIONAL,   -- Need R
        rank2-4                             SEQUENCE(SIZE(2)) OF PortIndex4 OPTIONAL,   -- Need R
        rank3-4                             SEQUENCE(SIZE(3)) OF PortIndex4 OPTIONAL,   -- Need R
        rank4-4                             SEQUENCE(SIZE(4)) OF PortIndex4 OPTIONAL    -- Need R
    },
    portIndex2                          SEQUENCE{
        rank1-2                             PortIndex2                  OPTIONAL,   -- Need R
        rank2-2                             SEQUENCE(SIZE(2)) OF PortIndex2 OPTIONAL    -- Need R
    },
    portIndex1                          NULL
}

PortIndex8::=                       INTEGER (0..7)
PortIndex4::=                       INTEGER (0..3)
PortIndex2::=                       INTEGER (0..1)

-- TAG-CSI-REPORTCONFIG-STOP
-- ASN1STOP
```

***CSI-ReportConfig* field descriptions**
carrier Indicates in which serving cell the *CSI-ResourceConfig* indicated below are to be found. If the field is absent, the resources are on the same serving cell as this report configuration.
codebookConfig Codebook configuration for Type-1 or Type-2 including codebook subset restriction. Network does not configure codebookConfig and codebookConfig-r16 simultaneously to a UE
cqi-FormatIndicator Indicates whether the UE shall report a single (wideband) or multiple (subband) CQI. (see TS 38.214 [19], clause 5.2.1.4).
cqi-Table Which CQI table to use for CQI calculation (see TS 38.214 [19], clause 5.2.2.1).
csi-IM-ResourcesForInterference CSI IM resources for interference measurement. *csi-ResourceConfigId* of a *CSI-ResourceConfig* included in the configuration of the serving cell indicated with the field "carrier" above. The *CSI-ResourceConfig* indicated here contains only CSI-IM resources. The *bwp-Id* in that *CSI-ResourceConfig* is the same value as the *bwp-Id* in the *CSI-ResourceConfig* indicated by *resourcesForChannelMeasurement*.
csi-ReportingBand 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).
dummy This field is not used in the specification. If received it shall be ignored by the UE.
groupBasedBeamReporting Turning on/off group beam based reporting (see TS 38.214 [19], clause 5.2.1.4).
non-PMI-PortIndication 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 *non-PMI-PortIndication* corresponds to the NZP-CSI-RS-Resource indicated by the first entry in *nzp-CSI-RS-Resources* in the *NZP-CSI-RS-ResourceSet* indicated in the first entry of *nzp-CSI-RS-ResourceSetList* of the *CSI-ResourceConfig* whose *CSI-ResourceConfigId* is indicated in a CSI-MeasId together with the above *CSI-ReportConfigId*; the second entry in *non-PMI-PortIndication* corresponds to the NZP-CSI-RS-Resource indicated by the second entry in *nzp-CSI-RS-Resources* in the *NZP-CSI-RS-ResourceSet* indicated in the first entry of *nzp-CSI-RS-ResourceSetList* of the same *CSI-ResourceConfig*, and so on until the NZP-CSI-RS-Resource indicated by the last entry in *nzp-CSI-RS-Resources* in the in the *NZP-CSI-RS-ResourceSet* indicated in the first entry of *nzp-CSI-RS-ResourceSetList* of the same *CSI-ResourceConfig*. Then the next entry corresponds to the NZP-CSI-RS-Resource indicated by the first entry in *nzp-CSI-RS-Resources* in the *NZP-CSI-RS-ResourceSet* indicated in the second entry of *nzp-CSI-RS-ResourceSetList* of the same *CSI-ResourceConfig* and so on.
nrofReportedRS The number (N) of measured RS resources to be reported per report setting in a non-group-based report. N <= N_max, where N_max 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.
nzp-CSI-RS-ResourcesForInterference NZP CSI RS resources for interference measurement. *csi-ResourceConfigId* of a *CSI-ResourceConfig* included in the configuration of the serving cell indicated with the field "carrier" above. The *CSI-ResourceConfig* indicated here contains only NZP-CSI-RS resources. The *bwp-Id* in that *CSI-ResourceConfig* is the same value as the *bwp-Id* in the *CSI-ResourceConfig* indicated by *resourcesForChannelMeasurement*.
p0alpha 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).
pdsch-BundleSizeForCSI PRB bundling size to assume for CQI calculation when *reportQuantity* 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).

pmi-FormatIndicator Indicates whether the UE shall report a single (wideband) or multiple (subband) PMI. (see TS 38.214 [19], clause 5.2.1.4).
pucch-CSI-ResourceList Indicates which PUCCH resource to use for reporting on PUCCH.
reportConfigType Time domain behavior of reporting configuration.
reportFreqConfiguration Reporting configuration in the frequency domain. (see TS 38.214 [19], clause 5.2.1.4).
reportQuantity The CSI related quantities to report. see TS 38.214 [19], clause 5.2.1. If the field *reportQuantity-r16* is present, UE shall ignore *reportQuantity* (without suffix).
reportSlotConfig Periodicity and slot offset (see TS 38.214 [19], clause 5.2.1.4). If the field *reportSlotConfig-v1530* is present, the UE shall ignore the value provided in *reportSlotConfig* (without suffix).
reportSlotOffsetList, reportSlotOffsetListForDCI-Format0-1, ***reportSlotOffsetListForDCI-Format0-2*** 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 *pusch-TimeDomainAllocationList* in *PUSCH-Config*. 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 *pusch-TimeDomainAllocationList* in *PUSCH-Config*. 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 *reportSlotOffsetList* applies to DCI format 0_0, the field *reportSlotOffsetListForDCI-Format0-1* applies to DCI format 0_1 and the field *reportSlotOffsetListForDCI-Format0-2* applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.2.1).
resourcesForChannelMeasurement Resources for channel measurement. *csi-ResourceConfigId* of a *CSI-ResourceConfig* included in the configuration of the serving cell indicated with the field "carrier" above. The *CSI-ResourceConfig* indicated here contains only NZP-CSI-RS resources and/or SSB resources. This *CSI-ReportConfig* is associated with the DL BWP indicated by *bwp-Id* in that *CSI-ResourceConfig*.
subbandSize 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 *csi-ReportingBand* is absent, the UE shall ignore this field.
timeRestrictionForChannelMeasurements Time domain measurement restriction for the channel (signal) measurements (see TS 38.214 [19], clause 5.2.1.1).
timeRestrictionForInterferenceMeasurements Time domain measurement restriction for interference measurements (see TS 38.214 [19], clause 5.2.1.1).

PortIndexFor8Ranks **field descriptions**
portIndex8 Port-Index configuration for up to rank 8. If present, the network configures port indexes for at least one of the ranks.
portIndex4 Port-Index configuration for up to rank 4. If present, the network configures port indexes for at least one of the ranks.
portIndex2 Port-Index configuration for up to rank 2. If present, the network configures port indexes for at least one of the ranks.
portIndex1 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
```

***CSI-ResourceConfig* field descriptions**
bwp-Id The DL BWP which the CSI-RS associated with this *CSI-ResourceConfig* are located in (see TS 38.214 [19], clause 5.2.1.2.
csi-IM-ResourceSetList List of references to CSI-IM resources used for beam measurement and reporting in a CSI-RS resource set. Contains up to *maxNrofCSI-IM-ResourceSetsPerConfig* resource sets if *resourceType* is 'aperiodic' and 1 otherwise (see TS 38.214 [19], clause 5.2.1.2).
csi-ResourceConfigId Used in *CSI-ReportConfig* to refer to an instance of *CSI-ResourceConfig.*
csi-SSB-ResourceSetList 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).
nzp-CSI-RS-ResourceSetList List of references to NZP CSI-RS resources used for beam measurement and reporting in a CSI-RS resource set. Contains up to *maxNrofNZP-CSI-RS-ResourceSetsPerConfig* resource sets if *resourceType* is 'aperiodic' and 1 otherwise (see TS 38.214 [19], clause 5.2.1.2).
resourceType 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 *csi-SSB-ResourceSetList*.

– *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
    }                                                                                   OPTIONAL, -- Need R
    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
```

***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.

***CSI-RS-Resource-Mobility* field descriptions**
associatedSSB If this field is present, the UE may base the timing of the CSI-RS resource indicated in *CSI-RS-Resource-Mobility* on the timing of the cell indicated by the *cellId* in the *CSI-RS-CellMobility*. 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 *associatedSSB* and *cellId*. If this field is absent, the UE shall base the timing of the CSI-RS resource indicated in *CSI-RS-Resource-Mobility* on the timing of the serving cell indicated by *refServCellIndex*. In this case, the UE is required to measure the CSI-RS resource even if SS/PBCH block(s) with *cellId* in the *CSI-RS-CellMobility* are not detected. CSI-RS resources with and without *associatedSSB* may be configured in accordance with the rules in TS 38.214 [19], clause 5.1.6.1.3.
csi-RS-Index CSI-RS resource index associated to the CSI-RS resource to be measured (and used for reporting).
firstOFDMSymbolInTimeDomain 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 *dmrs-TypeA-Position* equals *pos3*.
frequencyDomainAllocation 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.
isQuasiColocated 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.
sequenceGenerationConfig Scrambling ID for CSI-RS (see TS 38.211 [16], clause 7.4.1.5.2).
slotConfig Indicates the CSI-RS periodicity (in milliseconds) and for each periodicity the offset (in number of slots). When *subcarrierSpacingCSI-RS* is set to *kHz15*, the maximum offset values for periodicities *ms4/ms5/ms10/ms20/ms40* are 3/4/9/19/39 slots. When *subcarrierSpacingCSI-RS* is set to *kHz30*, the maximum offset values for periodicities *ms4/ms5/ms10/ms20/ms40* are 7/9/19/39/79 slots. When *subcarrierSpacingCSI-RS* is set to *kHz60*, the maximum offset values for periodicities *ms4/ms5/ms10/ms20/ms40* are 15/19/39/79/159 slots. When *subcarrierSpacingCSI-RS* is set *kHz120*, the maximum offset values for periodicities *ms4/ms5/ms10/ms20/ms40* are 31/39/79/159/319 slots.

– *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 ::=          SEQUENCE {
    frequencyDomainAllocation           CHOICE {
        row1                                BIT STRING (SIZE (4)),
        row2                                BIT STRING (SIZE (12)),
        row4                                BIT STRING (SIZE (3)),
        other                               BIT STRING (SIZE (6))
    },
    nrofPorts                           ENUMERATED {p1,p2,p4,p8,p12,p16,p24,p32},
    firstOFDMSymbolInTimeDomain         INTEGER (0..13),
    firstOFDMSymbolInTimeDomain2        INTEGER (2..12)                                                 OPTIONAL,   -- Need R
    cdm-Type                            ENUMERATED {noCDM, fd-CDM2, cdm4-FD2-TD2, cdm8-FD2-TD4},
    density                             CHOICE {
        dot5                                ENUMERATED {evenPRBs, oddPRBs},
```

```
        one                                 NULL,
        three                               NULL,
        spare                               NULL
    },
    freqBand                            CSI-FrequencyOccupation,
    ...
}

-- TAG-CSI-RS-RESOURCEMAPPING-STOP
-- ASN1STOP
```

***CSI-RS-ResourceMapping* field descriptions**
cdm-Type CDM type (see TS 38.214 [19], clause 5.2.2.3.1).
density Density of CSI-RS resource measured in RE/port/PRB (see TS 38.211 [16], clause 7.4.1.5.3). Values 0.5 (*dot5*), 1 (*one*) and 3 (*three*) are allowed for X=1, values 0.5 (*dot5*) and 1 (*one*) are allowed for X=2, 16, 24 and 32, value 1 (*one*) 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.
firstOFDMSymbolInTimeDomain2 Time domain allocation within a physical resource block. See TS 38.211 [16], clause 7.4.1.5.3.
firstOFDMSymbolInTimeDomain 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 *dmrs-TypeA-Position* equals *pos3*.
freqBand Wideband or partial band CSI-RS, (see TS 38.214 [19], clause 5.2.2.3.1).
frequencyDomainAllocation 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 *frequencyDomainAllocation* 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 *nrofPorts*, *cdm-Type* and density 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 *frequencyDomainAllocation*.
nrofPorts 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
```

***DMRS-DownlinkConfig* field descriptions**
dmrs-AdditionalPosition 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.
dmrs-Downlink This field indicates whether low PAPR DMRS is used, as specified in TS38.211 [16], clause 7.4.1.1.1.
dmrs-Type 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.
maxLength The maximum number of OFDM symbols for DL front loaded DMRS. *len1* corresponds to value 1. *len2* corresponds to value 2. If the field is absent, the UE applies value *len1*. If set to *len2*, 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).
phaseTrackingRS 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.
scramblingID0 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 *physCellId* configured for this serving cell.
scramblingID1 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 *physCellId* 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
        ]]
```

```
    }                                                                   OPTIONAL,   -- Need R
    ...
}

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
```

***DMRS-UplinkConfig* field descriptions**
dmrs-AdditionalPosition 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.
dmrs-Type 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.
dmrs-Uplink This field indicates whether low PAPR DMRS is used, as specified in TS38.211 [16], clause 6.4.1.1.1.1.
dmrs-UplinkTransformPrecoding 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 *tp-pi2BPSK* is configured in *PUSCH-Config*.
maxLength The maximum number of OFDM symbols for UL front loaded DMRS. *len1* corresponds to value 1. *len2* corresponds to value 2. If the field is absent, the UE applies value *len1*. If set to *len2*, 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).
nPUSCH-Identity Parameter: N_ID^(PUSCH) for DFT-s-OFDM DMRS. If the value is absent or released, the UE uses the value Physical cell ID (*physCellId*). See TS 38.211 [16].
phaseTrackingRS Configures uplink PTRS (see TS 38.211 [16]).
pi2BPSK-ScramblingID0, pi2BPSK-ScramblingID1 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 (physCellId) of the serving cell.
scramblingID0 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 (*physCellId*).
scramblingID1 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 (*physCellId*).
sequenceGroupHopping For DMRS transmission with transform precoder the NW may configure group hopping by the cell-specific parameter *groupHoppingEnabledTransformPrecoding* in *PUSCH-ConfigCommon*. 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 *PUSCH-ConfigCommon* (see TS 38.211 [16]). If the field is absent, the UE uses the same hopping mode as for Msg3.
sequenceHopping 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.
transformPrecodingDisabled DMRS related parameters for Cyclic Prefix OFDM.
transformPrecodingEnabled DMRS related parameters for DFT-s-OFDM (Transform Precoding).

– *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
InterFreqHOAndServCellAdd	This field is mandatory present for inter-frequency handover, and upon serving cell (PSCell/SCell) addition. Otherwise, the field is optionally present, Need M.
ServCellAdd	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 {
        sCS15KHZoneT                                                            SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..139),
        sCS30KHZoneT-SCS15KHZhalfT                                              SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..279),
        sCS60KHZoneT-SCS30KHZhalfT-SCS15KHZquarterT                             SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..559),
        sCS120KHZoneT-SCS60KHZhalfT-SCS30KHZquarterT-SCS15KHZoneEighthT         SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..1119),
        sCS120KHZhalfT-SCS60KHZquarterT-SCS30KHZoneEighthT-SCS15KHZoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..2239),
        sCS120KHZquarterT-SCS60KHZoneEighthT-SCS30KHZoneSixteenthT              SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..4479),
        sCS120KHZoneEighthT-SCS60KHZoneSixteenthT                               SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..8959),
        sCS120KHZoneSixteenthT                                                  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
```

***DownlinkConfigCommonSIB* field descriptions**
bcch-Config The modification period related configuration.
frequencyInfoDL-SIB Basic parameters of a downlink carrier and transmission thereon.
initialDownlinkBWP The initial downlink BWP configuration for a PCell. The network configures the *locationAndBandwidth* so that the initial downlink BWP contains the entire CORESET#0 of this serving cell in the frequency domain. The UE applies the *locationAndBandwidth* upon reception of this field (e.g. to determine the frequency position of signals described in relation to this *locationAndBandwidth*) but it keeps CORESET#0 until after reception of *RRCSetup*/*RRCResume*/*RRCReestablishment*.
nrofPDCCH-MonitoringOccasionPerSSB-InPO The number of PDCCH monitoring occasions corresponding to an SSB within a Paging Occasion, see TS 38.304 [20], clause 7.1.
pcch-Config The paging related configuration.

***BCCH-Config* field descriptions**
modificationPeriodCoeff
Actual modification period, expressed in number of radio frames m = *modificationPeriodCoeff * defaultPagingCycle*, see clause 5.2.2.2.2. *n2* corresponds to value 2, *n4* corresponds to value 4, and so on.

***PCCH-Config* field descriptions**
defaultPagingCycle
Default paging cycle, used to derive 'T' in TS 38.304 [20]. Value *rf32* corresponds to 32 radio frames, value *rf64* corresponds to 64 radio frames and so on.
firstPDCCH-MonitoringOccasionOfPO
Points out the first PDCCH monitoring occasion for paging of each PO of the PF, see TS 38.304 [20].
nAndPagingFrameOffset
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 *oneSixteenthT* corresponds to T / 16, a value of oneEighthT corresponds to T / 8, and so on. If *pagingSearchSpace* is set to zero and if SS/PBCH block and CORESET multiplexing pattern is 2 or 3 (as specified in TS 38.213 [13]): - for *ssb-periodicityServingCell* of 5 or 10 ms, N can be set to one of {*oneT, halfT, quarterT, oneEighthT, oneSixteenthT*} - for *ssb-periodicityServingCell* of 20 ms, N can be set to one of {*halfT, quarterT, oneEighthT, oneSixteenthT*} - for *ssb-periodicityServingCell* of 40 ms, N can be set to one of {*quarterT, oneEighthT, oneSixteenthT*} - for *ssb-periodicityServingCell* of 80 ms, N can be set to one of {*oneEighthT, oneSixteenthT*} - for *ssb-periodicityServingCell* of 160 ms, N can be set to *oneSixteenthT* If *pagingSearchSpace* 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 {*halfT, quarterT, oneEighthT, oneSixteenthT*} If *pagingSearchSpace* is not set to zero, N can be configured to one of {*oneT, halfT, quarterT, oneEighthT, oneSixteenthT*}
ns
Number of paging occasions per paging frame.

Conditional Presence	Explanation
SharedSpectrum2	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 ::=              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 ::=                      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},
    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)
    }                                                                                   OPTIONAL,   -- Need R
    drx-SlotOffset                      INTEGER (0..31)
}

-- TAG-DRX-CONFIG-STOP
-- ASN1STOP
```

***DRX-Config* field descriptions**
drx-HARQ-RTT-TimerDL Value in number of symbols of the BWP where the transport block was received.
drx-HARQ-RTT-TimerUL Value in number of symbols of the BWP where the transport block was transmitted.
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.
drx-LongCycleStartOffset *drx-LongCycle* in ms and *drx-StartOffset* in multiples of 1 ms. If *drx-ShortCycle* is configured, the value of *drx-LongCycle* shall be a multiple of the *drx-ShortCycle* value.
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.
drx-RetransmissionTimerDL Value in number of slot lengths of the BWP where the transport block was received. value *sl0* corresponds to 0 slots, *sl1* corresponds to 1 slot, *sl2* corresponds to 2 slots, and so on.
drx-RetransmissionTimerUL Value in number of slot lengths of the BWP where the transport block was transmitted. *sl0* corresponds to 0 slots, *sl1* corresponds to 1 slot, *sl2* corresponds to 2 slots, and so on.
drx-ShortCycleTimer Value in multiples of *drx-ShortCycle*. A value of 1 corresponds to *drx-ShortCycle*, a value of 2 corresponds to 2 * *drx-ShortCycle* and so on.
drx-ShortCycle Value in ms. *ms1* corresponds to 1 ms, *ms2* corresponds to 2 ms, and so on.
drx-SlotOffset 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
SpCellAdd	The field is mandatory present if this *FrequencyInfoDL* 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 ::=             SEQUENCE {
    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 ::=                 SEQUENCE {
    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
```

***FrequencyInfoUL* field descriptions**
absoluteFrequencyPointA 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 *scs-SpecificCarrierList* (see TS 38.211 [16], clause 4.4.4.2).
additionalSpectrumEmission 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 *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).
frequencyBandList List containing only one frequency band to which this carrier(s) belongs. Multiple values are not supported.
frequencyShift7p5khz 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-Max 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 *p-NR-FR1* (configured for the cell group) and by *p-UE-FR1* (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.
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
FDD-OrSUL	The field is mandatory present if this *FrequencyInfoUL* is for the paired UL for a DL (defined in a *FrequencyInfoDL*) or if this *FrequencyInfoUL* is for a supplementary uplink (SUL). It is absent, Need R, otherwise (if this *FrequencyInfoUL* is for an unpaired UL (TDD).
FDD-TDD-OrSUL-Optional	The field is optionally present, Need R, if this *FrequencyInfoUL* is for the paired UL for a DL (defined in a *FrequencyInfoDL*), or if this *FrequencyInfoUL* 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 *FrequencyInfoUL* 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 ::=             SEQUENCE {
    frequencyBandList               MultiFrequencyBandListNR-SIB                        OPTIONAL,   -- Cond FDD-OrSUL
    absoluteFrequencyPointA         ARFCN-ValueNR                                       OPTIONAL,   -- Cond FDD-OrSUL
    scs-SpecificCarrierList         SEQUENCE (SIZE (1..maxSCSs)) OF SCS-SpecificCarrier,
    p-Max                           P-Max                                               OPTIONAL,   -- Need S
```

```
    frequencyShift7p5khz                ENUMERATED {true}                                   OPTIONAL,   -- Cond FDD-TDD-OrSUL-Optional
    ...
}

-- TAG-FREQUENCYINFOUL-SIB-STOP
-- ASN1STOP
```

***FrequencyInfoUL-SIB* field descriptions**
absoluteFrequencyPointA 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 *scs-SpecificCarrierList* (see TS 38.211 [16], clause 4.4.4.2).
frequencyBandList Provides the frequency band indicator and a list of *additionalPmax* and *additionalSpectrumEmission* 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 *frequencyBandList* field.
frequencyShift7p5khz 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-Max 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].
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 UL BWPs configured in this serving cell.

Conditional Presence	Explanation
FDD-OrSUL	The field is mandatory present if this *FrequencyInfoUL-SIB* is for the paired UL for a DL (defined in a *FrequencyInfoDL-SIB*) or if this *FrequencyInfoUL-SIB* is for a supplementary uplink (SUL). It is absent otherwise (if this *FrequencyInfoUL-SIB* is for an unpaired UL (TDD).
FDD-TDD-OrSUL-Optional	The field is optionally present, Need R, if this *FrequencyInfoUL-SIB* is for the paired UL for a DL (defined in a *FrequencyInfoDL-SIB*), or if this *FrequencyInfoUL-SIB* 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 *FrequencyInfoUL-SIB* 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))
    }                                                           OPTIONAL,   -- Need M
    ...
}

-- TAG-INVALIDSYMBOLPATTERN-STOP
-- ASN1STOP
```

***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-FailureDetectionTimert 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-ARFCN-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, spare2, spare1},
    ...
}

-- TAG-LOCATIONMEASUREMENTINFO-STOP
-- ASN1STOP
```

***LocationMeasurementInfo* field descriptions**
carrierFreq
The EARFCN value of the carrier received from upper layers for which the UE needs to perform the inter-RAT RSTD measurements.
measPRS-Offset
Indicates the requested gap offset for performing RSTD measurements towards E-UTRA. It is the smallest subframe offset from the beginning of subframe 0 of SFN=0 of the serving cell of the requested gap for measuring PRS positioning occasions in the carrier frequency *carrierFreq* for which the UE needs to perform the inter-RAT RSTD measurements. The PRS positioning occasion information is received from upper layers. The value of *measPRS-Offset* is obtained by mapping the starting subframe of the PRS positioning occasion in the measured cell onto the corresponding subframe in the serving cell and is calculated as the serving cell's number of subframes from SFN=0 mod 40. The UE shall take into account any additional time required by the UE to start PRS measurements on the other carrier when it does this mapping for determining the *measPRS-Offset*. NOTE: Figure 6.2.2-1 in TS 36.331[10] illustrates the *measPRS-Offset* field.
dl-PRS-ARFCN-PointA
The ARFCN value of the carrier received from upper layers for which the UE needs to perform the NR DL PRS measurements.
nr-MeasPRS-RepetitionAndOffset
Indicates the gap periodicity in ms and offset in number of subframes of the requested measurement gap for performing NR DL PRS measurements.
nr-MeasPRS-length
Indicates measurement gap length in ms of the requested measurement gap for performing NR DL PRS measurements.
nr-CarrierFreq
The ARFCN value of the carrier received from upper layers for which the UE needs to perform the NR DL PRS measurements.

– *LogicalChannelConfig*

The IE *LogicalChannelConfig* is used to configure the logical channel parameters.

***LogicalChannelConfig* information element**

```
-- ASN1START
-- TAG-LOGICALCHANNELCONFIG-START

LogicalChannelConfig ::=            SEQUENCE {
    ul-SpecificParameters               SEQUENCE {
        priority                            INTEGER (1..16),
        prioritisedBitRate                  ENUMERATED {kBps0, kBps8, kBps16, kBps32, kBps64, kBps128, kBps256, kBps512,
                                            kBps1024, kBps2048, kBps4096, kBps8192, kBps16384, kBps32768, kBps65536, infinity},
        bucketSizeDuration                  ENUMERATED {ms5, ms10, ms20, ms50, ms100, ms150, ms300, ms500, ms1000,
                                                        spare7, spare6, spare5, spare4, spare3,spare2, spare1},
        allowedServingCells                 SEQUENCE (SIZE (1..maxNrofServingCells-1)) OF ServCellIndex
                                                                                                    OPTIONAL,   -- PDCP-CADuplication
        allowedSCS-List                     SEQUENCE (SIZE (1..maxSCSs)) OF SubcarrierSpacing       OPTIONAL,   -- Need R
        maxPUSCH-Duration                   ENUMERATED {ms0p02, ms0p04, ms0p0625, ms0p125, ms0p25, ms0p5, spare2, spare1}
                                                                                                    OPTIONAL,   -- Need R
        configuredGrantType1Allowed         ENUMERATED {true}                                       OPTIONAL,   -- Need R
        logicalChannelGroup                 INTEGER (0..maxLCG-ID)                                  OPTIONAL,   -- Need R
        schedulingRequestID                 SchedulingRequestId                                     OPTIONAL,   -- Need R
        logicalChannelSR-Mask               BOOLEAN,
        logicalChannelSR-DelayTimerApplied  BOOLEAN,
```

```
        ...,
        bitRateQueryProhibitTimer       ENUMERATED {s0, s0dot4, s0dot8, s1dot6, s3, s6, s12, s30}              OPTIONAL,    -- Need R
        [[
        allowedCG-List-r16                  SEQUENCE (SIZE (0.. maxNrofConfiguredGrantConfigMAC-r16-1)) OF ConfiguredGrantConfigIndexMAC-r16
                                                                                                               OPTIONAL,   -- Need S
        allowedPHY-PriorityIndex-r16        ENUMERATED {p0, p1}                                                OPTIONAL    -- Need S
        ]]
    }                                                                                                        OPTIONAL,   -- Cond UL
    ...,
    [[
    channelAccessPriority-r16           INTEGER (1..4)                                                       OPTIONAL,   -- Need R
    bitRateMultiplier-r16               ENUMERATED {x40, x70, x100, x200}                                    OPTIONAL    -- Need R
    ]]
}

-- TAG-LOGICALCHANNELCONFIG-STOP
-- ASN1STOP
```

***LogicalChannelConfig* field descriptions**
allowedCG-List 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].
allowedPHY-PriorityIndex 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 *p0*, 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].
allowedSCS-List 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].
allowedServingCells 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].
bitRateMultiplier Bit rate multiplier for recommended bit rate MAC CE as specified in TS 38.321 [3]. Value *x40* indicates bit rate multiplier 40, value *x60* indicates bit rate multiplier 60 and so on.
bitRateQueryProhibitTimer The timer is used for bit rate recommendation query in TS 38.321 [3], in seconds. Value *s0* means 0 s, *s0dot4* means 0.4 s and so on.
bucketSizeDuration Value in ms. *ms5* corresponds to 5 ms, value *ms10* corresponds to 10 ms, and so on.
channelAccessPriority 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.
configuredGrantType1Allowed 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].
logicalChannelGroup ID of the logical channel group, as specified in TS 38.321 [3], which the logical channel belongs to.
logicalChannelSR-Mask Controls SR triggering when a configured uplink grant of *type1* or *type2* is configured. *true* indicates that SR masking is configured for this logical channel as specified in TS 38.321 [3].
logicalChannelSR-DelayTimerApplied Indicates whether to apply the delay timer for SR transmission for this logical channel. Set to *false* if *logicalChannelSR-DelayTimer* is not included in *BSR-Config*.
maxPUSCH-Duration 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.
priority Logical channel priority, as specified in TS 38.321 [3].
prioritisedBitRate Value in kiloBytes/s. Value *kBps0* corresponds to 0 kiloBytes/s, value *kBps8* corresponds to 8 kiloBytes/s, value *kBps16* corresponds to 16 kiloBytes/s, and so on. For SRBs, the value can only be set to *infinity*.
schedulingRequestId If present, it indicates the scheduling request configuration applicable for this logical channel, as specified in TS 38.321 [3].

Conditional Presence	Explanation
PDCP-CADuplication	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.
UL	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 M
    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**
usePreBSR If set to true, the MAC entity of the IAB-MT may use the Pre- emptive-BSR.
csi-Mask If set to true, the UE limits CSI reports to the on-duration period of the DRX cycle, see TS 38.321 [3].
dataInactivityTimer Releases the RRC connection upon data inactivity as specified in clause 5.3.8.5 and in TS 38.321 [3]. Value *s1* corresponds to 1 second, value s2 corresponds to 2 seconds, and so on.
drx-Config Used to configure DRX as specified in TS 38.321 [3].
drx-ConfigSecondaryGroup 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.
lch-BasedPrioritization 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].
schedulingRequestID-BFR-SCell Indicates the scheduling request configuration applicable for BFR on SCell, as specified in TS 38.321 [3].
schedulingRequestID-LBT-SCell Indicates the scheduling request configuration applicable for consistent uplink LBT recovery on SCell, as specified in TS 38.321 [3].
skipUplinkTxDynamic If set to *true*, the UE skips UL transmissions as described in TS 38.321 [3].
tag-Config 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
MCG-Only	This field is optionally present, Need M, for the *MAC-CellGroupConfig* 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 ::=                      SEQUENCE {
    measObjectToRemoveList              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
    }                                                                                           OPTIONAL,   -- Need M
    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
```

***MeasConfig* field descriptions**
interFrequencyConfig-NoGap-r16 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.
measGapConfig Used to setup and release measurement gaps in NR.
measIdToAddModList List of measurement identities to add and/or modify.
measIdToRemoveList List of measurement identities to remove.
measObjectToAddModList List of measurement objects to add and/or modify.
measObjectToRemoveList List of measurement objects to remove.
reportConfigToAddModList List of measurement reporting configurations to add and/or modify.
reportConfigToRemoveList List of measurement reporting configurations to remove.
s-MeasureConfig Threshold for NR SpCell RSRP measurement controlling when the UE is required to perform measurements on non-serving cells. Choice of *ssb-RSRP* corresponds to cell RSRP based on SS/PBCH block and choice of *csi-RSRP* corresponds to cell RSRP of CSI-RS.
measGapSharingConfig 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
    ]]

}

-- 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.
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.
refFR2ServCellIAsyncCA 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
AsyncCA	This field is mandatory present when configuring FR2 gap pattern to UE in (NG)EN-DC / NR SA with asynchronous CA involving FR2 carrier(s), and NE-DC / NR-DC with asynchronous CA involving FR2 carrier(s) if the field *refServCellIndicator* is set to *mcg-FR2*. Otherwise, it is absent, Need R.
NEDCorNRDC	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.

– *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
```

***MeasGapSharingConfig* field descriptions**
gapSharingFR1 Indicates the measurement gap sharing scheme that applies to the gap set for FR1 only. In (NG)EN-DC, *gapSharingFR1* cannot be set up by NR RRC (i.e. only LTE RRC can configure FR1 gap sharing). In NE-DC, *gapSharingFR1* can only be set up by NR RRC (i.e. LTE RRC cannot configure FR1 gap sharing). In NR-DC, *gapSharingFR1* can only be set up in the *measConfig* associated with MCG. *gapSharingFR1* can not be configured together with *gapSharingUE*. For the applicability of the different gap sharing schemes, see TS 38.133 [14]. Value *scheme00* corresponds to scheme "00", value *scheme01* corresponds to scheme "01", and so on.
gapSharingFR2 Indicates the measurement gap sharing scheme that applies to the gap set for FR2 only. In (NG)EN-DC or NE-DC, *gapSharingFR2* can only be set up by NR RRC (i.e. LTE RRC cannot configure FR2 gap sharing). In NR-DC, *gapSharingFR2* can only be set up by MCG in the *measConfig* associated with MCG. *gapSharingFR2* cannot be configured together with *gapSharingUE*. For applicability of the different gap sharing schemes, see TS 38.133 [14]. Value *scheme00* corresponds to scheme "00", value *scheme01* corresponds to scheme "01", and so on.
gapSharingUE Indicates the measurement gap sharing scheme that applies to the gap set per UE. In (NG)EN-DC, *gapSharingUE* cannot be set up by NR RRC (i.e. only LTE RRC can configure per UE gap sharing). In NE-DC, *gapSharingUE* can only be set up by NR RRC (i.e. LTE RRC cannot configure per UE gap sharing). In NR-DC, *gapSharingUE* can only be set up in the *measConfig* associated with MCG. If *gapSharingUE* is configured, then neither *gapSharingFR1* nor *gapSharingFR2* can be configured. For the applicability of the different gap sharing schemes, see TS 38.133 [14]. Value *scheme00* corresponds to scheme "00", value *scheme01* corresponds to scheme "01", and so on.

– *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
    }                                                                                                  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
    }                                                                                                  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
    }                                                                                                  OPTIONAL,  -- Need S
    ...
}

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
```

***MeasIdleConfig* field descriptions**
absThreshSS-BlocksConsolidation Threshold for consolidation of L1 measurements per RS index.
beamMeasConfigIdle Indicates the beam level measurement configuration.
carrierFreq Indicates the NR carrier frequency to be used for measurements during RRC_IDLE or RRC_INACTIVE.
carrierFreqEUTRA Indicates the E-UTRA carrier frequency to be used for measurements during RRC_IDLE or RRC_INACTIVE.
deriveSSB-IndexFromCell 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].
frequencyBandList 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.
includeBeamMeasurements Indicates whether or not the UE shall include beam measurements in the NR idle/inactive measurement results.
maxNrofRS-IndexesToReport Max number of beam indices to include in the idle/inactive measurement result.
measCellListEUTRA Indicates the list of E-UTRA cells which the UE is requested to measure and report for idle/inactive measurements.
measCellListNR Indicates the list of NR cells which the UE is requested to measure and report for idle/inactive measurements.
measIdleCarrierListEUTRA Indicates the E-UTRA carriers to be measured during RRC_IDLE or RRC_INACTIVE.
measIdleCarrierListNR Indicates the NR carriers to be measured during RRC_IDLE or RRC_INACTIVE.
measIdleDuration 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.
nrofSS-BlocksToAverage Number of SS blocks to average for cell measurement derivation.
qualityThreshold Indicates the quality thresholds for reporting the measured cells for idle/inactive NR measurements.
qualityThresholdEUTRA Indicates the quality thresholds for reporting the measured cells for idle/inactive E-UTRA measurements.
reportQuantities Indicates which measurement quantities UE is requested to report in the idle/inactive measurement report.
reportQuantitiesEUTRA Indicates which E-UTRA measurement quantities the UE is requested to report in the idle/inactive measurement report.
reportQuantityRS-Indexes Indicates which measurement information per beam index the UE shall include in the NR idle/inactive measurement results.
smtc Indicates the measurement timing configuration for inter-frequency measurement. If this field is absent in *VarMeasIdleConfig*, the UE assumes that SSB periodicity is 5 ms in this frequency.

ssbSubcarrierSpacing Indicates subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable.
ssb-ToMeasure The set of SS blocks to be measured within the SMTC measurement duration (see TS 38.215 [9]). When the field is absent in *VarMeasIdleConfig*, the UE measures on all SS-blocks.
ss-RSSI-Measurement Indicates the SSB-based RSSI measurement configuration. If the field is absent in *VarMeasIdleConfig*, the UE behaviour is defined in TS 38.215 [89], clause 5.1.3.
validityAreaList 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,
    ...
}
```

```
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,
    ...
}

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,
    ...
}

RSSI-ResourceId-r16 ::=             INTEGER (0.. maxNrofCLI-RSSI-Resources-r16-1)

RSSI-PeriodicityAndOffset-r16 ::=   CHOICE {
    sl10                                INTEGER(0..9),
    sl20                                INTEGER(0..19),
    sl40                                INTEGER(0..39),
    sl80                                INTEGER(0..79),
    sl160                               INTEGER(0..159),
    sl320                               INTEGER(0..319),
    s1640                               INTEGER(0..639),
    ...
}

-- TAG-MEASOBJECTCLI-STOP
-- ASN1STOP
```

***CLI-ResourceConfig* field descriptions**
srs-ResourceConfig SRS resources to be used for CLI measurements.
rssi-ResourceConfig CLI-RSSI resources to be used for CLI measurements.

***MeasObjectCLI* field descriptions**
cli-ResourceConfig SRS and/or CLI-RSSI resource configuration for CLI measurement.

***SRS-ResourceConfigCLI* field descriptions**
srs-SCS-r16 Subcarrier spacing for SRS. Only the values 15, 30 kHz or 60 kHz (FR1), and 60 or 120 kHz (FR2) are applicable.

***RSSI-ResourceConfigCLI* field descriptions**
nrofPRBs 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.
nrofSymbols Within a slot that is configured for CLI-RSSI measurement (see slotConfiguration), the UE measures the RSSI from *startPosition* to *startPosition* + *nrofSymbols* - 1. The configured CLI-RSSI resource does not exceed the slot boundary of the reference SCS. If the SCS of configured active DL BWP(s) is larger than the reference SCS, network configures *startPosition* and *nrofSymbols* such that the configured CLI-RSSI resource not to exceed the slot boundary corresponding to the active BWP SCS. If the reference SCS is larger than SCS of active DL BWP(s), network ensures *startPosition* and *nrofSymbols* are integer multiple of reference SCS divided by active BWP SCS.
rssi-PeriodicityAndOffset-r16 Periodicity and slot offset for this CLI-RSSI resource. All values are in "number of slots". Value *sl1* corresponds to a periodicity of 1 slot, value *sl2* corresponds to a periodicity of 2 slots, and so on. For each periodicity the corresponding offset is given in number of slots.
rssi-scs-r16 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.
startPosition OFDM symbol location of the CLI-RSSI resource within a slot.
startPRB 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 startPRB and nrofPRBs are as a multiple of active BW SCS divided by reference SCS.

– *MeasObjectEUTRA*

The IE *MeasObjectEUTRA* specifies information applicable for E-UTRA cells.

***MeasObjectEUTRA* information element**

```
-- ASN1START
-- TAG-MEASOBJECTEUTRA-START

MeasObjectEUTRA::=                  SEQUENCE {
    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 ::=                          SEQUENCE {
    cellIndexEUTRA                          EUTRA-CellIndex,
    physCellId                              EUTRA-PhysCellId,
    cellIndividualOffset                    EUTRA-Q-OffsetRange
}


EUTRA-BlackCell ::=                     SEQUENCE {
    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.

***EUTRAN-Cell* field descriptions**
physicalCellId Physical cell identity of a cell in the cell list.
cellIndividualOffset Cell individual offset applicable to a specific cell. Value *dB-24* corresponds to -24 dB, *dB-22* corresponds to -22 dB and so on.

***MeasObjectEUTRA* field descriptions**
allowedMeasBandwidth The maximum allowed measurement bandwidth on a carrier frequency as defined by the parameter Transmission Bandwidth Configuration "N_{RB}" TS 36.104 [33].
blackCellsToAddModListEUTRAN List of cells to add/ modify in the black list of cells.
blackCellsToRemoveListEUTRAN List of cells to remove from the black list of cells.
carrierFreq Identifies E-UTRA carrier frequency for which this configuration is valid. Network does not configure more than one *MeasObjectEUTRA* for the same physical frequency, regardless of the E-ARFCN used to indicate this.
cellsToAddModListEUTRAN List of cells to add/ modify in the cell list.
cellsToRemoveListEUTRAN List of cells to remove from the cell list.
eutra-PresenceAntennaPort1 When set to *true*, the UE may assume that at least two cell-specific antenna ports are used in all neighbouring cells.
eutra-Q-OffsetRange 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 *dB-24* corresponds to -24 dB, value *dB-22* corresponds to -22 dB and so on.
widebandRSRQ-Meas If set to *true*, 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 *true* if the measurement bandwidth indicated by *allowedMeasBandwidth* is 50 resource blocks or larger; otherwise the network sets this field to *false*.

– *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 ::=                    SEQUENCE {
    ssbFrequency                        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 ::=               SEQUENCE {
    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 ::=                     SEQUENCE{
    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
```

***CellsToAddMod* field descriptions**
cellIndividualOffset Cell individual offsets applicable to a specific cell.
physCellId Physical cell identity of a cell in the cell list.

***MeasObjectNR* field descriptions**
absThreshCSI-RS-Consolidation 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.
absThreshSS-BlocksConsolidation 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.
blackCellsToAddModList List of cells to add/modify in the black list of cells. It applies only to SSB resources.
blackCellsToRemoveList List of cells to remove from the black list of cells.
cellsToAddModList List of cells to add/modify in the cell list.
cellsToRemoveList List of cells to remove from the cell list.
freqBandIndicatorNR The frequency band in which the SSB and/or CSI-RS indicated in this *MeasObjectNR* 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 *MeasObjectNR*.
measCycleSCell The parameter is used only when an SCell is configured on the frequency indicated by the measObjectNR 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 *measObjectNR*, but the field may also be signalled when an SCell is not configured. Value *sf160* corresponds to 160 sub-frames, value *sf256* corresponds to 256 sub-frames and so on.
nrofCSInrofCSI-RS-ResourcesToAverage 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 *MeasObjectNR*.
nrofSS-BlocksToAverage 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 *MeasObject*.
offsetMO Offset values applicable to all measured cells with reference signal(s) indicated in this *MeasObjectNR*.
quantityConfigIndex Indicates the n-*th* element of *quantityConfigNR-List* provided in *MeasConfig*.
referenceSignalConfig RS configuration for SS/PBCH block and CSI-RS.
refFreqCSI-RS 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.
smtc1 Primary measurement timing configuration. (see clause 5.5.2.10).
smtc2 Secondary measurement timing configuration for SS corresponding to this *MeasObjectNR* with PCI listed in *pci-List*. For these SS, the periodicity is indicated by *periodicity* in *smtc2* and the timing offset is equal to the offset indicated in *periodicityAndOffset* modulo *periodicity*. *periodicity* in smtc2 can only be set to a value strictly shorter than the periodicity indicated by *periodicityAndOffset* in *smtc1* (e.g. if *periodicityAndOffset* indicates *sf10*, *periodicity* can only be set of *sf5*, if *periodicityAndOffset* indicates *sf5*, *smtc2* cannot be configured).
smtc3list 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.

ssbFrequency Indicates the frequency of the SS associated to this *MeasObjectNR*. For operation with shared spectrum channel access, this field is a k*30 kHz shift from the sync raster where k = 0,1,2, and so on if the *reportType* within the corresponding *ReportConfigNR* is set to reportCGI (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]).
ssb-PositionQCL-Common Indicates the QCL relationship between SS/PBCH blocks for all measured cells as specified in TS 38.213 [13], clause 4.1.
ssbSubcarrierSpacing Subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable.
t312 The value of timer T312. Value ms0 represents 0 ms, ms50 represents 50 ms and so on.
whiteCellsToAddModList List of cells to add/modify in the white list of cells. It applies only to SSB resources.
whiteCellsToRemoveList List of cells to remove from the white list of cells.

RMTC-Config **field descriptions**
measDurationSymbols Number of consecutive symbols for which the Physical Layer reports samples of RSSI (see TS 38.215 [9], clause 5.1.21). Value *sym1* corresponds to one symbol, *sym14or12* corresponds to 14 symbols of the reference numerology for NCP and 12 symbols for ECP, and so on.
ref-SCS-CP 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).
rmtc-Frequency Indicates the center frequency of the measured bandwidth (see TS 38. 215 [9], clause 5.1.21).
rmtc-Periodicity Indicates the RSSI measurement timing configuration (RMTC) periodicity (see TS 38.215 [9], clause 5.1.21).
rmtc-SubframeOffset 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 *rmtc-SubframeOffset* for *measDurationSymbols* which shall be selected to be between 0 and the configured *rmtc-Periodicity* with equal probability.

ReferenceSignalConfig **field descriptions**
csi-rs-ResourceConfigMobility CSI-RS resources to be used for CSI-RS based RRM measurements.
ssb-ConfigMobility 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
CSI-RS	This field is mandatory present if *csi-rs-ResourceConfigMobility* is configured, otherwise, it is absent.
SSBorAssociatedSSB	This field is mandatory present if *ssb-ConfigMobility* is configured or *associatedSSB* is configured in at least one cell. Otherwise, it is absent, Need R.
IntraFreqConnected	This field is optionally present, Need R if the UE is configured with a serving cell for which (absoluteFrequencySSB, subcarrierSpacing) in ServingCellConfigCommon is equal to (*ssbFrequency*, *ssbSubcarrierSpacing*) in this *MeasObjectNR*, otherwise, it is absent.
SharedSpectrum	This field is mandatory present if this *MeasObject* 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
    ...
}
```

```
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**
carrierFreq 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.
cellIndexUTRA-FDD Entry index in the neighbouring cell list.
cellsToAddModList List of UTRA-FDD cells to add/modify in the neighbouring cell list.
cellsToRemoveList List of cells to remove from the neighbouring cell list.
utra-FDD-Q-OffsetRange 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, and inter-RAT mobility.

***MeasResults* information element**

```
-- ASN1START
```

```
-- TAG-MEASRESULTS-START

MeasResults ::=                         SEQUENCE {
    measId                                  MeasId,
    measResultServingMOList                 MeasResultServMOList,
    measResultNeighCells                    CHOICE {
        measResultListNR                        MeasResultListNR,
        ...,
        measResultListEUTRA                     MeasResultListEUTRA,
        measResultListUTRA-FDD-r16              MeasResultListUTRA-FDD-r16
    }                                                                               OPTIONAL,
    ...,
    [[
    measResultServFreqListEUTRA-SCG         MeasResultServFreqListEUTRA-SCG         OPTIONAL,
    measResultServFreqListNR-SCG            MeasResultServFreqListNR-SCG            OPTIONAL,
    measResultSFTD-EUTRA                    MeasResultSFTD-EUTRA                    OPTIONAL,
    measResultSFTD-NR                       MeasResultCellSFTD-NR                   OPTIONAL
     ]],
     [[
    measResultCellListSFTD-NR               MeasResultCellListSFTD-NR               OPTIONAL
    ]],
    [[
    measResultForRSSI-r16                   MeasResultForRSSI-r16                   OPTIONAL,
    locationInfo-r16                        LocationInfo-r16                        OPTIONAL,
    ul-PDCP-DelayValueResultList-r16        UL-PDCP-DelayValueResultList-r16        OPTIONAL,
    measResultsSL-r16                       MeasResultsSL-r16                       OPTIONAL,
    measResultCLI-r16                       MeasResultCLI-r16                       OPTIONAL
    ]]


}

MeasResultServMOList ::=                SEQUENCE (SIZE (1..maxNrofServingCells)) OF MeasResultServMO

MeasResultServMO ::=                    SEQUENCE {
    servCellId                              ServCellIndex,
    measResultServingCell                   MeasResultNR,
    measResultBestNeighCell                 MeasResultNR                            OPTIONAL,
    ...
}

MeasResultListNR ::=                    SEQUENCE (SIZE (1..maxCellReport)) OF MeasResultNR

MeasResultNR ::=                        SEQUENCE {
    physCellId                              PhysCellId                              OPTIONAL,
    measResult                              SEQUENCE {
        cellResults                             SEQUENCE{
            resultsSSB-Cell                         MeasQuantityResults             OPTIONAL,
            resultsCSI-RS-Cell                      MeasQuantityResults             OPTIONAL
        },
        rsIndexResults                          SEQUENCE{
            resultsSSB-Indexes                      ResultsPerSSB-IndexList         OPTIONAL,
            resultsCSI-RS-Indexes                   ResultsPerCSI-RS-IndexList      OPTIONAL
        }                                                                           OPTIONAL
```

```
    },
    ...,
    [[
    cgi-Info                            CGI-InfoNR                                                  OPTIONAL
    ]]
}

MeasResultListEUTRA ::=                 SEQUENCE (SIZE (1..maxCellReport)) OF MeasResultEUTRA

MeasResultEUTRA ::=                     SEQUENCE {
    eutra-PhysCellId                        PhysCellId,
    measResult                              MeasQuantityResultsEUTRA,

    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-Index,
    ssb-Results                             MeasQuantityResults                                     OPTIONAL
}

ResultsPerCSI-RS-IndexList::=           SEQUENCE (SIZE (1..maxNrofIndexesToReport2)) OF ResultsPerCSI-RS-Index

ResultsPerCSI-RS-Index ::=              SEQUENCE {
    csi-RS-Index                            CSI-RS-Index,
    csi-RS-Results                          MeasQuantityResults                                     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                          PhysCellIdUTRA-FDD-r16,
    measResult-r16                          SEQUENCE {
        utra-FDD-RSCP-r16                       INTEGER (-5..91)          OPTIONAL,
```

```
        utra-FDD-EcN0-r16                       INTEGER (0..49)          OPTIONAL
    }
}

MeasResultForRSSI-r16 ::=       SEQUENCE {
    rssi-Result-r16                 ENUMERATED{ffs},
    channelOccupancy-r16            INTEGER (0..100)
}

MeasResultCLI-r16 ::=           SEQUENCE {
    measResultListSRS-RSRP-r16      MeasResultListSRS-RSRP-r16                                  OPTIONAL,
    measResultListCLI-RSSI-r16      MeasResultListCLI-RSSI-r16                                  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
```

***MeasResultEUTRA* field descriptions**
eutra-PhysCellId
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.

***MeasResultNR* field descriptions**
averageDelay 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.
cellResults Cell level measurement results.
drb-Id Indicates DRB value for which uplink PDCP delay ratio or value is provided, according to TS 38.314 [53].
excessDelay 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.
locationInfo Positioning related information and measurements.
physCellId The physical cell identity of the NR cell for which the reporting is being performed.
resultsSSB-Cell Cell level measurement results based on SS/PBCH related measurements.
resultsSSB-Indexes Beam level measurement results based on SS/PBCH related measurements.
resultsCSI-RS-Cell Cell level measurement results based on CSI-RS related measurements.
resultsCSI-RS-Indexes Beam level measurement results based on CSI-RS related measurements.
rsIndexResults Beam level measurement results.

***MeasResultUTRA-FDD* field descriptions**
physCellId The physical cell identity of the UTRA-FDD cell for which the reporting is being performed.
utra-FDD-EcN0 According to CPICH_Ec/No in TS 25.133 [46] for FDD.
utra-FDD-RSCP According to CPICH_RSCP in TS 25.133 [46] for FDD.

***MeasResults* field descriptions**
measId Identifies the measurement identity for which the reporting is being performed.
measQuantityResults The value sinr is not included when it is used for LogMeasReport-r16.
measResultCellListSFTD-NR SFTD measurement results between the PCell and the NR neighbour cell(s) in NR standalone.
measResultCLI CLI measurement results.
measResultEUTRA Measured results of an E-UTRA cell.
measResultForRSSI Includes measured RSSI result in dBm (see TS 38.215 [9]) and *channelOccupancy* which is the percentage of samples when the RSSI was above the configured *channelOccupancyThreshold* for the associated *reportConfig*.
measResultListEUTRA List of measured results for the maximum number of reported best cells for an E-UTRA measurement identity.
measResultListNR List of measured results for the maximum number of reported best cells for an NR measurement identity.
measResultListUTRA-FDD List of measured results for the maximum number of reported best cells for a UTRA-FDD measurement identity.
measResultNR Measured results of an NR cell.
measResultServFreqListEUTRA-SCG 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.
measResultServFreqListNR-SCG 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.
measResultServingMOList 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 *MeasurementReport* message is triggered by a measurement configured by an NR *RRCReconfiguration* message that was received embedded within an E-UTRA RRCConnectionReconfiguration message (i.e. CBR measurements), this field is not applicable and its contents is ignored by the network.
measResultSFTD-EUTRA SFTD measurement results between the PCell and the E-UTRA PScell in NE-DC.
measResultSFTD-NR SFTD measurement results between the PCell and the NR PScell in NR-DC.
measResultUTRA-FDD 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
```

MeasResultIdleEUTRA field descriptions
carrierFreqEUTRA Indicates the E-UTRA carrier frequency.
eutra-PhysCellId Indicates the physical cell identity of an E-UTRA cell.
measIdleResultEUTRA Idle/inactive measurement results for an E-UTRA cell.
measResultsPerCarrierListIdleEUTRA List of idle/inactive measured results for the maximum number of reported E-UTRA carriers.
measResultsPerCellListIdleEUTRA 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
    }                                                                                   OPTIONAL
}

-- TAG-MEASRESULTIDLENR-STOP
-- ASN1STOP
```

***MeasResultIdleNR* field descriptions**
carrierFreq Indicates the NR carrier frequency.
measIdleResultNR Idle/inactive measurement results for an NR cell (optionally including beam level measurements).
measResultServingCell Measured results of the serving cell (i.e., PCell) from idle/inactive measurements.
measResultsPerCellListIdleNR List of idle/inactive measured results for the maximum number of reported best cells for a given NR carrier.
resultsSSB-Indexes 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 EN-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 and V2X 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
```

***MeasResultsSL* field descriptions**
measResultNR-SL Include the measured results for NR sidelink communication.

***MeasResultNR-SL* field descriptions**
measResultListCBR-NR CBR measurement results for NR sidelink communication.
sl-poolReportIdentity The identity of the transmission resource pool which is corresponding to the *sl-poolReportID* 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
InitialBWPConfig	The field is mandatory present when *MsgA-ConfigCommon* is configured for the initial uplink BWP, or when *MsgA-ConfigCommon* is configured for a non-initial uplink BWP and *MsgA-ConfigCommon* 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-MSGA-PUSCH-CONFIG-START

MsgA-PUSCH-Config-r16 ::=                   SEQUENCE {
    msgA-PUSCH-ResourceGroupA-r16               MsgA-PUSCH-Resource-r16                                 OPTIONAL, -- Cond InitialBWPConfig
    msgA-PUSCH-ResourceGroupB-r16               MsgA-PUSCH-Resource-r16                                 OPTIONAL, -- Cond GroupBConfigured
    msgA-TransformPrecoder-r16                 ENUMERATED {enabled, disabled}                           OPTIONAL, -- Need R
    msgA-DataScramblingIndex-r16                INTEGER (0..1023)                                       OPTIONAL, -- Need S
    msgA-DeltaPreamble-r16                      INTEGER (-1..6)                                         OPTIONAL  -- Need R
}

MsgA-PUSCH-Resource-r16 ::=                 SEQUENCE {
    msgA-MCS-r16                                INTEGER (0..15),
    nrofSlotsMsgA-PUSCH-r16                     INTEGER (1..4),
    nrofMsgA-PO-PerSlot-r16                     ENUMERATED {one, two, three, six},
    msgA-PUSCH-TimeDomainOffset-r16             INTEGER (1..32),
    msgA-PUSCH-TimeDomainAllocation-r16         INTEGER (1..maxNrofUL-Allocations)                      OPTIONAL, -- Need S
    startSymbolAndLengthMsgA-PO-r16             INTEGER (0..127)                                        OPTIONAL, -- Need S
    mappingTypeMsgA-PUSCH-r16                   ENUMERATED {typeA, typeB}                               OPTIONAL, -- Need S
    guardPeriodMsgA-PUSCH-r16                   INTEGER (0..3)                                          OPTIONAL, -- Need R
    guardBandMsgA-PUSCH-r16                     INTEGER (0..1),
    frequencyStartMsgA-PUSCH-r16                INTEGER (0..maxNrofPhysicalResourceBlocks-1),
    nrofPRBs-PerMsgA-PO-r16                     INTEGER (1..32),
    nrofMsgA-PO-FDM-r16                         ENUMERATED {one, two, four, eight},
    msgA-IntraSlotFrequencyHopping-r16          ENUMERATED {enabled}                                    OPTIONAL, -- Need R
    msgA-HoppingBits-r16                        BIT STRING (SIZE(2))                                    OPTIONAL, -- Need R
    msgA-DMRS-Config-r16                        MsgA-DMRS-Config-r16,
    nrofDMRS-Sequences-r16                      INTEGER (1..2),
    msgA-Alpha-r16                              ENUMERATED {alpha0, alpha04, alpha05, alpha06,
                                                            alpha07, alpha08, alpha09, alpha1}          OPTIONAL, -- Need S
    interlaceIndexFirstPO-MsgA-PUSCH-r16        INTEGER (1..10)                                         OPTIONAL, -- Need R
    nrofInterlacesPerMsgA-PO-r16                INTEGER (1..10)                                         OPTIONAL, -- Need R
    ...
}

MsgA-DMRS-Config-r16 ::=                    SEQUENCE {
    msgA-DMRS-AdditionalPosition-r16            ENUMERATED {pos0, pos1, pos3}                           OPTIONAL, -- Need S
    msgA-MaxLength-r16                          ENUMERATED {len2}                                       OPTIONAL, -- Need S
    msgA-PUSCH-DMRS-CDM-Group-r16               INTEGER (0..1)                                          OPTIONAL, -- Need S
```

```
    msgA-PUSCH-NrofPorts-r16                INTEGER (0..1)                          OPTIONAL, -- Need S
    msgA-ScramblingID0-r16                  INTEGER (0..65536)                      OPTIONAL, -- Need S
    msgA-ScramblingID1-r16                  INTEGER (0..65536)                      OPTIONAL  -- Need S
}

-- TAG-MSGA-PUSCH-CONFIG-STOP
-- ASN1STOP
```

***MsgA-PUSCH-Config* field descriptions**
msgA-DataScramblingIndex Identifier used to initiate data scrambling (c_init) for msgA PUSCH. If the field is absent the UE applies the value Physical cell ID (*physCellID*).
msgA-DeltaPreamble Power offset of msgA PUSCH relative to the preamble received target power (see TS 38.213 [13], clause 7.1).
msgA-PUSCH-ResourceGroupA 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.
msgA-PUSCH-ResourceGroupB MsgA PUSCH resources that the UE shall use when performing MsgA transmission using preambles group B.
msgA-TransformPrecoder Enables or disables the transform precoder for MsgA transmission (see clause 6.1.3 of TS 38.214 [19]).

***MsgA-PUSCH-Resource* field descriptions**
guardBandMsgA-PUSCH PRB-level guard band between FDMed PUSCH occasions (see TS 38.213 [13], clause 8.1A).
guardPeriodMsgA-PUSCH Guard period between PUSCH occasions in the unit of symbols (see TS 38.213 [13], clause 8.1A).
frequencyStartMsgA-PUSCH Offset of lowest PUSCH occasion in frequency domain with respect to PRB 0 (see TS 38.213 [13], clause 8.1A).
interlaceIndexFirstPO-MsgA-PUSCH 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).
mappingTypeMsgA-PUSCH PUSCH mapping type A or B. If the field is absent, the UE shall use the parameter *msgA-PUSCH-TimeDomainAllocation* (see TS 38.213 [13], clause 8.1A).
msgA-Alpha Dedicated alpha value for MsgA PUSCH. If value is absent, the UE shall use the value of *msg3-Alpha* if configured, else UE applies value 1 (see TS 38.213 [13], clause 7.1.1).
msgA-DMRS-Config DMRS configuration for msgA PUSCH (see TS 38.213 [13], clause 8.1A and TS 38.214 [19] clause 6.2.2).
msgA-HoppingBits Value of hopping bits to indicate which frequency offset to be used for second hop. See Table 8.3-1 in 38.213 [13].
msgA-IntraSlotFrequencyHopping Intra-slot frequency hopping per PUSCH occasion (see TS 38.213 [13], clause 8.1A).
msgA-MCS 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].
msgA-PUSCH-TimeDomainAllocation Indicates a combination of start symbol and length and PUSCH mapping type from the TDRA table (*PUSCH-TimeDomainResourceAllocationList* if provided in *PUSCH-ConfigCommon*, or else the default Table 6.1.2.1.1-2 in 38.214 [19] is used if *pusch-TimeDomainAllocationList* is not provided in PUSCH-ConfigCommon). The parameter K2 in the table is not used for msgA PUSCH. The network configures one of *msgA-PUSCH-TimeDomainAllocation* and *startSymbolAndLengthMsgA-PO,* but not both. If the field is absent, the UE shall use the value of startSymbolAndLenghtMsgA-PO.
msgA-PUSCH-TimeDomainOffset 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.
nrofDMRS-Sequences 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 *len2*) or 4 (for *len1*), then only DMRS port is configured.
nrofInterlacesPerMsgA-PO 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).
nrofMsgA-PO-FDM The number of msgA PUSCH occasions FDMed in one time instance (see TS 38.213 [13], clause 8.1A).
nrofMsgA-PO-PerSlot 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).
nrofPRBs-PerMsgA-PO Number of PRBs per PUSCH occasion (see TS 38.213 [13], clause 8.1A).
nrofSlotsMsgA-PUSCH 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).

startSymbolAndLengthMsgA-PO 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 *msgA-PUSCH-TimeDomainAllocation* (see TS 38.213 [13], clause 8.1A). The network configures one of *msgA-PUSCH-TimeDomainAllocation* and *startSymbolAndLengthMsgA-PO,* but not both. If the field is absent, the UE shall use the value of *msgA-PUSCH-TimeDomainAllocation.*

***MsgA-DMRS-Config* field descriptions**
msgA-DMRS-AdditionalPosition Indicates the position for additional DM-RS. If the field is absent, the UE applies value *pos2*.
msgA-MaxLength indicates single-symbol or double-symbol DMRS. If the field is absent, the UE applies value *len1*.
msgA-PUSCH-DMRS-CDM-group 1-bit indication of indices of CDM group(s). If the field is absent, then both CDM groups are used.
msgA-PUSCH-NrofPort 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.
msgA-ScramblingID0 UL DMRS scrambling initialization for CP-OFDM. If the field is absent the UE applies the value Physical cell ID (*physCellID*).
msgA-ScramblingID1 UL DMRS scrambling initialization for CP-OFDM. If the field is absent the UE applies the value Physical cell ID (*physCellID*).

Conditional Presence	Explanation
GroupBConfigured	The field is mandatory present if *groupB-ConfiguredTwoStepRA* is configured in *RACH-ConfigCommonTwoStepRA*, ortherwise the field is absent.
InitialBWPConfig	The field is mandatory present when *MsgA-ConfigCommon* is configured for the initial uplink BWP, or when *MsgA-ConfigCommon* is configured for a non-initial uplink BWP and *MsgA-ConfigCommon* 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
OptULNotSIB2	The field is absent for *SIB2* and is mandatory present in *SIB4* and *frequencyInfoDL-SIB*. Otherwise, if the field is absent in *frequencyInfoUL-SIB* in *UplinkConfigCommonSIB*, the UE will use the frequency band indicated in *frequencyInfoDL-SIB* in *DownlinkConfigCommonSIB*.

– *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
```

NeedForGapsConfigNR field descriptions
requestedTargetBandFilterNR 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
```

NeedForGapsInfoNR field descriptions
intraFreq-needForGap Indicates the measurement gap requirement information for NR intra-frequency measurement.
interFreq-needForGap Indicates the measurement gap requirement information for NR inter-frequency measurement.

NeedForGapsIntraFreq field descriptions
servCellId Indicates the serving cell which contains the target SSB (associated with the initial DL BWP) to be measured.
gapIndicationIntra Indicates whether measurement gap is required for the UE to perform intra-frequency SSB based measurements on the concerned serving cell. Value *gap* 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 *no-gap* 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.

***NeedForGapsNR* field descriptions**
bandNR Indicates the NR target band to be measured.
gapIndication 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 *RRCReconfiguration* or *RRCResume* message that triggers this response. Value *gap* indicates that a measurement gap is needed, value *no-gap* 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               PLMN-Identity,
        cag-IdentityList-r16            SEQUENCE (SIZE (1..maxNPN-r16)) OF CAG-IdentityInfo-r16
    },
    snpn-r16                        SEQUENCE {
        plmn-Identity                   PLMN-Identity,
        nid-List-r16                    SEQUENCE (SIZE (1..maxNPN-r16)) OF NID-r16
    }
}

CAG-IdentityInfo-r16 ::=        SEQUENCE {
    cag-Identity-r16                BIT STRING (SIZE (32)),
    manualCAGselectionAllowed-r16   ENUMERATED {true}                       OPTIONAL    -- Need R
}

NID-r16 ::=                     BIT STRING (SIZE (44))

-- TAG-NPN-IDENTITY-STOP
-- ASN1STOP
```

***NPN-Identity* field descriptions**
CAG-Identity A CAG-ID as specified in TS 23.003 [21]. The PLMN ID and a CAG ID in the *NPN-Identity* identifies a PNI-NPN.
cag-IdentityList The *cag-IdentityList* contains one or more *CAG-Identity*. All CAG IDs associated to the same PLMN ID are listed in the same *cag-IdentityList* entry.
manualCAGselectionAllowed The *manualCAGselectionAllowed* indicates that the CAG ID can be selected manually even if it is outside the UE's allowed CAG list.
NID A NID as specified in TS 23.003 [21]. The PLMN ID and a NID in the *NPN-Identity* identifies a SNPN.
nid-List The *nid-List* contains one or more *NID*.

– *NPN-IdentityInfoList*

The IE *NPN-IdentityInfoList* includes a list of NPN identity information.

ASN1START
TAG-NPN-IDENTITYINFOLIST-START

NPN-IdentityInfoList-r16 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
```

***NPN-IdentityInfoList* field descriptions**
iab-Support This field combines both the support of IAB-node and the cell status for IAB-node. If the field is present, the cell supports IAB-nodes and the cell is also considered as a candidate for IAB-nodes; if the field is absent, the cell does not support IAB and/or the cell is barred for IAB-node.
NPN-IdentityInfo The *NPN-IdentityInfo* 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 *NPN-IdentityInfo* element.
npn-IdentityList The *npn-IdentityList* contains one or more NPN Identity elements.
trackingAreaCode Indicates the Tracking Area Code to which the cell indicated by cellIdentity field belongs.
ranac Indicates the RAN Area Code to which the cell indicated by cellIdentity field belongs.
cellReservedForOperatorUse Indicates whether the cell is reserved for operator use (for the NPN(s) identified in the *npn-IdentyList*) as defined in TS 38.304 [20].

– *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                               OPTIONAL,   -- Need N
    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 ::=             SEQUENCE {
    nzp-CSI-RS-ResourceId               NZP-CSI-RS-ResourceId,
    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
```

***NZP-CSI-RS-Resource* field descriptions**
periodicityAndOffset Periodicity and slot offset *sl1* corresponds to a periodicity of 1 slot, *sl2* 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 *CSI-ResourceConfig*).
powerControlOffset 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).
powerControlOffsetSS Power offset of NZP CSI-RS RE to SSS RE. Value in dB (see TS 38.214 [19], clause 5.2.2.3.1).
qcl-InfoPeriodicCSI-RS For a target periodic CSI-RS, contains a reference to one *TCI-State* 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 *TCI-State* which has this value for *tci-StateId* and is defined in *tci-StatesToAddModList* in the *PDSCH-Config* included in the *BWP-Downlink* 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).
resourceMapping OFDM symbol location(s) in a slot and subcarrier occupancy in a PRB of the CSI-RS resource.
scramblingID Scrambling ID (see TS 38.214 [19], clause 5.2.2.3.1).

Conditional Presence	Explanation
Periodic	The field is optionally present, Need M, for periodic *NZP-CSI-RS-Resources* (as indicated in *CSI-ResourceConfig*). The field is absent otherwise.
PeriodicOrSemiPersistent	The field is optionally present, Need M, for periodic and semi-persistent *NZP-CSI-RS-Resources* (as indicated in *CSI-ResourceConfig*). 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
```

NZP-CSI-RS-ResourceSet field descriptions
aperiodicTriggeringOffset, aperiodicTriggeringOffset-r16 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 *aperiodicTriggeringOffset*, 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 *aperiodicTriggeringOffset-r16*, 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.
nzp-CSI-RS-Resources 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.
repetition Indicates whether repetition is on/off. If the field is set to *off* 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). Can only be configured for CSI-RS resource sets which are associated with *CSI-ReportConfig* with report of L1 RSRP or "no report".
trs-Info 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 *false* (see TS 38.214 [19], clause 5.2.2.3.1).

– *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 ::=                SEQUENCE {
    pci-RangeIndex                      PCI-RangeIndex,
    pci-Range                           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
    searchSpaceSwitchingTimer-r16       INTEGER (1..80)                                            OPTIONAL,    -- Need R
    cellGroupsForSwitchingList-r16      SEQUENCE(SIZE (1..4)) OF CellGroupForSwitching-r16         OPTIONAL,   -- Need R
```

```
    uplinkCancellation-r16              SetupRelease { UplinkCancellation-r16 }                          OPTIONAL,   -- Need M
    monitoringCapabilityConfig-r16      ENUMERATED { r15monitoringcapability,r16monitoringcapability }   OPTIONAL,  -- Need M
    searchSpaceSwitchingDelay-r16       INTEGER (10..52)                                                 OPTIONAL    -- Need R
    ]]
}

CellGroupForSwitching-r16 ::=       SEQUENCE(SIZE (1..16)) OF ServCellIndex

-- TAG-PDCCH-CONFIG-STOP
-- ASN1STOP
```

***PDCCH-Config* field descriptions**
cellGroupsForSwitchingList The list of serving cells which are bundled for the search space group switching purpose (see TS 38.213 [13], clause 11.5.2). A serving cell can belong to only one *CellGroupForSwitching*.
controlResourceSetToAddModList, controlResourceSetToAddModList2 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 *controlResourceSetToAddModList* and in *controlResourceSetToAddModList2* as a single list, i.e. an entry created using *controlResourceSetToAddModList* can be modifed using *controlResourceSetToAddModList2* and vice-versa. In case network reconfigures control resource set with the same *ControlResourceSetId* as used for *commonControlResourceSet* configured via *PDCCH-ConfigCommon*, the configuration from *PDCCH-Config* always takes precedence and should not be updated by the UE based on *servingCellConfigCommon*.
controlResourceSetToReleaseList List of UE specifically configured Control Resource Sets (CORESETs) to be released by the UE. This field only applies to CORESETs configured by *controlResourceSetToAddModList* and does not release the field *commonControlResourceSet* configured by *PDCCH-ConfigCommon*.
downlinkPreemption Configuration of downlink preemption indications to be monitored in this cell (see TS 38.213 [13], clause 11.2).
monitoringCapabilityConfig Configures either Rel-15 PDCCH monitoring capability or Rel-16 PDCCH monitoring capability for PDCCH monitoring on a serving cell. Value *r15monitoringcapablity* enables the Rel-15 monitoring capability, and value *r16monitoringcapablity* enables the Rel-16 PDCCH monitoring capability (see TS 38.213 [13], clause 10.1).
searchSpacesToAddModList, searchSpacesToAddModListExt 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 searchSpaceToAddModListExt, it includes the same number of entries, and listed in the same order, as in searchSpacesToAddModList.
searchSpaceSwitchingDelay 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 11.5.2.
tpc-PUCCH Enable and configure reception of group TPC commands for PUCCH.
tpc-PUSCH Enable and configure reception of group TPC commands for PUSCH.
tpc-SRS Enable and configure reception of group TPC commands for SRS.
uplinkCancellation Configuration of uplink cancellation indications to be monitored in this cell (see TS 38.213 [13], clause 11.2A).

– *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 ::=              SEQUENCE {
    controlResourceSetZero              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 {
        sCS15KHZoneT                                                    SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..139),
        sCS30KHZoneT-SCS15KHZhalfT                                      SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..279),
        sCS60KHZoneT-SCS30KHZhalfT-SCS15KHZquarterT                     SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..559),
        sCS120KHZoneT-SCS60KHZhalfT-SCS30KHZquarterT-SCS15KHZoneEighthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..1119),
        sCS120KHZhalfT-SCS60KHZquarterT-SCS30KHZoneEighthT-SCS15KHZoneSixteenthT SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..2239),
        sCS120KHZquarterT-SCS60KHZoneEighthT-SCS30KHZoneSixteenthT      SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..4479),
        sCS120KHZoneEighthT-SCS60KHZoneSixteenthT                       SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..8959),
        sCS120KHZoneSixteenthT                                          SEQUENCE (SIZE (1..maxPO-perPF)) OF INTEGER (0..17919)
    }                                                                                                   OPTIONAL,    -- Cond
OtherBWP
    commonSearchSpaceListExt-r16                                    SEQUENCE (SIZE(1..4)) OF SearchSpaceExt-r16     OPTIONAL    -- Need
R
    ]]
}

-- TAG-PDCCH-CONFIGCOMMON-STOP
-- ASN1STOP
```

***PDCCH-ConfigCommon* field descriptions**
commonControlResourceSet 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 *ControlResourceSetId* other than 0 for this *ControlResourceSet*. The network configures the *commonControlResourceSet* in *SIB1* so that it is contained in the bandwidth of CORESET#0.
commonSearchSpaceList, commonSearchSpaceListExt A list of additional common search spaces. If the network configures this field, it uses the *SearchSpaceId*s 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 *SearchSpace* entries is considered to be newly created and the conditions and Need codes for setup of the entry apply. If the network includes *commonSearchSpaceListExt*, it includes the same number of entries, and listed in the same order, as in *commonSearchSpaceList*.
controlResourceSetZero 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 *MIB pdcch-ConfigSIB1*. Even though this field is only configured in the initial BWP (BWP#0) *controlResourceSetZero* 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.
firstPDCCH-MonitoringOccasionOfPO Indicates the first PDCCH monitoring occasion of each PO of the PF on this BWP, see TS 38.304 [20].
pagingSearchSpace 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).
ra-SearchSpace 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.
searchSpaceOtherSystemInformation ID of the Search space for other system information, i.e., *SIB2* 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.
searchSpaceSIB1 ID of the search space for *SIB1* 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 *SIB1* in this BWP. (see TS 38.213 [13], clause 10)
searchSpaceZero Parameters of the common SearchSpace#0. The values are interpreted like the corresponding bits in *MIB pdcch-ConfigSIB1*. Even though this field is only configured in the initial BWP (BWP#0), *searchSpaceZero* 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.

Conditional Presence	Explanation
InitialBWP-Only	If *SIB1* is broadcast the field is mandatory present in the *PDCCH-ConfigCommon* of the initial BWP (BWP#0) in *ServingCellConfigCommon*; it is absent in other BWPs and when sent in system information. If SIB1 is not broadcast and there is an SSB associated to the cell, the field is optionally present, Need M, in the *PDCCH-ConfigCommon* of the initial BWP (BWP#0) in *ServingCellConfigCommon* (still with the same setting for all UEs). In other cases, the field is absent.
OtherBWP	This field is optionally present, Need R, if this BWP is not the initial DL BWP and *pagingSearchSpace* 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 ::=                SEQUENCE {
    controlResourceSetZero              ControlResourceSetZero,
    searchSpaceZero                     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 ::=         SEQUENCE {
    slotFormatIndicator                 SetupRelease { SlotFormatIndicator }                        OPTIONAL,   -- Need M
    ...,
    [[
    availabilityIndicator-r16           SetupRelease {AvailabilityIndicator-r16}                    OPTIONAL,   -- Need M
    searchSpaceSwitchingTimer-r16       INTEGER (1..80)                                             OPTIONAL    -- Need R
    ]]
}

-- TAG-PDCCH-SERVINGCELLCONFIG-STOP
-- ASN1STOP
```

***PDCCH-ServingCellConfig* field descriptions**
availabilityIndicator
Use to configure monitoring a PDCCH for Availability Indicators (AI).
searchSpaceSwitchingTimer
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 11.5.2). For 15 kHz SCS, {1..20} are valid. For 30 kHz SCS, {1..40} are valid. For 60kHz SCS, {1..80} are valid.
slotFormatIndicator
Configuration of Slot-Format-Indicators to be monitored in the correspondingly configured PDCCHs of this serving cell.

– *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 }                                  OPTIONAL,   -- Cond ConnectedTo5GC1
        statusReportRequired    ENUMERATED { true }                                     OPTIONAL,   -- Cond Rlc-AM-UM
        outOfOrderDelivery      ENUMERATED { true }                                     OPTIONAL    -- Need R
    }                                                                                   OPTIONAL,   -- Cond DRB
    moreThanOneRLC          SEQUENCE {
        primaryPath             SEQUENCE {
            cellGroup               CellGroupId                                         OPTIONAL,   -- Need R
            logicalChannel          LogicalChannelIdentity                              OPTIONAL    -- Need R
        },
        ul-DataSplitThreshold   UL-DataSplitThreshold                                   OPTIONAL,   -- Cond SplitBearer
        pdcp-Duplication            BOOLEAN                                             OPTIONAL    -- Need R
    }                                                                                   OPTIONAL,   -- Cond MoreThanOneRLC

    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 }                                  OPTIONAL, -- Need S
    ...,
    [[
    cipheringDisabled       ENUMERATED {true}                                           OPTIONAL    -- Cond ConnectedTo5GC
    ]],
    [[
    discardTimerExt-r16     SetupRelease { DiscardTimerExt-r16 }                        OPTIONAL,    -- Cond DRB2
    moreThanTwoRLC-DRB-r16  SEQUENCE {
        splitSecondaryPath      LogicalChannelIdentity                                  OPTIONAL,   -- Cond SplitBearer2
        duplicationState        SEQUENCE (SIZE (3)) OF BOOLEAN                          OPTIONAL    -- Need S
    }                                                                                   OPTIONAL,   -- Cond MoreThanTwoRLC-DRB
    ethernetHeaderCompression-r16  SetupRelease { EthernetHeaderCompression-r16 }       OPTIONAL    -- Need M
    ]]
}

EthernetHeaderCompression-r16 ::=  SEQUENCE {
    ehc-Common                      SEQUENCE {
        ehc-CID-Length                  ENUMERATED { bits7, bits15 },
         ...
    },
    ehc-Downlink                SEQUENCE {
        drb-ContinueEHC-DL          ENUMERATED { true }                                 OPTIONAL,   -- Need R
        ...
    }                                                                                   OPTIONAL,   -- Need M
    ehc-Uplink                  SEQUENCE {
        maxCID-EHC-UL               INTEGER (1..32767),
        drb-ContinueEHC-UL          ENUMERATED { true }                                 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
```

***PDCP-Config* field descriptions**
cipheringDisabled 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.
discardTimer Value in ms of *discardTimer* specified in TS 38.323 [5]. Value *ms10* corresponds to 10 ms, value *ms20* 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.
discardTimerExt Value in ms of *discardTimer* specified in TS 38.323 [5]. Value *ms0dot5* corresponds to 0.5 ms, value *ms1* corresponds to 1ms and so on. If this field is present, the field *discardTimer* is ignored and *discardTimerExt* is used instead.
drb-ContinueROHC 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 *fullConfig* is not indicated. The network does not include the field if any DAPS bearer is configured.
duplicationState This field indicates the uplink PDCP duplication state for the associated RLC entities at the time of receiving this IE. If set to *true,* 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 *primaryPath* 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.
ethernetHeaderCompression This fields configures Ethernet Header Compresssion. This field can only be configured for DRB. The network reconfigures *ethernetHeaderCompression* only upon reconfiguration involving PDCP re-establishment.
headerCompression If rohc is configured, the UE shall apply the configured ROHC profile(s) in both uplink and downlink. If *uplinkOnlyROHC* 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 *headerCompression* only upon reconfiguration involving PDCP re-establishment. Network configures *headerCompression* to *notUsed* when *outOfOrderDelivery* is configured.
integrityProtection 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.
maxCID 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 *maxNumberROHC-ContextSessions* parameter as indicated by the UE.
moreThanOneRLC 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 bearere is configured as DAPS bearer.
moreThanTwoRLC-DRB This field configures UL data transmission when more than two RLC entities are associated with the PDCP entity for DRBs.
outOfOrderDelivery 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 radio bearer is established.

***PDCP-Config* field descriptions**
pdcp-Duplication
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 *true*, duplication is activated. The value of this field is always *true*, when configured for a SRB. For PDCP entity with more than two associated RLC entities, this field is always present. If the field *moreThanTwoRLC-DRB* is present, the value of this field is ignored and the state of the duplication is indicated by *duplicationState*. For PDCP entity with more than two associated RLC entities, only NR RLC bearer is supported.
pdcp-SN-SizeDL
PDCP sequence number size for downlink, 12 or 18 bits, as specified in TS 38.323 [5]. For SRBs only the value *len12bits* is applicable. The value for this field cannot be changed in case of reconfiguration with sync, if the bearer is configured as DAPS bearere.
pdcp-SN-SizeUL
PDCP sequence number size for uplink, 12 or 18 bits, as specified in TS 38.323 [5]. For SRBs only the value *len12bits* is applicable. The value for this field cannot be changed in case of reconfiguration with sync, if the bearer is configured as DAPS bearer.
primaryPath
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 *cellGroup* for split bearers using logical channels in different cell groups. The NW indicates *logicalChannel* for CA based PDCP duplication, i.e., if both logical channels terminate in the same cell group.
splitSecondaryPath
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 *cellGroup* in the field *primaryPath.*
statusReportRequired
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].
t-Reordering
Value in ms of t-Reordering specified in TS 38.323 [5]. Value *ms0* corresponds to 0 ms, value *ms20* corresponds to 20 ms, value *ms40* corresponds to 40 ms, and so on. When the field is absent the UE applies the value *infinity*. The value for this field cannot be changed in case of reconfiguration with sync, if the bearer is configured as DAPS bearer.
ul-DataSplitThreshold
Parameter specified in TS 38.323 [5]. Value *b0* corresponds to 0 bytes, value *b100* corresponds to 100 bytes, value *b200* corresponds to 200 bytes, and so on. The network sets this field to *infinity* for UEs not supporting *splitDRB-withUL-Both-MCG-SCG*. If the field is absent when the split bearer is configured for the radio bearer first time, then the default value *infinity* is applied.

EthernetHeaderCompression field descriptions
drb-ContinueEHC-DL 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 *fullConfig* is not indicated.
drb-ContinueEHC-UL 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 *fullConfig* is not indicated.
ehc-CID-Length Indicates the length of the CID field for EHC packet. The value *bits7* indicates the length is 7 bits, and the value *bits15* indicates the length is 15 bits. Once the field *ethernetHeaderCompression-r16* is configured for a DRB, the value of the field *ehc-CID-Length* for this DRB is not reconfigured to a different value.
ehc-Common Indicates the configurations that apply for both downlink and uplink.
ehc-Downlink 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.
ehc-Uplink Indicates the configurations that apply for only uplink. If the field is configured, then Ethernet header compression is configured for uplnik. Otherwise, it is not configured for uplink.
maxCID-EHC-UL 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 *maxNumberEHC-Contexts* parameter as indicated by the UE.

Conditional presence	Explanation
DRB	This field is mandatory present when the corresponding DRB is being set up, absent for SRBs. Otherwise this field is optionally present, need M.
DRB2	This field is optionally present in case of DRB, need M. Otherwise, it is absent for SRBs.
MoreThanOneRLC	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 *moreThanTwoRLC-DRB* is included in *PDCP-Config*. 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.
MoreThanTwoRLC-DRB	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.
Rlc-AM-UM	For RLC UM (if the UE supports DAPS handover) or RLC AM, the field is optionally present, need R. Otherwise, the field is absent.
Setup	The field is mandatory present in case of radio bearer setup. Otherwise the field is optionally present, need M.
SplitBearer	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.
SplitBearer2	The field is mandatory present, in case of a split bearer. Otherwise the field is absent.
ConnectedTo5GC	The field is optionally present, need R, if the UE is connected to 5GC. Otherwise the field is absent.
ConnectedTo5GC1	The field is optionally present, need R, if the UE is connected to NR/5GC. Otherwise the field is absent.
Setup2	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},
    pdsch-TimeDomainAllocationList          SetupRelease { PDSCH-TimeDomainResourceAllocationList }             OPTIONAL,   -- Need M
    pdsch-AggregationFactor                 ENUMERATED { n2, n4, n8 }                                           OPTIONAL,   -- Need S
    rateMatchPatternToAddModList            SEQUENCE (SIZE (1..maxNrofRateMatchPatterns)) OF RateMatchPattern   OPTIONAL,   -- Need N
    rateMatchPatternToReleaseList           SEQUENCE (SIZE (1..maxNrofRateMatchPatterns)) OF RateMatchPatternId OPTIONAL,   -- Need N
    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
    antennaPortsFieldPresenceForDCI-Format1-2-r16   ENUMERATED {enabled}                                            OPTIONAL,   -- Need S
    aperiodicZP-CSI-RS-ResourceSetsToAddModListForDCI-Format1-2-r16  SEQUENCE (SIZE (1..maxNrofZP-CSI-RS-ResourceSets)) OF ZP-CSI-RS-ResourceSet
                                                                                                                    OPTIONAL,   -- Need N
    aperiodicZP-CSI-RS-ResourceSetsToReleaseListForDCI-Format1-2-r16 SEQUENCE (SIZE (1..maxNrofZP-CSI-RS-ResourceSets)) OF ZP-CSI-RS-ResourceSetId
                                                                                                                    OPTIONAL,   -- Need N
    dmrs-DownlinkForPDSCH-MappingTypeA-ForDCI-Format1-2-r16     SetupRelease { DMRS-DownlinkConfig }                OPTIONAL,   -- Need M
    dmrs-DownlinkForPDSCH-MappingTypeB-ForDCI-Format1-2-r16     SetupRelease { DMRS-DownlinkConfig }                OPTIONAL,   -- Need M
    dmrs-SequenceInitializationForDCI-Format1-2-r16 ENUMERATED {enabled}                                            OPTIONAL,   -- Need S
    harq-ProcessNumberSizeForDCI-Format1-2-r16      INTEGER (0..4)                                                  OPTIONAL,   -- Need R
    mcs-TableForDCI-Format1-2-r16                   ENUMERATED {qam256, qam64LowSE}                                 OPTIONAL,   -- Need S
    numberOfBitsForRV-ForDCI-Format1-2-r16          INTEGER (0..2)                                                  OPTIONAL,   -- Need R
    pdsch-TimeDomainAllocationListForDCI-Format1-2-r16        SetupRelease { PDSCH-TimeDomainResourceAllocationList-r16 }
                                                                                                                    OPTIONAL,   -- Need M
    prb-BundlingTypeForDCI-Format1-2-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
        }
    }                                                                                                               OPTIONAL,   -- Need R
    priorityIndicatorForDCI-Format1-2-r16           ENUMERATED {enabled}                                            OPTIONAL,   -- Need S
    rateMatchPatternGroup1ForDCI-Format1-2-r16  RateMatchPatternGroup                                               OPTIONAL,   -- Need R
    rateMatchPatternGroup2ForDCI-Format1-2-r16  RateMatchPatternGroup                                               OPTIONAL,   -- Need R
    resourceAllocationType1GranularityForDCI-Format1-2-r16  ENUMERATED {n2,n4,n8,n16}                               OPTIONAL,   -- Need S
    vrb-ToPRB-InterleaverForDCI-Format1-2-r16       ENUMERATED {n2, n4}                                             OPTIONAL,   -- Need S
    referenceOfSLIVForDCI-Format1-2-r16             ENUMERATED {enabled}                                            OPTIONAL,   -- Need S
    resourceAllocationForDCI-Format1-2-r16          ENUMERATED { resourceAllocationType0, resourceAllocationType1, dynamicSwitch}
                                                                                                                    OPTIONAL,   -- Need M
    -- End of the parameters for DCI format 1_2 introduced in V16.1.0

    priorityIndicatorForDCI-Format1-1-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
```

***PDSCH-Config* field descriptions**
antennaPortsFieldPresenceForDCI-Format1-2
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 *dmrs-DownlinkForPDSCH-MappingTypeA-ForDCI-Format1-2* nor *dmrs-DownlinkForPDSCH-MappingTypeB-ForDCI-Format1-2* is configured, this field is absent.
aperiodic-ZP-CSI-RS-ResourceSetsToAddModList, aperiodic-ZP-CSI-RS-ResourceSetsToAddModListForDCI-Format1-2
AddMod/Release lists for configuring aperiodically triggered zero-power CSI-RS resource sets. Each set contains a *ZP-CSI-RS-ResourceSetId* and the IDs of one or more *ZP-CSI-RS-Resources* (the actual resources are defined in the *zp-CSI-RS-ResourceToAddModList*). The network configures the UE with at most 3 aperiodic *ZP-CSI-RS-ResourceSets* and it uses only the *ZP-CSI-RS-ResourceSetId* 1 to 3. The network triggers a set by indicating its *ZP-CSI-RS-ResourceSetId* in the DCI payload. The DCI codepoint '01' triggers the resource set with *ZP-CSI-RS-ResourceSetId* 1, the DCI codepoint '10' triggers the resource set with *ZP-CSI-RS-ResourceSetId 2*, and the DCI codepoint '11' triggers the resource set with *ZP-CSI-RS-ResourceSetId* 3 (see TS 38.214 [19], clause 5.1.4.2). The field *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList* applies to DCI format 1_1 and the field *aperiodic-ZP-CSI-RS-ResourceSetsToAddModListForDCI-Format1-2* 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).
dataScramblingIdentityPDSCH, dataScramblingIdentityPDSCH2
Identifier(s) used to initialize data scrambling (c_init) for PDSCH as specified in TS 38.211 [16], clause 7.3.1.1. The *dataScramblingIdentityPDSCH2* is configured if *coresetPoolIndex* is configured with 1 for at least one CORESET in the same BWP.
dmrs-DownlinkForPDSCH-MappingTypeA, dmrs-DownlinkForPDSCH-MappingTypeA-ForDCI-Format1-2
DMRS configuration for PDSCH transmissions using PDSCH mapping type A (chosen dynamically via *PDSCH-TimeDomainResourceAllocation*). Only the fields *dmrs-Type*, *dmrs-AdditionalPosition* and *maxLength* may be set differently for mapping type A and B. The field *dmrs-DownlinkForPDSCH-MappingTypeA* applies to DCI format 1_1 and the field *dmrs-DownlinkForPDSCH-MappingTypeA-ForDCI-Format1-2* applies to DCI format 1_2 (see TS 38.212 [17], clause 7.3.1).
dmrs-DownlinkForPDSCH-MappingTypeB, dmrs-DownlinkForPDSCH-MappingTypeB-ForDCI-Format1-2
DMRS configuration for PDSCH transmissions using PDSCH mapping type B (chosen dynamically via *PDSCH-TimeDomainResourceAllocation*). Only the fields *dmrs-Type*, *dmrs-AdditionalPosition* and *maxLength* may be set differently for mapping type A and B. The field *dmrs-DownlinkForPDSCH-MappingTypeB* applies to DCI format 1_1 and the field *dmrs-DownlinkForPDSCH-MappingTypeB-ForDCI-Format1-2* applies to DCI format 1_2 (see TS 38.212 [17], clause 7.3.1).
dmrs-SequenceInitializationForDCI-Format1_2
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).
harq-ProcessNumberSizeForDCI-Format1-2
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).
maxMIMO-Layers
Indicates the maximum number of MIMO layers to be used for PDSCH in this DL BWP. If absent, the UE uses the *maxMIMO-Layers* configuration in IE *PDSCH-ServingCellConfig* when the UE operates in this BWP. The value of *maxMIMO-Layers* for a DL BWP shall be smaller than or equal to the value of *maxMIMO-Layers* configured in IE *PDSCH-ServingCellConfig*.
maxNrofCodeWordsScheduledByDCI
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.
mcs-Table, mcs-TableForDCI-Format1-2
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 *mcs-Table* applies to DCI format 1_0 and DCI format 1_1, and the field *mcs-TableForDCI-Format1-2* applies to DCI format 1_2 (see TS 38.214 [19], clause 5.1.3.1).
minimumSchedulingOffsetK0
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).
numberOfBitsForRV-ForDCI-Format1-2
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).
pdsch-AggregationFactor
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.

pdsch-TimeDomainAllocationList, pdsch-TimeDomainAllocationListForDCI-Format1-2 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 *pdsch-TimeDomainAllocationList (with or without suffix)* applies to DCI format 1_0 and DCI format 1_1, and the field *pdsch-TimeDomainAllocationListForDCI-Format1-2* 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 *pdsch-TimeDomainAllocationList-r16* or the pdsch-TimeDomainAllocationListForDCI-Format1-2 simultaneously with i the *pdsch-TimeDomainAllocationList* (without suffix).
prb-BundlingType, prb-BundlingTypeForDCI-Format1-2 Indicates the PRB bundle type and bundle size(s) (see TS 38.214 [19], clause 5.1.2.3). If *dynamic* is chosen, the actual *bundleSizeSet1 or bundleSizeSet2* to use is indicated via DCI. Constraints on *bundleSize(Set)* setting depending on *vrb-ToPRB-Interleaver* and *rbg-Size* settings are described in TS 38.214 [19], clause 5.1.2.3. If a *bundleSize(Set)* value is absent, the UE applies the value *n2*. The field *prb-BundlingType* applies to DCI format 1_1, and the field *prb-BundlingTypeForDCI-Format1-2* 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).
priorityIndicatorForDCI-Format1-1, priorityIndicatorForDCI-Format1-2 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 *priorityIndicatorForDCI-Format1-1* applies to DCI format 1_1 and the field *priorityIndicatorForDCI-Format1-2* applies to DCI format 1_2, respectively (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13] clause 9).
p-ZP-CSI-RS-ResourceSet A set of periodically occurring ZP-CSI-RS-Resources (the actual resources are defined in the zp-CSI-RS-ResourceToAddModList). The network uses the ZP-CSI-RS-ResourceSetId=0 for this set.
rateMatchPatternGroup1, rateMatchPatternGroup1ForDCI-Format1-2 The IDs of a first group of *RateMatchPatterns* defined in *PDSCH-Config->rateMatchPatternToAddModList* (BWP level) or in *ServingCellConfig ->rateMatchPatternToAddModLis*t (cell level). These patterns can be activated dynamically by DCI (see TS 38.214 [19], clause 5.1.4.1). The field *rateMatchPatternGroup1* applies to DCI format 1_1, and the field *rateMatchPatternGroup1ForDCI-Format1-2* applies to DCI format 1_2 (see TS 38.214 [19], clause 5.1.4.1).
rateMatchPatternGroup2, rateMatchPatternGroup2ForDCI-Format1-2 The IDs of a second group of *RateMatchPatterns* defined in *PDSCH-Config->rateMatchPatternToAddModList* (BWP level) or in *ServingCellConfig ->rateMatchPatternToAddModLis*t (cell level). These patterns can be activated dynamically by DCI (see TS 38.214 [19], clause 5.1.4.1). The field *rateMatchPatternGroup2* applies to DCI format 1_1, and the field *rateMatchPatternGroup2ForDCI-Format1-2* applies to DCI format 1_2 (see TS 38.214 [19], clause 5.1.4.1).
rateMatchPatternToAddModList 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).
rbg-Size Selection between config 1 and config 2 for RBG size for PDSCH. The UE ignores this field if *resourceAllocation* is set to *resourceAllocationType1* (see TS 38.214 [19], clause 5.1.2.2.1).
referenceOfSLIVForDCI-Format1-2 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).
repetitionSchemeConfig Configure the UE with repetition schemes
resourceAllocation, resourceAllocationForDCI-Format1-2 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 *resourceAllocation* applies to DCI format 1_1, and the field *resourceAllocationForDCI-Format1-2* applies to DCI format 1_2 (see TS 38.214 [19], clause 5.1.2.2).
resourceAllocationType1GranularityForDCI-Format1-2 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).

sp-ZP-CSI-RS-ResourceSetsToAddModList AddMod/Release lists for configuring semi-persistent zero-power CSI-RS resource sets. Each set contains a *ZP-CSI-RS-ResourceSetId* and the IDs of one or more *ZP-CSI-RS-Resources* (the actual resources are defined in the *zp-CSI-RS-ResourceToAddModList*) (see TS 38.214 [19], clause 5.1.4.2).
tci-StatesToAddModList 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).
vrb-ToPRB-Interleaver, vrb-ToPRB-InterleaverForDCI-Format1-2 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 *vrb-ToPRB-Interleaver* applies to DCI format 1_1, and the field *vrb-ToPRB-InterleaverForDCI-Format1-2* applies to DCI format 1_2 (see TS 38.211 [16], clause 7.3.1.6).
zp-CSI-RS-ResourceToAddModList 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]).

– *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 ::=                  SEQUENCE {
    pdsch-TimeDomainAllocationList                  PDSCH-TimeDomainResourceAllocationList          OPTIONAL,   -- Need R
    ...
}

-- TAG-PDSCH-CONFIGCOMMON-STOP
-- ASN1STOP
```

***PDSCH-ConfigCommon* field descriptions**
pdsch-TimeDomainAllocationList 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]).

– *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 }           OPTIONAL,   -- Need M
    xOverhead                               ENUMERATED { xOh6, xOh12, xOh18 }                           OPTIONAL,   -- Need S
    nrofHARQ-ProcessesForPDSCH              ENUMERATED {n2, n4, n6, n10, n12, n16}                      OPTIONAL,   -- Need S
    pucch-Cell                              ServCellIndex                                               OPTIONAL,   -- Cond SCellAddOnly
    ...,
    [[
    maxMIMO-Layers                          INTEGER (1..8)                                              OPTIONAL,   -- Need M
    processingType2Enabled                  BOOLEAN                                                     OPTIONAL    -- Need M
    ]],
    [[
    pdsch-CodeBlockGroupTransmissionList-r16 SetupRelease { PDSCH-CodeBlockGroupTransmissionList-r16 }  OPTIONAL    -- Need M
    ]]
}

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
```

***PDSCH-CodeBlockGroupTransmission* field descriptions**
codeBlockGroupFlushIndicator Indicates whether CBGFI for CBG based (re)transmission in DL is enabled (true). (see TS 38.212 [17], clause 7.3.1.2.2).
maxCodeBlockGroupsPerTransportBlock 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).

***PDSCH-ServingCellConfig* field descriptions**
codeBlockGroupTransmission Enables and configures code-block-group (CBG) based transmission (see TS 38.213 [13], clause 9.1.1).
maxMIMO-Layers 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).
nrofHARQ-ProcessesForPDSCH The number of HARQ processes to be used on the PDSCH of a serving cell. Value *n2* corresponds to 2 HARQ processes, value *n4* 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).
pdsch-CodeBlockGroupTransmissionList A list of configurations for up to two simultaneously constructed HARQ-ACK codebooks (see TS 38.213 [13], clause 9.3).
processingType2Enabled Enables configuration of advanced processing time capability 2 for PDSCH (see 38.214 [19], clause 5.3).
pucch-Cell 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.
xOverhead 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).

Conditional Presence	Explanation
SCellAddOnly	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**
k0 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.
mappingType PDSCH mapping type. (see TS 38.214 [19], clause 5.3).
repetitionNumber Indicates the number of PDSCH transmission occations for slot-based repetition scheme in IE *RepetitionSchemeConfig.* The parameter is used as specified in 38.214 [19].
startSymbolAndLength 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
Formats1-0and1-1	In *pdsch-TimeDomainResourceAllocationList-r16*, this field is optionally present, Need R. In *pdsch-TimeDomainAllocationListForDCI-Format1-2*, 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},
    ...
}
```

```
-- TAG-PHR-CONFIG-STOP
-- ASN1STOP
```

***PHR-Config* field descriptions**
dummy This field is not used in this version of the specification and the UE ignores the received value.
multiplePHR 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 *true* for MR-DC and UL CA for NR, and to *false* in all other cases.
phr-ModeOtherCG 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.
phr-PeriodicTimer Value in number of subframes for PHR reporting as specified in TS 38.321 [3]. Value *sf10* corresponds to 10 subframes, value *sf20* corresponds to 20 subframes, and so on.
phr-ProhibitTimer Value in number of subframes for PHR reporting as specified in TS 38.321 [3]. Value *sf0* corresponds to 0 subframe, value *sf10* corresponds to 10 subframes, value *sf20* corresponds to 20 subframes, and so on.
phr-Tx-PowerFactorChange Value in dB for PHR reporting as specified in TS 38.321 [3]. Value *dB1* corresponds to 1 dB, *dB3* 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).
phr-Type2OtherCell 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 *false* if the UE is not configured with an E-UTRA MAC entity.

– *PhysCellId*

The *PhysCellId* identifies the physical cell identity (PCI).

PhysCellId information element

```
-- ASN1START
-- TAG-PHYSCELLID-START

PhysCellId ::=                      INTEGER (0..1007)

-- TAG-PHYSCELLID-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-secondaryPUCCH-group-r16    ENUMERATED {true}                             OPTIONAL,   -- Cond twoPUCCHgroup
    harq-ACK-SpatialBundlingPUSCH-secondaryPUCCH-group-r16    ENUMERATED {true}                             OPTIONAL,   -- Cond twoPUCCHgroup
    pdsch-HARQ-ACK-Codebook-secondaryPUCCH-group-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
    nrdc-PCmode-FR1-r16               ENUMERATED {semi-static-mode1, semi-static-mode2, dynamic}            OPTIONAL,   -- Cond MCG-Only
    nrdc-PCmode-FR2-r16               ENUMERATED {semi-static-mode1, 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 M
    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
    downlinkAssignmentIndexForDCI-Format0-2-r16    ENUMERATED { enabled }                                   OPTIONAL,   -- Need S
    downlinkAssignmentIndexForDCI-Format1-2-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
```

***PhysicalCellGroupConfig* field descriptions**
ackNackFeedbackMode
Indicates which among the joint and separate ACK/NACK feedback modes to use within a slot as sapecified in TS 38.213 (clause 9). Field is present only when two different values of CORESETPoolIndex in ControlResourceSet are configured in a cell.
bdFactorR
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.
cs-RNTI
RNTI value for downlink SPS (see *SPS-Config*) and uplink configured grant (see *ConfiguredGrantConfig*).
downlinkAssignmentIndexForDCI-Format0-2
Indicates if "Downlink assignment index" is present or absent in DCI format 0_2. If the field "*downlinkAssignmentIndexForDCI-Format0-2*" is absent, then 0 bit for "Downlink assignment index" in DCI format 0_2. If the field "*downlinkAssignmentIndexForDCI-Format0-2*" is present, then the bitwidth of "Downlink assignment index" in DCI format 0_2 is defined in the same was as that in DCI format 0_1 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 9.1).
downlinkAssignmentIndexForDCI-Format1-2
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).
harq-ACK-SpatialBundlingPUCCH
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 *harq-ACK SpatialBundlingPUCCH-secondaryPUCCHgroup* is present, *harq-ACK-SpatialBundlingPUCCH* is only applied to primary PUCCH group.
harq-ACK-SpatialBundlingPUCCH-secondaryPUCCHgroup
Enables spatial bundling of HARQ ACKs. It is configured for secondary PUCCH group for PUCCH reporting of HARQ-ACK. It 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 spatial bundling of PUCCH HARQ ACKs for the secondary PUCCH group is disabled (see TS 38.213 [13], clause 9.1.2.1).
harq-ACK-SpatialBundlingPUSCH
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 *harq-ACK SpatialBundlingPUSCH-secondaryPUCCHgroup* is present, *harq-ACK-SpatialBundlingPUSCH* is only applied to primary PUCCH group.
harq-ACK-SpatialBundlingPUSCH-secondaryPUSCHgroup
Enables spatial bundling of HARQ ACKs. It is configured for secondary PUCCH group for PUSCH reporting of HARQ-ACK. It 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 spatial bundling of PUSCH HARQ ACKs for the secondary PUCCH group is disabled (see TS 38.213 [13], clauses 9.1.2.2 and 9.1.3.2).
mcs-C-RNTI
RNTI to indicate use of *qam64LowSE* for grant-based transmissions. When the *mcs-C-RNTI* is configured, RNTI scrambling of DCI CRC is used to choose the corresponding MCS table.
nfi-TotalDAI-Included
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 (*pdsch-HARQ-ACK-Codebook* is set to *enhancedDynamic*).
nrdc-PCmode-FR1
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).
nrdc-PCmode-FR2
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).

pdcch-BlindDetection, pdcch-BlindDetection2, pdcch-BlindDetection3 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 *pdcch-BlindDetection* only if the UE is in NR-DC. The network configures *pdcch-BlindDetection2* only if the UE is in NR-DC with at least one downlink cell using Rel-16 PDCCH monitoring capability. The network configures *pdcch-BlindDetection3* only if the UE is in NR-DC with at least one downlink cell using Rel-15 PDCCH monitoring capability.
pdcch-BlindDetectionCA-CombIndicator Configure one combination of pdcch-BlindDetectionCA1 (for R15) and pdcch-BlindDetectionCA2 (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 pdcch-BlindDetectionCA1 and pdcch-BlindDetectionCA2 as UE capability. The combination of pdcch-BlindDetectionCA1 and pdcch-BlindDetectionCA2) configured by pdcch-BlindDetectionCACombIndicator is from the more than one combination of pdcch-BlindDetectionCA1 and pdcch-BlindDetectionCA2 reported by UE (see TS 38.213 [13], clause 10).
p-NR-FR1 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 *p-Max* (configured in *FrequencyInfoUL*) and by *p-UE-FR1* (configured total for all serving cells operating on FR1).
p-NR-FR2 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 *p-Max* (configured in *FrequencyInfoUL*) and by *p-UE-FR2* (configured total for all serving cells operating on FR2). This field is only used in NR-DC.
ps-RNTI RNTI value for scrambling CRC of DCI format 2-6 used for power saving (see TS 38.213 [13], clause 10.1).
ps-Offset The start of the search-time of DCI format 2-6 with CRC scrambled by PS-RNTI relative to the start of the *drx-onDurationTimer* of Long DRX (see TS 38.213 [13], clause 11.5). 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.
ps-WakeUp Indicates the UE to wake-up if DCI format 2-6 is not detected outside active time (see TS 38.213 [13], clause 11.5). If the field is absent, the UE does not wake-up if DCI format 2-6 is not detected outside active time.
ps-PositionDCI-2-6 Starting position of UE wakeup and SCell dormancy indication in DCI format 2-6 (see TS 38.213 [13], clause 11.5).
ps-TransmitPeriodicL1-RSRP Indicates the UE to transmit periodic L1-RSRP report(s) when the *drx-onDurationTimer* 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 *drx-onDurationTimer* does not start.
ps-TransmitOtherPeriodicCSI Indicates the UE to transmit periodic CSI report(s) other than L1-RSRP reports when the *drx-onDurationTimer* 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) when the *drx-onDurationTimer* does not start.
p-UE-FR1 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 *p-Max* (configured in *FrequencyInfoUL*) and by *p-NR-FR1* (configured for the cell group).
p-UE-FR2 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 p-Max (configured in FrequencyInfoUL) and by p-NR-FR2 (configured for the cell group).
pdsch-HARQ-ACK-Codebook 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 *pdsch-HARQ-ACK-Codebook -r16* is signalled, UE shall ignore the *pdsch-HARQ-ACK-Codebook* (without suffix). If the field *pdsch-HARQ-ACK-Codebook-secondaryPUCCHgroup* is present, *pdsch-HARQ-ACK-Codebook* 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).

pdsch-HARQ-ACK-CodebookList 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 *pdsch-HARQ-ACK-Codebook* (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 *pdsch-HARQ-ACK-Codebook* is ignored for the case at least two HARQ-ACK codebooks are simultaneously constructed.
pdsch-HARQ-ACK-Codebook-secondaryPUCCHgroup 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.
pdsch-HARQ-ACK-OneShotFeedback 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).
pdsch-HARQ-ACK-OneShotFeedbackCBG 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 *pdsch-HARQ-ACK-OneShotFeedback* is configured.
pdsch-HARQ-ACK-OneShotFeedbackNDI 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 *pdsch-HARQ-ACK-OneShotFeedback* is configured.
sizeDCI-2-6 Size of DCI format 2-6 (see TS 38.213 [13], clause 11.5).
sp-CSI-RNTI RNTI for Semi-Persistent CSI reporting on PUSCH (see *CSI-ReportConfig*) (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 *CSI-ReportConfig* with *reportConfigType* set to *semiPersistentOnPUSCH* is configured.
tpc-PUCCH-RNTI RNTI used for PUCCH TPC commands on DCI (see TS 38.213 [13], clause 10.1).
tpc-PUSCH-RNTI RNTI used for PUSCH TPC commands on DCI (see TS 38.213 [13], clause 10.1).
tpc-SRS-RNTI RNTI used for SRS TPC commands on DCI (see TS 38.213 [13], clause 10.1).
ul-TotalDAI-Included Indicaes whether the total DAI fields of the additonal 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 (*pdsch-HARQ-ACK-Codebook* is set to *enhancedDynamic*).
xScale 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 *xScale* 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
MCG-Only	This field is optionally present, Need R, in the *PhysicalCellGroupConfig* of the MCG. It is absent otherwise.
SCG-Only	This field is optionally present, Need S, in the *PhysicalCellGroupConfig* of the SCG in (NG)EN-DC as defined in TS 38.213 [13]. It is absent otherwise.
twoPUCCHgroup	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 ::=                   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
mcc 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 *mcc* of the immediately preceding IE PLMN-Identity. See TS 23.003 [21].
mnc 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 ::=               SEQUENCE {
    plmn-IdentityList                   SEQUENCE (SIZE (1..maxPLMN)) OF PLMN-Identity,
    trackingAreaCode                    TrackingAreaCode                                    OPTIONAL,       -- Need R
    ranac                               RAN-AreaCode                                        OPTIONAL,       -- Need R
    cellIdentity                        CellIdentity,
```

```
    cellReservedForOperatorUse              ENUMERATED {reserved, notReserved},
    ...,
    [[
    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-node and the cell status for IAB-node. If the field is present, the cell supports IAB-nodes 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 ::=             SEQUENCE {
    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**
epre-Ratio 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).
frequencyDensity 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).
maxNrofPorts 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 with sPDCCH mTRP mode as specified in TS 38.214 Clause 5.1.
resourceElementOffset 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).
timeDensity 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 ::=                 SEQUENCE {
    transformPrecoderDisabled             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
    }                                                                                       OPTIONAL,   -- Need R
    ...
}

-- TAG-PTRS-UPLINKCONFIG-STOP
-- ASN1STOP
```

***PTRS-UplinkConfig* field descriptions**
frequencyDensity 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).
maxNrofPorts The maximum number of UL PTRS ports for CP-OFDM (see TS 38.214 [19], clause 6.2.3.1).
ptrs-Power UL PTRS power boosting factor per PTRS port (see TS 38.214 [19], clause 6.1, table 6.2.3.1.3).
resourceElementOffset 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).
sampleDensity 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.
timeDensity 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).
timeDensityTransformPrecoding 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).
transformPrecoderDisabled Configuration of UL PTRS without transform precoder (with CP-OFDM).
transformPrecoderEnabled 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-AccessConfigListForDCI-Format-1-1-r16 SetupRelease { UL-AccessConfigListForDCI-Format1-1-r16 }               OPTIONAL, -- Need M
    subslotLengthForPUCCH-r16               CHOICE {
            normalCP-r16                        ENUMERATED {n2,n7},
            extendedCP-r16                      ENUMERATED {n2,n6}
    }                                                                                                               OPTIONAL, -- Need R
    dl-DataToUL-ACK-ForDCI-Format1-2-r16    SetupRelease { DL-DataToUL-ACK-ForDCI-Format1-2-r16}                    OPTIONAL, -- Need M
    numberOfBitsForPUCCH-ResourceIndicatorForDCI-Format1-2-r16  INTEGER (0..3)                                      OPTIONAL, -- Need R
    dmrs-UplinkTransformPrecodingPUCCH-r16  ENUMERATED {enabled}                                                    OPTIONAL,  -- Cond PI2-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 ::=                  SEQUENCE {
    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 ::=                   SEQUENCE {
    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 ::=                  SEQUENCE {
    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 ::=           SEQUENCE {
    interlaceAllocation-r16             SEQUENCE {
        rb-SetIndex                         INTEGER (0..4),
        interlace0                          CHOICE {
            scs15                               INTEGER (0..9),
            scs30                               INTEGER (0..4)
        }
    }                                                                           OPTIONAL,  --Need R
    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-ForDCI-Format1-2-r16 ::=    SEQUENCE (SIZE (1..8)) OF INTEGER (0..15)

UL-AccessConfigListForDCI-Format1-1-r16 ::=  SEQUENCE (SIZE (1..16)) OF INTEGER (0..15)

-- TAG-PUCCH-CONFIG-STOP
-- ASN1STOP
```

***PUCCH-Config* field descriptions**
dl-DataToUL-ACK, dl-DataToUL-ACK-ForDCI-Format1-2 List of timing for given PDSCH to the DL ACK (see TS 38.213 [13], clause 9.1.2). The field *dl-DataToUL-ACK* applies to DCI format 1_1 and the field *dl-DataToUL-ACKForDCI-Format1-2* 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 *dl-DataToUL-ACK-r16* is signalled, UE shall ignore the *dl-DataToUL-ACK* (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.
dmrs-UplinkTransformPrecodingPUCCH This field is used for PUCCH formats 3 and 4 according to TS 38.211, Clause 6.4.1.3.3.1.
format1 Parameters that are common for all PUCCH resources of format 1.
format2 Parameters that are common for all PUCCH resources of format 2.
format3 Parameters that are common for all PUCCH resources of format 3.
format4. Parameters that are common for all PUCCH resources of format 4
numberOfBitsForPUCCH- ResourceIndicatorForDCI-Format1-2 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).
resourceGroupToAddModList, resourceGroupToReleaseList Lists for adding and releasing groups of PUCCH resources that can be updated simultaneously for spatial relations with a MAC CE
resourceSetToAddModList, resourceSetToReleaseList Lists for adding and releasing PUCCH resource sets (see TS 38.213 [13], clause 9.2).
resourceToAddModList, resourceToAddModListExt, resourceToReleaseList Lists for adding and releasing PUCCH resources applicable for the UL BWP and serving cell in which the *PUCCH-Config* 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 *resourceToAddModListExt*, it includes the same number of entries, and listed in the same order, as in *resourceToAddModList*.
spatialRelationInfoToAddModList, spatialRelationInfoToAddModList2 , spatialRelationInfoToAddModListExt 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 *spatialRelationInfoToAddModList* and in *spatialRelationInfoToAddModList2* as a single list, i.e. an entry created using *spatialRelationInfoToAddModList* can be modifed using *spatialRelationInfoToAddModList2* (or deleted using *spatialRelationInfoToReleaseList2*) and vice-versa. If the network includes *spatialRelationInfoToAddModListExt*, it includes the same number of entries, and listed in the same order, as in the concatenation of *spatialRelationInfoToAddModList* and of spatialRelationInfoToAddModList2.
sps-PUCCH-AN-List Indicates a list of PUCCH resources for DL SPS HARQ ACK. The field *maxPayloadSize* is absent for the first and the last *SPS-PUCCH-AN* in the list. If configured, this overrides *n1PUCCH-AN* in *SPS-config.*
subslotLengthForPUCCH Indicate the sub-slot length for sub-slot based PUCCH feedback in number of symbols (see TS 38.213 [13], clause 9.1). Value *n2* corresponds to 2 symbols, value *n6* corresponding to 6 symbols, value *n7* corresponds to 7 symbols. For normal CP, the value is either *n2* or *n7*. For extended CP, the value is either *n2* or *n6*.
ul-AccessConfigListForDCI-Format1-1 List of the combinations of cyclic prefix extension and UL channel access type (See TS 38.212 [17], Clause 7.3.1).

***PUCCH-format3* field descriptions**
nrofPRBs The supported values are 1,2,3,4,5,6,8,9,10,12,15 and 16. The UE shall ignore this field when *formatExt* is configured.

***PUCCH-FormatConfig* field descriptions**
additionalDMRS
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.
interslotFrequencyHopping
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.
maxCodeRate
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.
nrofSlots
Number of slots with the same PUCCH F1, F3 or F4. When the field is absent the UE applies the value *n1*. The field is not applicable for format 2. See TS 38.213 [13], clause 9.2.6.
pi2BPSK
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.
rb-SetIndex
Indicates the RB set where PUCCH resource is allocated.
simultaneousHARQ-ACK-CSI
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 *off.* The field is not applicable for format 1.

***PUCCH-Resource, PUCCH-ResourceExt* field descriptions**
format, formatExt
Selection of the PUCCH format (format 0 – 4) and format-specific parameters, see TS 38.213 [13], clause 9.2. *format0* and *format1* are only allowed for a resource in a first PUCCH resource set. *format2*, *format3* and *format4* are only allowed for a resource in non-first PUCCH resource set. The network can only configure *formatExt* when format is set to *format2* or *format3*.
interlace0
This is the only interlace of interlaced PUCCH Format 0 and 1 and the first interlace for interlaced PUCCH Format 2 and 3.
interlace1
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 *interlace1* shall satisfy *interlace1*=mod(*interlace0*+X,10) where X=1, -1, or 5.
intraSlotFrequencyHopping
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.
occ-Index
Indicates the orthogonal cover code index (see TS 38.213 [13], clause 9.2.1). This field is Applicable when *useInterlacePUCCH-Dedicated-r16* is configured.
occ-Length
Indicates the orthogonal cover code length (see TS 38.213 [13], clause 9.2.1). Applicable when *useInterlacePUCCH-Dedicated-r16* is configured.
pucch-ResourceId
Identifier of the PUCCH resource.
secondHopPRB
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).

***PUCCH-ResourceSet* field descriptions**
maxPayloadSize 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 *PUCCH-ResourceSet* 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.
resourceList PUCCH resources of *format0* and *format1* are only allowed in the first PUCCH resource set, i.e., in a PUCCH-ResourceSet with *pucch-ResourceSetId* = 0. This set may contain between 1 and 32 resources. PUCCH resources of *format2*, *format3* and *format4* are only allowed in a *PUCCH-ResourceSet* with *pucch-ResourceSetId* > 0. If present, these sets contain between 1 and 8 resources each. The UE chooses a *PUCCH-Resource* 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 *PUCCH-Config*.

Conditional Presence	Explanation
PI2-BPSK	The field is optionally present, Need R, if *format3* and/or *format4* are configured and *pi2BPSK* 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 ::=              SEQUENCE {
    pucch-ResourceCommon                INTEGER (0..15)                                 OPTIONAL,   -- Cond InitialBWP-Only
    pucch-GroupHopping                  ENUMERATED { neither, enable, disable },
    hoppingId                           INTEGER (0..1023)                               OPTIONAL,   -- Need R
    p0-nominal                          INTEGER (-202..24)                              OPTIONAL,   -- Need R
    ...
}

-- TAG-PUCCH-CONFIGCOMMON-STOP
-- ASN1STOP
```

***PUCCH-ConfigCommon* field descriptions**
hoppingId Cell-specific scrambling ID for group hopping and sequence hopping if enabled, see TS 38.211 [16], clause 6.3.2.2.
p0-nominal 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).
pucch-GroupHopping Configuration of group- and sequence hopping for all the PUCCH formats 0, 1, 3 and 4. Value *neither* implies neither group or sequence hopping is enabled. Value *enable* enables group hopping and disables sequence hopping. Value *disable* disables group hopping and enables sequence hopping (see TS 38.211 [16], clause 6.3.2.2).
pucch-ResourceCommon 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 *PUCCH-Config* (e.g. during initial access) on the initial uplink BWP. Once the network provides a dedicated *PUCCH-Config* 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
InitialBWP-Only	The field is mandatory present in the *PUCCH-ConfigCommon* 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            PUCCH-PathlossReferenceRS-Id,
    referenceSignal                         CHOICE {
        ssb-Index                               SSB-Index,
        csi-RS-Index                            NZP-CSI-RS-ResourceId
    }
}

PUCCH-PathlossReferenceRS-r16 ::=               SEQUENCE {
    pucch-PathlossReferenceRS-Id-r16            PUCCH-PathlossReferenceRS-Id-v1610,
    referenceSignal-r16                         CHOICE {
        ssb-Index-r16                               SSB-Index,
        csi-RS-Index-r16                            NZP-CSI-RS-ResourceId
    }
}
```

```
-- TAG-PUCCH-POWERCONTROL-STOP
-- ASN1STOP
```

***P0-PUCCH* field descriptions**
p0-PUCCH-Value P0 value for PUCCH with 1dB step size.

***PUCCH-PowerControl* field descriptions**
deltaF-PUCCH-f0 deltaF for PUCCH format 0 with 1dB step size (see TS 38.213 [13], clause 7.2).
deltaF-PUCCH-f1 deltaF for PUCCH format 1 with 1dB step size (see TS 38.213 [13], clause 7.2).
deltaF-PUCCH-f2 deltaF for PUCCH format 2 with 1dB step size (see TS 38.213 [13], clause 7.2).
deltaF-PUCCH-f3 deltaF for PUCCH format 3 with 1dB step size (see TS 38.213 [13], clause 7.2).
deltaF-PUCCH-f4 deltaF for PUCCH format 4 with 1dB step size (see TS 38.213 [13], clause 7.2).
p0-Set A set with dedicated P0 values for PUCCH, i.e., {P01, P02,... } (see TS 38.213 [13], clause 7.2).
pathlossReferenceRSs, pathlossReferenceRSs-v1610 A set of Reference Signals (e.g. a CSI-RS config or a SS block) to be used for PUCCH pathloss estimation. Up to *maxNrofPUCCH-PathlossReference-RSs* may be configured. When the field is absent, the UE uses the SSB as reference signal (see TS 38.213 [13], clause 7.2). The set includes References Signals indicated in pathlossReferenceRSs (without suffix) and in pathlossReferenceRSs-v1610.
twoPUCCH-PC-AdjustmentStates Number of PUCCH power control adjustment states maintained by the UE (i.e., g(i)). If the field is present (n2) the UE maintains two power control states (i.e., g(i,0) and g(i,1)). If the field is absent, it maintains one power control state (i.e., g(i,0)) (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 ::=           SEQUENCE {
    pucch-SpatialRelationInfoId         PUCCH-SpatialRelationInfoId,
    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 ::=      SEQUENCE {
    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).
servingCellId If the field is absent, the UE applies the *ServCellId* of the serving cell in which this *PUCCH-SpatialRelationInfo* is configured

Conditional Presence	Explanation
SetupOnly	This field is mandatory present upon creation of a *PUCCH-SpatialRelationInfo*. It is absent, Need M otherwise.

– *PUCCH-SpatialRelationInfo-Id*

The IE *PUCCH-SpatialRelationInfo-Id* is used to indentify 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 ::=             SEQUENCE {
    tpc-IndexPCell                          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
PDCCH-OfSpcell	The field is mandatory present if the *PUCCH-TPC-CommandConfig* is provided in the *PDCCH-Config* for the SpCell. Otherwise, the field is absent, Need R.
PDCCH-ofSpCellOrPUCCH-SCell	The field is mandatory present if the *PUCCH-TPC-CommandConfig* is provided in the *PDCCH-Config* 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 *PUCCH-TPC-CommandConfig* is provided in the *PDCCH-Config* 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 ::=                        SEQUENCE {
    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-AccessConfigListForDCI-Format0-1-r16 SetupRelease { UL-AccessConfigListForDCI-Format0-1-r16 }            OPTIONAL,  -- Need M
    -- Start of the parameters for DCI format 0_2 introduced in V16.1.0
    harq-ProcessNumberSizeForDCI-Format0-2-r16              INTEGER (0..4)                                      OPTIONAL,   -- Need R
    dmrs-SequenceInitializationForDCI-Format0-2-r16         ENUMERATED {enabled}                                OPTIONAL,   -- Need S
    numberOfBitsForRV-ForDCI-Format0-2-r16                  INTEGER (0..2)                                      OPTIONAL,   -- Need R
    antennaPortsFieldPresenceForDCI-Format0-2-r16           ENUMERATED {enabled}                                OPTIONAL,   -- Need S
    dmrs-UplinkForPUSCH-MappingTypeA-ForDCI-Format0-2-r16   SetupRelease { DMRS-UplinkConfig }                   OPTIONAL,   -- Need M
    dmrs-UplinkForPUSCH-MappingTypeB-ForDCI-Format0-2-r16   SetupRelease { DMRS-UplinkConfig }                   OPTIONAL,   -- Need M
    frequencyHoppingForDCI-Format0-2-r16                    CHOICE {
        pusch-RepTypeA                                          ENUMERATED {intraSlot, interSlot},
        pusch-RepTypeB                                          ENUMERATED {interRepetition, interSlot}
    }                                                                                                           OPTIONAL,   -- Need S
    frequencyHoppingOffsetListsForDCI-Format0-2-r16 SetupRelease { FrequencyHoppingOffsetListsForDCI-Format0-2-r16} OPTIONAL,  -- Need M
    codebookSubsetForDCI-Format0-2-r16                  ENUMERATED {fullyAndPartialAndNonCoherent, partialAndNonCoherent,nonCoherent}
                                                                                                                OPTIONAL,   -- Cond codebookBased
    invalidSymbolPatternIndicatorForDCI-Format0-2-r16       ENUMERATED {enabled}                                OPTIONAL,   -- Need S
    maxRankForDCI-Format0-2-r16                             INTEGER (1..4)                                      OPTIONAL,   -- Cond codebookBased
    mcs-TableForDCI-Format0-2-r16                           ENUMERATED {qam256, qam64LowSE}                     OPTIONAL,   -- Need S
    mcs-TableTransformPrecoderForDCI-Format0-2-r16          ENUMERATED {qam256, qam64LowSE}                     OPTIONAL,   -- Need S
    priorityIndicatorForDCI-Format0-2-r16                   ENUMERATED {enabled}                                OPTIONAL,   -- Need S
    pusch-RepTypeIndicatorForDCI-Format0-2-r16              ENUMERATED { pusch-RepTypeA, pusch-RepTypeB} OPTIONAL,  -- Need R
    resourceAllocationForDCI-Format0-2-r16                ENUMERATED { resourceAllocationType0, resourceAllocationType1, dynamicSwitch}
                                                                                                                OPTIONAL,   -- Need M
    resourceAllocationType1GranularityForDCI-Format0-2-r16  ENUMERATED { n2,n4,n8,n16 }                         OPTIONAL,   -- Need S
    uci-OnPUSCH-ListForDCI-Format0-2-r16        SetupRelease { UCI-OnPUSCH-ListForDCI-Format0-2-r16}  OPTIONAL,   -- Need M
    pusch-TimeDomainAllocationListForDCI-Format0-2-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-TimeDomainAllocationListForDCI-Format0-1-r16  SetupRelease { PUSCH-TimeDomainResourceAllocationList-r16 }
                                                                                                    OPTIONAL,   -- Need M
    invalidSymbolPatternIndicatorForDCI-Format0-1-r16 ENUMERATED {enabled}                          OPTIONAL,   -- Need S
    priorityIndicatorForDCI-Format0-1-r16             ENUMERATED {enabled}                          OPTIONAL,   -- Need S
    pusch-RepTypeIndicatorForDCI-Format0-1-r16        ENUMERATED { pusch-RepTypeA, pusch-RepTypeB}  OPTIONAL,   -- Need R
    frequencyHoppingForDCI-Format0-1-r16        ENUMERATED {interRepetition, interSlot}             OPTIONAL,   -- Cond RepTypeB
    uci-OnPUSCH-ListForDCI-Format0-1-r16        SetupRelease { UCI-OnPUSCH-ListForDCI-Format0-1-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, fullpoweMode2}   OPTIONAL,   -- Need R
    pusch-TimeDomainAllocationListForMultiPUSCH-r16  SetupRelease { PUSCH-TimeDomainResourceAllocationList-r16 }
                                                                                                    OPTIONAL,  --  Need M
    numberOfInvalidSymbolsForDL-UL-Switching-r16        INTEGER (1..4)                              OPTIONAL    -- Cond RepTypeB2
    ]]
}

UCI-OnPUSCH ::=                         SEQUENCE {
    betaOffsets                             CHOICE {
        dynamic                             SEQUENCE (SIZE (4)) OF BetaOffsets,
        semiStatic                          BetaOffsets
    }                                                                                               OPTIONAL, -- Need M
    scaling                                 ENUMERATED { f0p5, f0p65, f0p8, f1 }
}

MinSchedulingOffsetK2-Values-r16 ::=    SEQUENCE (SIZE (1..maxNrOfMinSchedulingOffsetValues-r16)) OF INTEGER (0..maxK2-SchedulingOffset-r16)

UCI-OnPUSCH-ForDCI-Format0-2-r16 ::=    SEQUENCE {
    betaOffsetsForDCI-Format0-2-r16         CHOICE {
        dynamicForDCI-Format0-2-r16             CHOICE {
            oneBit-r16                              SEQUENCE (SIZE (2)) OF BetaOffsets,
            twoBits-r16                             SEQUENCE (SIZE (4)) OF BetaOffsets
        },
        semiStaticForDCI-Format0-2-r16          BetaOffsets
    }                                                                                               OPTIONAL,   -- Need M
    scalingForDCI-Format0-2-r16                 ENUMERATED { f0p5, f0p65, f0p8, f1 }
}

FrequencyHoppingOffsetListsForDCI-Format0-2-r16 ::=  SEQUENCE (SIZE (1..4)) OF INTEGER (1.. maxNrofPhysicalResourceBlocks-1)

UCI-OnPUSCH-ListForDCI-Format0-2-r16 ::=  SEQUENCE (SIZE (1..2)) OF UCI-OnPUSCH-ForDCI-Format0-2-r16

UCI-OnPUSCH-ListForDCI-Format0-1-r16 ::=  SEQUENCE (SIZE (1..2)) OF UCI-OnPUSCH

UL-AccessConfigListForDCI-Format0-1-r16 ::= SEQUENCE (SIZE (1..64)) OF INTEGER (0..63)

-- TAG-PUSCH-CONFIG-STOP
-- ASN1STOP
```

***PUSCH-Config* field descriptions**
antennaPortsFieldPresenceForDCI-Format0-2
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 *dmrs-UplinkForPUSCH-MappingTypeA-ForDCI-Format0-2* nor *dmrs-UplinkForPUSCH-MappingTypeB-ForDCI-Format0-2* is configured, this field is absent.
codebookSubset, codebookSubsetForDCI-Format0-2
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 *codebookSubset* applies to DCI format 0_1 and the field *codebookSubsetForDCI-Format0-2* applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.1.1).
dataScramblingIdentityPUSCH
Identifier used to initalite data scrambling (c_init) for PUSCH. If the field is absent, the UE applies the physical cell ID. (see TS 38.211 [16], clause 6.3.1.1).
dmrs-SequenceInitializationForDCI-Format0-2
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).
dmrs-UplinkForPUSCH-MappingTypeA, dmrs-UplinkForPUSCH-MappingTypeA-ForDCI-Format0-2
DMRS configuration for PUSCH transmissions using PUSCH mapping type A (chosen dynamically via *PUSCH-TimeDomainResourceAllocation*). Only the fields *dmrs-Type*, *dmrs-AdditionalPosition* and *maxLength* may be set differently for mapping type A and B. The field *dmrs-UplinkForPUSCH-MappingTypeA* applies to DCI format 0_1 and the field *dmrs-UplinkForPUSCH-MappingTypeA-ForDCI-Format0-2* applies to DCI format 0_2 (see TS 38.212 [17], clause 7.3.1).
dmrs-UplinkForPUSCH-MappingTypeB, dmrs-UplinkForPUSCH-MappingTypeB-ForDCI-Format0-2
DMRS configuration for PUSCH transmissions using PUSCH mapping type B (chosen dynamically via *PUSCH-TimeDomainResourceAllocation*). Only the fields *dmrs-Type*, *dmrs-AdditionalPosition* and *maxLength* may be set differently for mapping type A and B. The field *dmrs-UplinkForPUSCH-MappingTypeB* applies to DCI format 0_1 and the field *dmrs-UplinkForPUSCH-MappingTypeB-ForDCI-Format0-2* applies to DCI format 0_2 (see TS 38.212 [17], clause 7.3.1).
frequencyHopping
The value *intraSlot* enables 'Intra-slot frequency hopping' and the value *interSlot* 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 *frequencyHopping* applies to DCI format 0_0 and 0_1 for 'pusch-RepTypeA'.
frequencyHoppingForDCI-Format0-1
Indicates the frequency hopping scheme for DCI format 0_1 when *pusch-RepTypeIndicatorForDCI-Format0-1* is set to 'pusch-RepTypeB', The value *interRepetition* enables 'Inter-repetition frequency hopping', and the value *interSlot* 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).
frequencyHoppingForDCI-Format0-2
Indicate the frequency hopping scheme for DCI format 0_2. The value *intraSlot* enables 'intra-slot frequency hopping', and the value *interRepetition* enables 'Inter-repetition frequency hopping', and the value *interSlot* enables 'Inter-slot frequency hopping'. When *pusch-RepTypeIndicatorForDCI-Format0-2* 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 *pusch-RepTypeIndicatorForDCI-Format0-2* 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).
frequencyHoppingOffsetLists, frequencyHoppingOffsetListsForDCI-Format0-2
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 *frequencyHoppingOffsetLists* applies to DCI format 0_0 and DCI format 0_1 and the field *frequencyHoppingOffsetListsForDCI-Format0-2* applies to DCI format 0_2 (see TS 38.214 [19], clause 6.3).
harq-ProcessNumberSizeForDCI-Format0-2
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).
invalidSymbolPattern
Indicates one pattern for invalid symbols for PUSCH transmission repetition type B applicable to both DCI format 0_1 and 0_2. If *InvalidSymbolPattern* 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).
invalidSymbolPatternIndicatorForDCI-Format0-1, invalidSymbolPatternIndicatorForDCI-Format0-2
Indicates the presence of an additional bit in the DCI format 0_1/0_2. If *invalidSymbolPattern* is absent, then both *invalidSymbolPatternIndicatorForDCI-Format0-1* and *invalidSymbolPatternIndicatorForDCI-Format0-2* are absent. The field *invalidSymbolPatternIndicatorForDCI-Format0-1* applies to the DCI format 0_1 and the field *invalidSymbolPatternIndicatorForDCI-Format0-1* applies to DCI format 0_2 (see TS 38.214 [19] clause 6.1).

maxRank, maxRankForDCI-Format0-2 Subset of PMIs addressed by TRIs from 1 to ULmaxRank (see TS 38.214 [19], clause 6.1.1.1). The field *maxRank* applies to DCI format 0_1 and the field *maxRankForDCI-Format0-2* applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.1.1).
mcs-Table, mcs-TableFormat0-2 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 *mcs-Table* applies to DCI format 0_0 and DCI format 0_1 and the field *mcs-TableForDCI-Format0-2* applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.4.1).
mcs-TableTransformPrecoder, mcs-TableTransformPrecoderForDCI-Format0-2 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 *mcs-TableTransformPrecoder* applies to DCI format 0_0 and DCI format 0_1 and the field *mcs-TableTransformPrecoderForDCI-Format0-2* applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.4.1).
minimumSchedulingOffsetK2 List of minimum K2 values. Minimum K2 parameter denotes minimum applicable value(s) for the *Time domain resource assignment* table for PUSCH (see TS 38.214 [19], clause 6.1.2.1).
numberOfBitsRV-ForDCI-Format0-2 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).
numberOfInvalidSymbolsForDL-UL-Switching 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).
priorityIndicatorForDCI-Format0-1, priorityIndicatorForDCI-Format0-2 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 *priorityIndicatorForDCI-Format0-1* applies to DCI format 0_1 and the field *priorityIndicatorForDCI-Format0-2* applies to DCI format 0_2 (see TS 38.212 [17] clause 7.3.1 and TS 38.213 [13] clause 9).
pusch-AggregationFactor 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.
pusch-RepTypeIndicatorForDCI-Format0-1, pusch-RepTypeIndicatorForDCI-Format0-2 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 *pusch-RepTypeA* enables the 'PUSCH repetition type A' and the value *pusch-RepTypeB* enables the 'PUSCH repetition type B'. The field *pusch-RepTypeIndicatorForDCI-Format0-1* applies to DCI format 0_1 and the field *pusch-RepTypeIndicatorForDCI-Format0-2* applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.2.1).
pusch-TimeDomainAllocationList 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 *pusch-TimeDomainAllocationList* applies to DCI formats 0_0 or DCI format 0_1 when the field *pusch-TimeDomainAllocationListForDCI-Format0-1* 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 *pusch-TimeDomainAllocation* (without suffix) simultaneously with the *pusch-TimeDomainAllocation-r16*.
pusch-TimeDomainAllocationListForDCI-Format0-1 Configuration of the time domain resource allocation (TDRA) table for DCI format 0_1 (see TS 38.214 [19], clause 6.2.1, table 6.1.2.1.1-1A).
pusch-TimeDomainAllocationListForDCI-Format0-2 Configuration of the time domain resource allocation (TDRA) table for DCI format 0_2 (see TS 38.214 [19], clause 6.2.1, table 6.1.2.1.1-1B).
rbg-Size Selection between configuration 1 and configuration 2 for RBG size for PUSCH. The UE does not apply this field if *resourceAllocation* is set to *resourceAllocationType1*. Otherwise, the UE applies the value *config1* when the field is absent (see TS 38.214 [19], clause 6.1.2.2.1).
resourceAllocation, resourceAllocationForDCI-Format0-2 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 *resourceAllocation* applies to DCI format 0_1 and the field *resourceAllocationForDCI-Format0-2* applies to DCI format 0_2 (see TS 38.214 [19], clause 6.1.2).
resourceAllocationType1GranularityForDCI-Format0-2 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).

tp-pi2BPSK Enables pi/2-BPSK modulation with transform precoding if the field is present and disables it otherwise.
transformPrecoder 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 *msg3-transformPrecoder*.
txConfig 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.
uci-OnPUSCH-ListForDCI-Format0-1, uci-OnPUSCH-ListForDCI-Format0-2 Configuration for up to 2 HARQ-ACK codebooks specific to DCI format 0_1/0_2. The field uci-OnPUSCH-ListForDCI-Format0-1 applies to DCI format 0_1 and the field uci-OnPUSCH-ListForDCI-Format0-2 applies to DCI format 0_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13] clause 9.3).
ul-AccessConfigListForDCI-Format0-1 List of the combinations of cyclic prefix extension, channel access priority class (CAPC), and UL channel access type (see TS 38.212 [17], Table 7.3.1-2-35).
ul-FullPowerTransmission Configures the UE with UL full power transmission mode as specified in TS 38.213.

***UCI-OnPUSCH* field descriptions**
betaOffsets 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).
scaling 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 *f0p5* corresponds to 0.5, value *f0p65* 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-ForDCI-Format0-2* field descriptions**
betaOffsetsForDCI-Format0-2 Configuration of beta-offset for DCI format 0_2. If semiStaticForDCI-Format0-2 is chosen, the UE shall apply the value of 0 bit for the field of beta offset indicator in DCI format 0_2. If dynamicForDCI-Format0-2 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).
dynamicForDCI-Format0-2 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).
semiStaticForDCI-Format0-2 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).
scalingForDCI-Format0-2 Indicates a scaling factor to limit the number of resource elements assigned to UCI on PUSCH for DCI format 0_2. Value f0p5 corresponds to 0.5, value *f0p65* corresponds to 0.65, and so on (see TS 38.212 [17], clause 6.3).

Conditional Presence	Explanation
codebookBased	The field is mandatory present if *txConfig* is set to codebook and absent otherwise.
RepTypeB	The field is optionally present, Need S, if *pusch-RepTypeIndicatorForDCI-Format0-1* is set to pusch-RepTypeB. It is absent otherwise.
RepTypeB2	The field is optionally present, Need S, if *pusch-RepTypeIndicatorForDCI-Format0-1* or *pusch-RepTypeIndicatorForDCI-Format0-2* 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
```

PUSCH-ConfigCommon **field descriptions**
groupHoppingEnabledTransformPrecoding   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.
msg3-DeltaPreamble   Power offset between msg3 and RACH preamble transmission. Actual value = field value * 2 [dB] (see TS 38.213 [13], clause 7.1)
p0-NominalWithGrant   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
pusch-TimeDomainAllocationList   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
                                                                                                            OPTIONAL, -- Need N
    pathlossReferenceRSToReleaseList2-r16  SEQUENCE (SIZE (1..maxNrofPUSCH-PathlossReferenceRSsDiff-r16)) OF PUSCH-PathlossReferenceRS-Id-v1610
                                                                                                            OPTIONAL, -- Need N
    p0-PUSCH-SetList-r16               SEQUENCE (SIZE (1..maxNrofSRI-PUSCH-Mappings)) OF P0-PUSCH-Set-r16    OPTIONAL, -- Need R
    olpc-ParameterSet                  SEQUENCE {
        olpc-ParameterSetForDCI-Format0-1-r16   INTEGER (1..2)                                              OPTIONAL, -- Need R
        olpc-ParameterSetForDCI-Format0-2-r16   INTEGER (1..2)                                              OPTIONAL  -- Need R
    }                                                                                                       OPTIONAL, -- Need M
    ...
}

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        OPTIONAL, -- Need R
    ...
}

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 *OLPCParameterSet-ForDCIFormat0_1* and *OLPCParameterSet-ForDCIFormat0_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 *OLPCParameterSet-ForDCIFormat0_1* and *OLPCParameterSet-ForDCIFormat0_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).

***PUSCH-PowerControl* field descriptions**
deltaMCS Indicates whether to apply delta MCS. When the field is absent, the UE applies Ks = 0 in delta_TFC formula for PUSCH (see TS 38.213 [13], clause 7.1).
msg3-Alpha 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.
olpc-ParameterSetForDCI-Format0-1, olpc-ParameterSetForDCI-Format0-2 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 *olpc-ParameterSetForDCI-Format0-1* applies to DCI format 0_1 and the field *olpc-ParameterSetForDCI-Format0-2* applies to DCI format 0_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 11).
p0-AlphaSets 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.
p0-NominalWithoutGrant 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).
p0-PUSCH-SetList Configure one additional *P0-PUSCH-Set* 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 *P0-PUSCH-AlphaSet* and the P0 value(s) from the *P0-PUSCH-Set* (See TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 17).
pathlossReferenceRSToAddModList, pathlossReferenceRSToAddModList2 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 *pathLossReferenceRSToAddModList* and *Reference* Signals configured using pathlossReferenceRSToAddModList2.Up to *maxNrofPUSCH-PathlossReferenceRSs* may be configured (see TS 38.213 [13], clause 7.1).
sri-PUSCH-MappingToAddModList A list of *SRI-PUSCH-PowerControl* elements among which one is selected by the SRI field in DCI (see TS 38.213 [13], clause 7.1).
tpc-Accumulation 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).
twoPUSCH-PC-AdjustmentStates 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).

***SRI-PUSCH-PowerControl* field descriptions**
sri-P0-PUSCH-AlphaSetId The ID of a *P0-PUSCH-AlphaSet* as configured in *p0-AlphaSets in PUSCH-PowerControl*.
sri-PUSCH-ClosedLoopIndex The index of the closed power control loop associated with this *SRI-PUSCH-PowerControl.*
sri-PUSCH-PathlossReferenceRS-Id The ID of *PUSCH-PathlossReferenceRS* as configured in the *pathlossReferenceRSToAddModList* in *PUSCH-PowerControl*.
sri-PUSCH-PowerControlId The ID of this *SRI-PUSCH-PowerControl* 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-LayersForDCI-Format0-2-r16      SetupRelease { MaxMIMO-LayersForDCI-Format0-2-r16}      OPTIONAL    -- Need M
    ]]
}

PUSCH-CodeBlockGroupTransmission ::=    SEQUENCE {
    maxCodeBlockGroupsPerTransportBlock     ENUMERATED {n2, n4, n6, n8},
    ...
}

MaxMIMO-LayersForDCI-Format0-2-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).

***PUSCH-ServingCellConfig* field descriptions**
codeBlockGroupTransmission Enables and configures code-block-group (CBG) based transmission (see TS 38.214 [19], clause 5.1.5).
maxMIMO-Layers 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 *maxRank* to the same value. For SUL, the maximum number of MIMO layers is always 1, and network does not configure this field. The field *maxMIMO-Layers* refers to DCI format 0_1.
processingType2Enabled Enables configuration of advanced processing time capability 2 for PUSCH (see 38.214 [19], clause 6.4).
rateMatching 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).
xOverhead If the field is absent, the UE applies the value 'xoh0' (see TS 38.214 [19], clause 5.1.3.2).
maxMIMO-LayersForDCI-Format0-2 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 *maxRankForDCI-Format0-2* 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
```

***PUSCH-TimeDomainResourceAllocationList* field descriptions**
k2 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.
length Indicates the length allocated for PUSCH for DCI format 0_1/0_2 (see TS 38.214 [19], clause 6.1.2.1).
mappingType Mapping type (see TS 38.214 [19], clause 6.1.2.1).
numberOfRepetitions Number of repetitions for DCI format 0_1/0_2 (see TS 38.214 [19], clause 6.1.2.1).
puschAllocationList 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 *pusch-TimeDomainAllocationListForDCI-Format0-1-r16* and in *pusch-TimeDomainAllocationListForDCI-Format0-2-r16*.
startSymbol 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).
startSymbolAndLength 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).

Conditional Presence	Explanation
Format01-02	In *pusch-TimeDomainAllocationListForMultiPUSCH-r16*, the field is absent. In *pusch-TimeDomainAllocationListForDCI-Format0-1* and in *pusch-TimeDomainAllocationListForDCI-Format0-2*, the field is mandatory present.
NotFormat01-02-Or-TypeA	In *pusch-TimeDomainAllocationListForMultiPUSCH-r16*, the field is mandatory present. In *pusch-TimeDomainAllocationListForDCI-Format0-1,* the field is optionally present if *pusch-RepTypeIndicatorForDCI-Format0-1* is set to pusch-RepTypeA, Need R. It is absent otherwise, Need R. In *pusch-TimeDomainAllocationListForDCI-Format0-2,* the field is optionally present if *pusch-RepTypeIndicatorForDCI-Format0-2* is set to pusch-RepTypeA, Need R. It is absent otherwise, Need R.
RepTypeB	In *pusch-TimeDomainAllocationListForMultiPUSCH-r16*, the field is absent. In *pusch-TimeDomainAllocationListForDCI-Format0-1,* the field is optionally present if *pusch-RepTypeIndicatorForDCI-Format0-1* is set to pusch-RepTypeB, Need R. It is absent otherwise, Need R. In *pusch-TimeDomainAllocationListForDCI-Format0-2,* the field is optionally present if *pusch-RepTypeIndicatorForDCI-Format0-2* is set to pusch-RepTypeB, 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**
targetCell 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.
tpc-Index An index determining the position of the first bit of TPC command inside the DCI format 2-2 payload.
tpc-IndexSUL An index determining the position of the first bit of TPC command inside the DCI format 2-2 payload.

Conditional Presence	Explanation
SUL-Only	The field is optionally present, Need R, if this serving cell is configured with a supplementary uplink (SUL). It is absent otherwise.
SUL	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 $Q_{qualmin}$ in TS 38.304 [20]. Actual value $Q_{qualmin}$ = 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 $Q_{rxlevmin}$ in TS 38.304 [20]. Actual value $Q_{rxlevmin}$ = field value * 2 [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 ::=                  SEQUENCE {
    quantityConfigNR-List               SEQUENCE (SIZE (1..maxNrofQuantityConfig)) OF QuantityConfigNR          OPTIONAL,   -- Need M
    ...,
    [[
    quantityConfigEUTRA                 FilterConfig                                                            OPTIONAL    -- Need M
    ]],
    [[
    quantityConfigUTRA-FDD-r16          QuantityConfigUTRA-FDD-r16                                              OPTIONAL,   -- Need M
    quantityConfigCLI-r16               FilterConfigCLI-r16                                                     OPTIONAL    -- Need M
    ]]
}

QuantityConfigNR::=                 SEQUENCE {
    quantityConfigCell                  QuantityConfigRS,
    quantityConfigRS-Index              QuantityConfigRS                                                        OPTIONAL    -- Need M
}

QuantityConfigRS ::=                SEQUENCE {
    ssb-FilterConfig                    FilterConfig,
    csi-RS-FilterConfig                 FilterConfig
}

FilterConfig ::=                    SEQUENCE {
    filterCoefficientRSRP               FilterCoefficient                                   DEFAULT fc4,
    filterCoefficientRSRQ               FilterCoefficient                                   DEFAULT fc4,
    filterCoefficientRS-SINR            FilterCoefficient                                   DEFAULT fc4
}

FilterConfigCLI-r16 ::=             SEQUENCE {
    filterCoefficientSRS-RSRP-r16       FilterCoefficient                                   DEFAULT fc4,
    filterCoefficientCLI-RSSI-r16       FilterCoefficient                                   DEFAULT fc4
}

QuantityConfigUTRA-FDD-r16 ::=      SEQUENCE {
    filterCoefficientRSCP-r16           FilterCoefficient                                   DEFAULT fc4,
    filterCoefficientEcNO-r16           FilterCoefficient                                   DEFAULT fc4
}

-- TAG-QUANTITYCONFIG-STOP
-- ASN1STOP
```

***QuantityConfigNR* field descriptions**
quantityConfigCell 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).
quantityConfigRS-Index 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).

***QuantityConfigRS* field descriptions**
csi-RS-FilterConfig 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].
ssb-FilterConfig 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].

QuantityConfigUTRA-FDD field descriptions
filterCoefficientRSCP Specifies L3 filter coefficient for FDD UTRAN CPICH_RSCP measuement results from L1 filter.
filterCoefficientEcN0 Specifies L3 filter coefficient for FDD UTRAN CPICH_EcN0 measuement 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                    SEQUENCE {
        ra-Msg3SizeGroupA                   ENUMERATED {b56, b144, b208, b256, b282, b480, b640,
                                                        b800, b1000, b72, spare6, spare5,spare4, spare3, spare2, spare1},
        messagePowerOffsetGroupB            ENUMERATED { minusinfinity, dB0, dB5, dB8, dB10, dB12, dB15, dB18},
        numberOfRA-PreamblesGroupA          INTEGER (1..64)
    }                                                                                       OPTIONAL,   -- Need R
    ra-ContentionResolutionTimer            ENUMERATED { sf8, sf16, sf24, sf32, sf40, sf48, sf56, sf64},
    rsrp-ThresholdSSB                       RSRP-Range                                      OPTIONAL,   -- Need R
    rsrp-ThresholdSSB-SUL                   RSRP-Range                                      OPTIONAL,   -- Cond SUL
    prach-RootSequenceIndex                 CHOICE {
        l839                                    INTEGER (0..837),
        l139                                    INTEGER (0..137)
    },
    msg1-SubcarrierSpacing                  SubcarrierSpacing                               OPTIONAL,   -- Cond L139
    restrictedSetConfig                     ENUMERATED {unrestrictedSet, restrictedSetTypeA, restrictedSetTypeB},
    msg3-transformPrecoder                  ENUMERATED {enabled}                            OPTIONAL,   -- Need R
    ...,
    [[
    ra-PrioritizationForAccessIdentity      SEQUENCE {
        ra-Prioritization-r16                   RA-Prioritization,
        ra-PrioritizationForAI-r16              BIT STRING (SIZE (2))
    }                                                                                       OPTIONAL,   -- Cond InitialBWP-Only
    prach-RootSequenceIndex-r16             CHOICE {
        l571                                    INTEGER (0..569),
        l1151                                   INTEGER (0..1149)
    }   OPTIONAL    -- Need R
    ]]
}

-- TAG-RACH-CONFIGCOMMON-STOP
-- ASN1STOP
```

***RACH-ConfigCommon* field descriptions**
messagePowerOffsetGroupB
Threshold for preamble selection. Value is in dB. Value *minusinfinity* corresponds to –infinity. Value *dB0* corresponds to 0 dB, *dB5* corresponds to 5 dB and so on. (see TS 38.321 [3], clause 5.1.2)
msg1-SubcarrierSpacing
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 *prach-ConfigurationIndex* in *RACH-ConfigGeneric* (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 (*RACH-ConfigDedicated*), 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 *BeamFailureRecoveryConfig*).
msg3-transformPrecoder
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).
numberOfRA-PreamblesGroupA
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 *ssb-perRACH-OccasionAndCB-PreamblesPerSSB*.
prach-RootSequenceIndex
PRACH root sequence index (see TS 38.211 [16], clause 6.3.3.1). The value range depends on whether L=839 or L=139. The short/long preamble format indicated in this IE should be consistent with the one indicated in *prach-ConfigurationIndex* in the *RACH-ConfigDedicated* (if configured). If *prach-RootSequenceIndex-r16* is signalled, UE shall ignore the *prach-RootSequenceIndex* (without suffix).
ra-ContentionResolutionTimer
The initial value for the contention resolution timer (see TS 38.321 [3], clause 5.1.5). Value *sf8* corresponds to 8 subframes, value *sf16* corresponds to 16 subframes, and so on.
ra-Msg3SizeGroupA
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).
ra-PrioritizationForAI
Indicates whether the field *ra-Prioritization-r16* 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 *ra-Prioritization-r16* applies otherwise the field does not apply (see TS 23.501 [32]).
ra-Prioritization
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).
rach-ConfigGeneric
RACH parameters for both regular random access and beam failure recovery.
restrictedSetConfig
Configuration of an unrestricted set or one of two types of restricted sets, see TS 38.211 [16], clause 6.3.3.1.
rsrp-ThresholdSSB
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]).
rsrp-ThresholdSSB-SUL
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.
ssb-perRACH-OccasionAndCB-PreamblesPerSSB
The meaning of this field is twofold: the CHOICE conveys the information about the number of SSBs per RACH occasion. Value *oneEighth* corresponds to one SSB associated with 8 RACH occasions, value *oneFourth* 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 *n4* corresponds to 4 Contention Based preambles per SSB, value *n8* corresponds to 8 Contention Based preambles per SSB, and so on. The total number of CB preambles in a RACH occasion is given by *CB-preambles-per-SSB* * max(1, *SSB-per-rach-occasion*). See TS 38.213 [13].
totalNumberOfRA-Preambles
Total number of preambles used for contention based and contention free 4-step or 2-step random access in the RACH resources defined in *RACH-ConfigCommon*, 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 *ssb-perRACH-OccasionAndCB-PreamblesPerSSB*, i.e. it should be a multiple of the number of SSBs per RACH occasion.

Conditional Presence	Explanation
L139	The field is mandatory present if *prach-RootSequenceIndex* L=139, otherwise the field is absent, Need S.
SUL	The field is mandatory present in *initialUplinkBWP* in *supplementaryUplink*; 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 ::=                  SEQUENCE {
    rach-ConfigGenericTwoStepRA-r16                     RACH-ConfigGenericTwoStepRA-r16,
    msgA-TotalNumberOfRA-Preambles-r16                  INTEGER (1..63)                                         OPTIONAL, -- Need S
    msgA-SSB-PerRACH-OccasionAndCB-PreamblesPerSSB-r16  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, -- Cond 2StepOnly
    msgA-CB-PreamblesPerSSB-PerSharedRO-r16             INTEGER (1..60)                                         OPTIONAL, -- Cond SharedRO
    msgA-SSB-SharedRO-MaskIndex-r16                     INTEGER (1..15)                                         OPTIONAL, -- Need S
    groupB-ConfiguredTwoStepRA-r16                      GroupB-ConfiguredTwoStepRA-r16                          OPTIONAL, -- Need S
    msgA-PRACH-RootSequenceIndex-r16                    CHOICE {
        l839                                                INTEGER (0..837),
        l139                                                INTEGER (0..137),
        l571                                                INTEGER (0..569),
        l1151                                               INTEGER (0..1149)
    }                                                                                                           OPTIONAL, -- Cond 2StepOnly
    msgA-TransMax-r16                                   ENUMERATED {n1, n2, n4, n6, n8, n10, n20, n50, n100, n200}  OPTIONAL, -- Need R
    msgA-RSRP-Threshold-r16                             RSRP-Range                                              OPTIONAL, -- Cond
2Step4Step
    msgA-RSRP-ThresholdSSB-r16                          RSRP-Range                                              OPTIONAL, -- Need R
    msgA-SubcarrierSpacing-r16                          SubcarrierSpacing                                       OPTIONAL, -- Cond
2StepOnlyL139
    msgA-RestrictedSetConfig-r16                        ENUMERATED {unrestrictedSet, restrictedSetTypeA,
                                                                    restrictedSetTypeB}                         OPTIONAL, -- Cond 2StepOnly
    ra-PrioritizationForAccessIdentityTwoStep-r16       SEQUENCE {
        ra-Prioritization-r16                               RA-Prioritization,
        ra-PrioritizationForAI-r16                          BIT STRING (SIZE (2))
```

```
    }                                                                                                   OPTIONAL, -- Cond
InitialBWP-Only
    ra-ContentionResolutionTimer-r16                ENUMERATED {sf8, sf16, sf24, sf32, sf40, sf48, sf56, sf64}      OPTIONAL, -- Cond 2StepOnly
    ...
}

GroupB-ConfiguredTwoStepRA-r16 ::=                  SEQUENCE {
    ra-MsgA-SizeGroupA                              ENUMERATED {b56, b144, b208, b256, b282, b480, b640, b800,
                                                                b1000, b72, spare6, spare5, spare4, spare3, spare2, spare1},
    messagePowerOffsetGroupB                        ENUMERATED {minusinfinity, dB0, dB5, dB8, dB10, dB12, dB15, dB18},
    numberofRA-PreamblesGroupA                      INTEGER (1..64)
}

-- TAG-RACH-CONFIGCOMMONTWOSTEPRA-STOP
-- ASN1STOP
```

***RACH-ConfigCommonTwoStepRA* field descriptions**
groupB-ConfiguredTwoStepRA
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.
msgA-CB-PreamblesPerSSB-PerSharedRO
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 *SSB-perRACH-OccasionAndCB-PreamblesPerSSB* in *RACH-ConfigCommon*. The field is only applicable for the case of shared ROs with 4-step type random access.
msgA-PRACH-RootSequenceIndex
PRACH root sequence index. If the field is not configured, the UE applies the value in field *prach-RootSequenceIndex* in *RACH-ConfigCommon* 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.
msgA-RestrictedSetConfig
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 *restrictedSetConfig* in *RACH-ConfigCommon* 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.
msgA-RSRP-Threshold
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.
msgA-RSRP-ThresholdSSB
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]).
msgA-SSB-PerRACH-OccasionAndCB-PreamblesPerSSB
The meaning of this field is twofold: the CHOICE conveys the information about the number of SSBs per RACH occasion. Value *oneEight* corresponds to one SSB associated with 8 RACH occasions, value *oneFourth* 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 *n4* corresponds to 4 Contention Based preambles per SSB, value *n8* corresponds to 8 Contention Based preambles per SSB, and so on. The total number of CB preambles in a RACH occasion is given by *CB-preambles-per-SSB* * max(1, *SSB-per-rach-occasion*). 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 *ssb-perRACH-OccasionAndCB-PreamblesPerSSB* in *RACH-ConfigCommon*. The field is not present when RACH occasions are shared between 2-step and 4-step type random access in the BWP.
msgA-SSB-SharedRO-MaskIndex
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.
msgA-SubcarrierSpacing
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 *msg1-SubcarrierSpacing* in *RACH-ConfigCommon*. The value also applies to contention free 2-step random access type (*RACH-ConfigDedicated*).
msgA-TotalNumberOfRA-Preambles
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.
msgA-TransMax
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.
ra-PrioritizationForAI
Indicates whether the field ra-Prioritization-r16 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 ra-Prioritization-r16 applies, otherwise the field does not apply.

ra-ContentionResolutionTimer 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 *sf8* corresponds to 8 subframes, value *sf16* 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.
ra-Prioritization 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).
rach-ConfigGenericTwoStepRA 2-step random access type parameters for both regular random access and beam failure recovery.

***GroupB-ConfiguredTwoStepRA* field descriptions**
messagePowerOffsetGroupB Threshold for preamble selection. Value is in dB. Value *minusinfinity* corresponds to –infinity. Value *dB0* corresponds to 0 dB, *dB5* corresponds to 5 dB and so on. (see TS 38.321 [3], clause 5.1.1).
numberofRA-PreamblesGroupA 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 *ssb-perRACH-OccasionAndCB-PreamblesPerSSB-TwoStepRA* or *msgA-CB-PreamblesPerSSB* if configured.
ra-MsgA-SizeGroupA 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
2StepOnlyL139	The field is mandatory present if *prach-RootSequenceIndex* L=139 and no 4-step random access type is configured, otherwise the field is absent, Need S.
2StepOnly	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.
SharedRO	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.
2Step4Step	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.
InitialBWP-Only	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}
                                                                                                        OPTIONAL  -- Cond Mandatory
    }                                                                                                   OPTIONAL, -- Need S
    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}
    }                                                                                       OPTIONAL, -- Need S
    msgA-CFRA-PUSCH-r16                     MsgA-PUSCH-Resource-r16,
    msgA-TransMax-r16                       ENUMERATED {n1, n2, n4, n6, n8, n10, n20, n50, n100, n200}    OPTIONAL, -- Need S
    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.

***CFRA-SSB-Resource* field descriptions**
msgA-PUSCH-resource-Index 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 $DMRS_{id}$ 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.
ra-PreambleIndex The preamble index that the UE shall use when performing CF-RA upon selecting the candidate beams identified by this SSB.
ssb The ID of an SSB transmitted by this serving cell.

***CFRA-TwoStep* field descriptions**
msgA-CFRA-PUSCH PUSCH resource configuration(s) for msgA CFRA.
msgA-TransMax 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 *RACH-ConfigDedidated*, switching from 2-step RA type to 4-step RA type is not allowed.
occasionsTwoStepRA RA occasions for contention free random access. If the field is absent, the UE uses the RA occasions configured in *RACH-ConfigCommonTwoStepRA* 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-ConfigGenericTwoStepRA Configuration of contention free random access occasions for CFRA 2-step random access type.
ssb-PerRACH-OccasionTwoStep Number of SSBs per RACH occasion for 2-step random access type.

***RACH-ConfigDedicated* field descriptions**
cfra Parameters for contention free random access to a given target cell. If this field and *cfra-TwoStep* are absent, the UE performs contention based random access.
cfra-TwoStep Parameters for contention free 2-step random access type to a given target cell. Network ensures that *cfra* and *cfra-TwoStep* are not configured at the same time. If this field and *cfra* are absent, the UE performs contention based random access. This field may only be present if *msgA-ConfigCommon* is configured on the BWP.
ra-prioritization Parameters which apply for prioritized random access procedure to a given target cell (see TS 38.321 [3], clause 5.1.1).
ra-PrioritizationTwoStep 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).

Conditional Presence	Explanation
Mandatory	The field is mandatory present.
Occasions	The field is optionally present, Need S, if the field *occasions* is present, otherwise it is absent.
2StepCFRA	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 {sl1, sl2, sl4, sl8, sl10, sl20, sl40, sl80},
    ...,
    [[
    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 { sl60, sl160}                             OPTIONAL, -- Need R
    prach-ConfigurationIndex-v1610              INTEGER (256..262)                                    OPTIONAL  -- Need R
    ]]
}

-- TAG-RACH-CONFIGGENERIC-STOP
-- ASN1STOP
```

***RACH-ConfigGeneric* field descriptions**
msg1-FDM The number of PRACH transmission occasions FDMed in one time instance. (see TS 38.211 [16], clause 6.3.3.2).
msg1-FrequencyStart Offset of lowest PRACH transmission occasion in frequency domain with respective 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).
powerRampingStep Power ramping steps for PRACH (see TS 38.321 [3],5.1.3).
prach-ConfigurationFrameOffset-IAB Scaling factor for ROs defined in the baseline configuration indicated by *prach-ConfigurationIndex* and is used only by the IAB-MT. (see TS 38.211 [16], clause 6.3.3.2).
prach-ConfigurationIndex PRACH configuration index. For *prach-ConfigurationIndex* configured under *beamFailureRecovery-Config*, the *prach-ConfigurationIndex* can only correspond to the short preamble format, (see TS 38.211 [16], clause 6.3.3.2). If the field *prach-ConfigurationIndex-v1610* is present, the UE shall ignore the value provided in *prach-ConfigurationIndex* (without suffix).
prach-ConfigurationPeriodScaling-IAB Scaling factor to extend the periodicity of the baseline configuration indicated by *prach-ConfigurationIndex* and is used only by the IAB-MT. Value scf1 correponds to scaling factor of 1 and so on. (see TS 38.211 [16], clause 6.3.3.2).
prach-ConfigurationSOffset-IAB Subframe/Slot offset for ROs defined in the baseline configuration indicated by *prach-ConfigurationIndex* and is used only by the IAB-MT. (see TS 38.211 [16], clause 6.3.3.2).
preambleReceivedTargetPower 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, ...).
preambleTransMax Max number of RA preamble transmission performed before declaring a failure (see TS 38.321 [3], clauses 5.1.4, 5.1.5).
ra-ResponseWindow 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 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 *SCellConfig*. If *ra-ResponseWindow-v1610* is signalled, UE shall ignore the *ra-ResponseWindow* (without suffix). For operation with shared spectrum channel access and when *ra-ResponseWindow* 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]).
zeroCorrelationZoneConfig 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-CONFIGGENERICTWOSTEPRA-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 {sl1, sl2, sl4, sl8, sl10, sl20, sl40, sl80, sl160, sl320}
                                                                                                            OPTIONAL, -- Cond NoCFRA
    preambleTransMax-r16                    ENUMERATED {n3, n4, n5, n6, n7, n8, n10, n20, n50, n100, n200}  OPTIONAL, -- Cond 2StepOnlyNoCFRA
    ...
}

-- TAG-RACH-CONFIGGENERICTWOSTEPRA-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
2StepOnly	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
2StepOnlyNoCFRA	The field is mandatory present if *RACH-ConfigGenericTwoStepRA* is included in the *RACH-ConfigCommonTwoStepRA* 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 *RACH-ConfigGenericTwoStepRA* is included in the *RACH-ConfigDedicated*, this field is absent.
NoCFRA	The field is mandatory present if *RACH-ConfigGenericTwoStepRA* is not included in *CFRA-TwoStep* in *RACH-ConfigDedicated,* 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**
powerRampingStepHighPrioritiy   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 ::=               SEQUENCE {
    srb-ToAddModList                    SRB-ToAddModList                    OPTIONAL,   -- Cond HO-Conn
    srb3-ToRelease                      ENUMERATED{true}                    OPTIONAL,   -- Need N
    drb-ToAddModList                    DRB-ToAddModList                    OPTIONAL,   -- Cond HO-toNR
    drb-ToReleaseList                   DRB-ToReleaseList                   OPTIONAL,   -- Need N
    securityConfig                      SecurityConfig                      OPTIONAL,   -- Need M
    ...
}

SRB-ToAddModList ::=                SEQUENCE (SIZE (1..2)) OF SRB-ToAddMod
SRB-ToAddMod ::=                    SEQUENCE {
    srb-Identity                        SRB-Identity,
    reestablishPDCP                     ENUMERATED{true}                    OPTIONAL,   -- Need N
    discardOnPDCP                       ENUMERATED{true}                    OPTIONAL,   -- Need N
    pdcp-Config                         PDCP-Config                         OPTIONAL,   -- Cond PDCP
    ...
}

DRB-ToAddModList ::=                SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod

DRB-ToAddMod ::=                    SEQUENCE {
    cnAssociation                       CHOICE {
        eps-BearerIdentity                  INTEGER (0..15),
        sdap-Config                         SDAP-Config
    }                                                                       OPTIONAL,   -- Cond DRBSetup
    drb-Identity                        DRB-Identity,
    reestablishPDCP                     ENUMERATED{true}                    OPTIONAL,   -- Need N
    recoverPDCP                         ENUMERATED{true}                    OPTIONAL,   -- Need N
    pdcp-Config                         PDCP-Config                         OPTIONAL,   -- Cond PDCP
    ...,
    [[
    daps-Config-r16                     ENUMERATED{true}                    OPTIONAL     --Need N
    ]]
}
DRB-ToReleaseList ::=               SEQUENCE (SIZE (1..maxDRB)) OF DRB-Identity

SecurityConfig ::=                  SEQUENCE {
    securityAlgorithmConfig             SecurityAlgorithmConfig             OPTIONAL,   -- Cond RBTermChange1
    keyToUse                            ENUMERATED{master, secondary}       OPTIONAL,   -- Cond RBTermChange
    ...
}

-- TAG-RADIOBEARERCONFIG-STOP
-- ASN1STOP
```

***DRB-ToAddMod* field descriptions**
cnAssociation
Indicates if the bearer is associated with the *eps-bearerIdentity* (when connected to EPC) or *sdap-Config* (when connected to 5GC).
daps-Config
Indicates that the bearer is configured as DAPS bearer.This field is optional present, need N, in case *masterCellGroup* includes *ReconfigurationWithSync*, MR-DC is not configured and *ethernetHeaderCompression* is not configured for the DRB. Otherwise the field is absent.
drb-Identity
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.
eps-BearerIdentity
The EPS bearer ID determines the EPS bearer.
reestablishPDCP
Indicates that PDCP should be re-established. Network sets this to *true* 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. Network doesn't include this field for SRB if any DAPS bearer is configured.
recoverPDCP
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.
sdap-Config
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.

***RadioBearerConfig* field descriptions**
securityConfig
Indicates the security algorithm and key to use for the signalling and data radio bearers configured with the list in this IE *RadioBearerConfig*. When the field is not included after AS security has been activated, the UE shall continue to use the currently configured *keyToUse* and security algorithm for the radio bearers reconfigured with the lists in this IE *RadioBearerConfig*. The field is not included when configuring SRB1 before AS security is activated.
srb3-ToRelease
Release SRB3. SRB3 release can only be done over SRB1 and only at SCG release and reconfiguration with sync.

***SecurityConfig* field descriptions**
keyToUse
Indicates if the bearers configured with the list in this IE *RadioBearerConfig* 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 *keyToUse* for the radio bearers reconfigured with the lists in this IE *RadioBearerConfig*.
securityAlgorithmConfig
Indicates the security algorithm for the signalling and data radio bearers configured with the list in this IE *RadioBearerConfig*. 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 *RadioBearerConfig*.

***SRB-ToAddMod* field descriptions**
discardOnPDCP
Indicates that PDCP should discard stored SDU and PDU according to TS 38.323 [5].
reestablishPDCP
Indicates that PDCP should be re-established. Network sets this to *true* 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.
srb-Identity
Value 1 is applicable for SRB1 only. Value 2 is applicable for SRB2 only. Value 3 is applicable for SRB3 only.

Conditional Presence	Explanation
RBTermChange	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.
RBTermChange1	The field is mandatory present in case of: - set up of signalling and data radio bearer, - change of termination point for the radio bearer between MN and SN, - handover from E-UTRA/EPC or E-UTRA/5GC to NR, - handover from NR or E-UTRA/EPC to E-UTRA/5GC if the UE supports NGEN-DC. It is optionally present otherwise, Need S.
PDCP	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.
DRBSetup	The field is mandatory present if the corresponding DRB is being setup; otherwise the field is optionally present, need M.
HO-Conn	The field is mandatory present - in case of inter-system handover from E-UTRA/EPC to E-UTRA/5GC or NR, - or when the *fullConfig* is included in the *RRCReconfiguration* message and NE-DC/NR-DC is not configured, - or in case of *RRCSetup*. Otherwise the field is optionally present, need N. Upon *RRCSetup*, only SRB1 can be present.
HO-toNR	The field is mandatory present - in case of inter-system handover from E-UTRA/EPC to E-UTRA/5GC or NR, - or when the *fullConfig* is included in the *RRCReconfiguration* message and NE-DC/NR-DC is not configured. In case of *RRCSetup*, 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
                                                                                                    OPTIONAL, -- Need N
    failureDetectionResourcesToReleaseList  SEQUENCE (SIZE(1..maxNrofFailureDetectionResources)) OF RadioLinkMonitoringRS-Id
                                                                                                    OPTIONAL, -- Need N
    beamFailureInstanceMaxCount             ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10}        OPTIONAL, -- Need R
    beamFailureDetectionTimer               ENUMERATED {pbfd1, pbfd2, pbfd3, pbfd4, pbfd5, pbfd6, pbfd8, pbfd10}  OPTIONAL, -- Need R
    ...
}

RadioLinkMonitoringRS ::=           SEQUENCE {
    radioLinkMonitoringRS-Id            RadioLinkMonitoringRS-Id,
    purpose                             ENUMERATED {beamFailure, rlf, both},
    detectionResource                   CHOICE {
        ssb-Index                           SSB-Index,
        csi-RS-Index                        NZP-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 "$Q_{out,LR}$ reporting periods of Beam Failure Detection" Reference Signal (see TS 38.213 [13], clause 6). Value *pbfd1* corresponds to 1 $Q_{out,LR}$ reporting period of Beam Failure Detection Reference Signal, value *pbfd2* corresponds to 2 $Q_{out,LR}$ 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 ::=                SEQUENCE {
    rateMatchPatternId                  RateMatchPatternId,

    patternType                         CHOICE {
        bitmaps                             SEQUENCE {
            resourceBlocks                      BIT STRING (SIZE (275)),
            symbolsInResourceBlock              CHOICE {
                oneSlot                             BIT STRING (SIZE (14)),
                twoSlots                            BIT STRING (SIZE (28))
```

```
            },
            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))
            }                                                                   OPTIONAL,   -- Need S
            ...
        },
        controlResourceSet                  ControlResourceSetId
    },
    subcarrierSpacing                   SubcarrierSpacing                       OPTIONAL,   -- Cond CellLevel
    dummy                               ENUMERATED { dynamic, semiStatic },
    ...,
    [[
    controlResourceSet-r16              ControlResourceSetId-r16                OPTIONAL    -- Need R
    ]]

}

-- TAG-RATEMATCHPATTERN-STOP
-- ASN1STOP
```

***RateMatchPattern* field descriptions**
bitmaps Indicates rate matching pattern by a pair of bitmaps *resourceBlocks* and *symbolsInResourceBlock* to define the rate match pattern within one or two slots, and a third bitmap *periodicityAndPattern* to define the repetition pattern with which the pattern defined by the above bitmap pair occurs.
controlResourceSet 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 *controlResourceSetId-r16* is present, UE shall ignore the *controlResourceSetId* (without suffix).
periodicityAndPattern A time domain repetition pattern at which the pattern defined by *symbolsInResourceBlock* and *resourceBlocks* recurs. This slot pattern repeats itself continuously. Absence of this field indicates the value *n1*, i.e., the *symbolsInResourceBlock* recurs every 14 symbols (see TS 38.214 [19], clause 5.1.4.1).
resourceBlocks 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 *symbolsInResourceBlock* 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).
subcarrierSpacing The SubcarrierSpacing for this resource pattern. If the field is absent, the UE applies the SCS of the associated BWP. The value *kHz15* corresponds to μ=0, the value *kHz30* corresponds to μ=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).
symbolsInResourceBlock 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 periodicityAndPattern (see TS 38.214 [19], clause 5.1.4.1). For *oneSlot*, 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 *twoSlots*, 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
CellLevel	The field is mandatory present if the *RateMatchPattern* is defined on cell level. The field is absent when the *RateMatchPattern* is defined on BWP level. If the *RateMatchPattern* is defined on BWP level, the UE applies the SCS of the BWP.

– *RateMatchPatternId*

The IE *RateMatchPatternId* identifies one RateMatchMattern (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**
carrierBandwidthDL BW of the LTE carrier in number of PRBs (see TS 38.214 [19], clause 5.1.4.2).
carrierFreqDL Center of the LTE carrier (see TS 38.214 [19], clause 5.1.4.2).
mbsfn-SubframeConfigList LTE MBSFN subframe configuration (see TS 38.214 [19], clause 5.1.4.2).
nrofCRS-Ports Number of LTE CRS antenna port to rate-match around (see TS 38.214 [19], clause 5.1.4.2).
v-Shift 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
RefTime	The field is mandatory present if *referenceTimeInfo* is included in *DLInformationTransfer* 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, sequenticalMapping},
    sequenceOffsetforRV-r16       INTEGER (1..3)
}

-- TAG-REPETITIONSCHEMECONFIG-STOP
-- ASN1STOP
```

***RepetitionSchemeConfig* field descriptions**
fdm-TDM Configures UE with a repetition scheme among fdmSchemeA, fdmSchemeB and tdmSchemeA as specified in clause 5.1 of TS 38.214 [19].
sequenceOffsetforRV For slot-based repetition scheme, selected RV sequence is applied to transmission occasions associated to the first TRP (i.e. the first TCI state). The RV sequence associated to the second TRP (i.e. the second TCI state) is determined by a RV offset from that selected RV sequence.
slotBased Configures UE with slot-based repetition scheme. Network always configures this field when the parameter *repetitionNumber* is present in IE *PDSCH-TimeDomainResourceAllocationList*
startingSymbolOffsetK 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 *tdmSchemeA,* the parameter *startingSymbolOffsetK* is present, otherwise absent.
tciMapping 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 B*N* 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                                  CHOICE {
        periodical                                  PeriodicalReportConfigInterRAT,
        eventTriggered                              EventTriggerConfigInterRAT,
        reportCGI                                   ReportCGI-EUTRA,
        ...,
        reportSFTD                                  ReportSFTD-EUTRA
    }
}

ReportCGI-EUTRA ::=                         SEQUENCE {
    cellForWhichToReportCGI         EUTRA-PhysCellId,
    ...,
    [[
    useAutonomousGaps-r16           ENUMERATED {setup}              OPTIONAL     -- Need R
    ]]
}

ReportSFTD-EUTRA ::=                    SEQUENCE {
    reportSFTD-Meas                         BOOLEAN,
    reportRSRP                              BOOLEAN,
    ...
}

EventTriggerConfigInterRAT ::=              SEQUENCE {
    eventId                                     CHOICE {
        eventB1                                     SEQUENCE {
            b1-ThresholdEUTRA                           MeasTriggerQuantityEUTRA,
            reportOnLeave                               BOOLEAN,
            hysteresis                                  Hysteresis,
            timeToTrigger                               TimeToTrigger,
            ...
        },
        eventB2                                     SEQUENCE {
            b2-Threshold1                               MeasTriggerQuantity,
            b2-Threshold2EUTRA                          MeasTriggerQuantityEUTRA,
            reportOnLeave                               BOOLEAN,
            hysteresis                                  Hysteresis,
            timeToTrigger                               TimeToTrigger,
            ...
        },
        ...,
        [[
        eventB1-UTRA-FDD-r16                        SEQUENCE {
            b1-ThresholdUTRA-FDD-r16                    MeasTriggerQuantityUTRA-FDD-r16,
            reportOnLeave-r16                           BOOLEAN,
            hysteresis-r16                              Hysteresis,
            timeToTrigger-r16                           TimeToTrigger,
            ...
        },
        eventB2-UTRA-FDD-r16                        SEQUENCE {
            b2-Threshold1-r16                           MeasTriggerQuantity,
            b2-Threshold2UTRA-FDD-r16                   MeasTriggerQuantityUTRA-FDD-r16,
            reportOnLeave-r16                           BOOLEAN,
            hysteresis-r16                              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{
    utra-FDD-RSCP-r16                           INTEGER (-5..91),
    utra-FDD-EcN0-r16                           INTEGER (0..49)
}

MeasReportQuantityUTRA-FDD-r16 ::=        SEQUENCE {
    cpich-RSCP                              BOOLEAN,
    cpich-EcN0                              BOOLEAN
}

-- TAG-REPORTCONFIGINTERRAT-STOP
-- ASN1STOP
```

ReportConfigInterRAT field descriptions
reportType
Type of the configured measurement report. In EN-DC, network does not configure report of type *ReportCGI-EUTRA*.

ReportCGI-EUTRA field descriptions
useAutonomousGaps
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.

***EventTriggerConfigInterRAT* field descriptions**
b2-Threshold1
NR threshold to be used in inter RAT measurement report triggering condition for event B2.
bN-ThresholdEUTRA
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 *eventB2*, the network configures the same CHOICE name (*rsrp*, *rsrq* or *sinr*) for the *MeasTriggerQuantity* of the *b2-Threshold1* and for the *MeasTriggerQuantityEUTRA* of the *b2-Threshold2EUTRA*.
eventId
Choice of inter RAT event triggered reporting criteria.
maxReportCells
Max number of non-serving cells to include in the measurement report.
reportAmount
Number of measurement reports applicable for *eventTriggered* as well as for *periodical* report types
reportOnLeave
Indicates whether or not the UE shall initiate the measurement reporting procedure when the leaving condition is met for a cell in *cellsTriggeredList*, as specified in 5.5.4.1.
reportQuantity, reportQuantityUTRA-FDD
The cell measurement quantities to be included in the measurement report. If the field *eventB1-UTRA-FDD* or *eventB2-UTRA-FDD* is present, the UE shall ignore the value(s) provided in *reportQuantity*.
timeToTrigger
Time during which specific criteria for the event needs to be met in order to trigger a measurement report.
bN-ThresholdUTRA-FDD
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. *utra-FDD-RSCP* corresponds to CPICH_RSCP in TS 25.133 [46] for FDD. *utra-FDD-EcN0* corresponds to CPICH_Ec/No in TS 25.133 [46] for FDD. For *utra-FDD-RSCP*: The actual value is field value – 115 dBm. For *utra-FDD-EcN0*: The actual value is (field value – 49)/2 dB.

***PeriodicalReportConfigInterRAT* field descriptions**
maxReportCells
Max number of non-serving cells to include in the measurement report.
reportAmount
Number of measurement reports applicable for *eventTriggered* as well as for *periodical* report types
reportQuantity, reportQuantityUTRA-FDD
The cell measurement quantities to be included in the measurement report. If the field *reportQuantityUTRA-FDD* is present, the UE shall ignore the value(s) provided in *reportQuantity*.

– *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 ::=                          SEQUENCE {
    reportType                                  CHOICE {
        periodical                                  PeriodicalReportConfig,
        eventTriggered                              EventTriggerConfig,
        ...,
        reportCGI                                   ReportCGI,
        reportSFTD                                  ReportSFTD-NR,
        condTriggerConfig-r16                       CondTriggerConfig-r16,
        cli-Periodical-r16                          CLI-PeriodicalReportConfig-r16,
        cli-EventTriggered-r16                      CLI-EventTriggerConfig-r16
    }
}

ReportCGI ::=                       SEQUENCE {
    cellForWhichToReportCGI             PhysCellId,
        ...,
    [[
    useAutonomousGaps-r16               ENUMERATED {setup}              OPTIONAL    -- Need R
    ]]
```

```
}

ReportSFTD-NR ::=                SEQUENCE {
    reportSFTD-Meas                 BOOLEAN,
    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 ::=       SEQUENCE {
    condEventId                     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::=                   SEQUENCE {
    eventId                                 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 ::=          SEQUENCE {
    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           RSSI-Range-r16          OPTIONAL    -- Need R
}

CLI-EventTriggerConfig-r16 ::=          SEQUENCE {
    eventId-r16                             CHOICE {
        eventI1-r16                             SEQUENCE {
            i1-Threshold-r16                        MeasTriggerQuantityCLI-r16,
            reportOnLeave-r16                       BOOLEAN,
            hysteresis-r16                          Hysteresis,
            timeToTrigger-r16                       TimeToTrigger
        },
    ...
    },
```

```
    reportInterval-r16                      ReportInterval,
    reportAmount-r16                        ENUMERATED {r1, r2, r4, r8, r16, r32, r64, infinity},
    maxReportCLI-r16                        INTEGER (1..maxCLI-Report-r16),
    ...
}

CLI-PeriodicalReportConfig-r16 ::=          SEQUENCE {
    reportInterval-r16                      ReportInterval,
    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 event number a5. In the same *eventA5*, 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.

***EventTriggerConfig* field descriptions**
a3-Offset/a6-Offset
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.
aN-ThresholdM
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 *MeasTriggerQuantity* of the *a5-Threshold1* and for the *MeasTriggerQuantity* of the *a5-Threshold2*.
channelOccupancyThreshold
RSSI threshold which is used for channel occupancy evaluation.
eventId
Choice of NR event triggered reporting criteria.
maxNrofRS-IndexesToReport
Max number of RS indexes to include in the measurement report for A1-A6 events.
maxReportCells
Max number of non-serving cells to include in the measurement report.
reportAddNeighMeas
Indicates that the UE shall include the best neighbour cells per serving frequency.
reportAmount
Number of measurement reports applicable for *eventTriggered* as well as for *periodical* report types.
reportOnLeave
Indicates whether or not the UE shall initiate the measurement reporting procedure when the leaving condition is met for a cell in *cellsTriggeredList*, as specified in 5.5.4.1.
reportQuantityCell
The cell measurement quantities to be included in the measurement report.
reportQuantityRS-Indexes
Indicates which measurement information per RS index the UE shall include in the measurement report.
timeToTrigger
Time during which specific criteria for the event needs to be met in order to trigger a measurement report.
ul-DelayValueConfig
If the field is present, the UE shall perform the actual PDCP queueing delay measurement per DRB as specified in TS 38.314 [53] and the UE shall ignore the fields *reportQuantityCell* and *maxReportCells*. The applicable values for the corresponding *reportInterval* are (one of the) {ms120, ms240, ms480, ms640, ms1024, ms2048, ms5120, ms10240, ms20480, ms40960, min1,min6, min12, min30}. The *reportInterval* indicates the periodicity for performing and reporting of UL PDCP Delay per DRB measurement as specified in TS 38.314 [53].
useT312
If value *TRUE* is configured, the UE shall use the timer T312 with the value *t312* as specified in the corresponding *measObjectNR*. If value FALSE is configured, the timer T312 is considered as disabled. Network configures value *TRUE* only if *reportType* is set to *eventTriggered*.
useWhiteCellList
Indicates whether only the cells included in the white-list of the associated measObject are applicable as specified in 5.5.4.1.

***CLI-EventTriggerConfig* field descriptions**
i1-Threshold 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.
eventId Choice of CLI event triggered reporting criteria.
maxReportCLI Max number of CLI measurement resource to include in the measurement report.
reportAmount *Number* of measurement reports.
reportOnLeave Indicates whether or not the UE shall initiate the measurement reporting procedure when the leaving condition is met for a CLI measurement resource in *srsTriggeredList* or *rssiTriggeredList*, as specified in 5.5.4.1.
timeToTrigger Time during which specific criteria for the event needs to be met in order to trigger a measurement report.

***CLI-PeriodicalReportConfig* field descriptions**
maxReportCLI Max number of CLI measurement resource to include in the measurement report.
reportAmount *Number* of measurement reports.
reportQuantityCLI The CLI measurement quantities to be included in the measurement report.

***PeriodicalReportConfig* field descriptions**
maxNrofRS-IndexesToReport Max number of RS indexes to include in the measurement report.
maxReportCells Max number of non-serving cells to include in the measurement report.
reportAddNeighMeas Indicates that the UE shall include the best neighbour cells per serving frequency.
reportAmount *Number* of measurement reports applicable for *eventTriggered* as well as for *periodical* report types
reportQuantityCell The cell measurement quantities to be included in the measurement report.
reportQuantityRS-Indexes Indicates which measurement information per RS index the UE shall include in the measurement report.
useWhiteCellList Indicates whether only the cells included in the white-list of the associated measObject are applicable as specified in 5.5.4.1.

***ReportSFTD-NR* field descriptions**
cellForWhichToReportSFTD Indicates the target NR neighbour cells for SFTD measurement between PCell and NR neighbour cells.
drx-SFTD-NeighMeas 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 *drx-SFTD-NeighMeas* field when *reprtSFTD-NeighMeas* is set to true.
reportSFTD-Meas Indicates whether UE is required to perform SFTD measurement between PCell and NR PSCell in NR-DC.
reportSFTD-NeighMeas 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 *reportSFTD-Meas* is set to *true*.
reportRSRP 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 *ssb-ConfigMobility* is included in the measurement object for NR PSCell or NR neighbour cells.

other field descriptions
MeasTriggerQuantity 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
```

***ReportConfigNR-SL* field descriptions**
reportType Type of the configured CBR measurement report for NR sidelink communication.

***EventTriggerConfig* field descriptions**
cN-Threshold Threshold used for events C1 and C2 specified in subclauses 5.5.4.11 and 5.5.4.12, respectively.
eventId Choice of NR event triggered reporting criteria.
reportAmoun Number of measurement reports applicable for *eventTriggered* as well as for *periodical* report types.
reportQuantity The sidelink measurement quantities to be included in the measurement report. In this release, this is set as the CBR measurement result.
timeToTrigger Time during which specific criteria for the event needs to be met in order to trigger a measurement report.
SL-CBR Value 0 corresponds to 0, value 1 to 0.01, value 2 to 0.02, and so on.

***PeriodicalReportConfigNR-SL* field descriptions**
reportAmount Number of measurement reports applicable for *eventTriggered* as well as for *periodical* report types.
reportQuantity 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 ::=                SEQUENCE {
    logicalChannelIdentity              LogicalChannelIdentity,
    servedRadioBearer                   CHOICE {
        srb-Identity                        SRB-Identity,
        drb-Identity                        DRB-Identity
    }                                                                   OPTIONAL,   -- Cond LCH-SetupOnly
    reestablishRLC                      ENUMERATED {true}               OPTIONAL,   -- Need N
    rlc-Config                          RLC-Config                      OPTIONAL,   -- Cond LCH-Setup
    mac-LogicalChannelConfig            LogicalChannelConfig            OPTIONAL,   -- Cond LCH-Setup
    ...,
    [[
    rlc-Config-v1610                    RLC-Config-v1610                OPTIONAL    -- Need R
    ]]
}

-- TAG-RLC-BEARERCONFIG-STOP
-- ASN1STOP
```

***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
LCH-Setup	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.
LCH-SetupOnly	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                           UL-AM-RLC,
        dl-AM-RLC                           DL-AM-RLC
    },
    um-Bi-Directional                   SEQUENCE {
        ul-UM-RLC                           UL-UM-RLC,
        dl-UM-RLC                           DL-UM-RLC
    },
    um-Uni-Directional-UL               SEQUENCE {
        ul-UM-RLC                           UL-UM-RLC
    },
    um-Uni-Directional-DL               SEQUENCE {
        dl-UM-RLC                           DL-UM-RLC
    },
    ...
}

UL-AM-RLC ::=                       SEQUENCE {
    sn-FieldLength                      SN-FieldLengthAM                                    OPTIONAL,   -- Cond Reestab
    t-PollRetransmit                    T-PollRetransmit,
    pollPDU                             PollPDU,
    pollByte                            PollByte,
    maxRetxThreshold                    ENUMERATED { t1, t2, t3, t4, t6, t8, t16, t32 }
}

DL-AM-RLC ::=                       SEQUENCE {
    sn-FieldLength                      SN-FieldLengthAM                                    OPTIONAL,   -- Cond Reestab
    t-Reassembly                        T-Reassembly,
    t-StatusProhibit                    T-StatusProhibit
}

UL-UM-RLC ::=                       SEQUENCE {
    sn-FieldLength                      SN-FieldLengthUM                                    OPTIONAL    -- Cond Reestab
}
```

```
DL-UM-RLC ::=                   SEQUENCE {
    sn-FieldLength                  SN-FieldLengthUM                                OPTIONAL,   -- Cond Reestab
    t-Reassembly                    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, ms1-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**
maxRetxThreshold Parameter for RLC AM in TS 38.322 [4]. Value *t1* corresponds to 1 retransmission, value *t2* corresponds to 2 retransmissions and so on.
pollByte Parameter for RLC AM in TS 38.322 [4]. Value *kB25* corresponds to 25 kBytes, value *kB50* corresponds to 50 kBytes and so on. *infinity* corresponds to an infinite amount of kBytes.
pollPDU Parameter for RLC AM in TS 38.322 [4]. Value *p4* corresponds to 4 PDUs, value *p8* corresponds to 8 PDUs and so on. *infinity* corresponds to an infinite number of PDUs.
sn-FieldLength Indicates the RLC SN field size, see TS 38.322 [4], in bits. Value *size6* means 6 bits, value *size12* means 12 bits, value *size18* means 18 bits. The value of *sn-FieldLength* for a DRB shall be changed only using reconfiguration with sync. The network configures only value *size12* in *SN-FieldLengthAM* for SRB.
t-PollRetransmit Timer for RLC AM in TS 38.322 [4], in milliseconds. Value *ms5* means 5 ms, value *ms10* means 10 ms and so on.
t-Reassembly Timer for reassembly in TS 38.322 [4], in milliseconds. Value *ms0* means 0 ms, value *ms5* means 5 ms and so on.
t-StatusProhibit Timer for status reporting in TS 38.322 [4], in milliseconds. Value *ms0* means 0 ms, value *ms5* means 5 ms and so on. If *t-StatusProhibit-v1610* is present, the UE shall ignore *t-StatusProhibit* (without suffix).

Conditional Presence	Explanation
Reestab	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-SCELLINDEX-START

SCellIndex ::=                      INTEGER (1..31)

-- TAG-SCELLINDEX-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.

***SchedulingRequestToAddMod* field descriptions**
schedulingRequestId Used to modify a SR configuration and to indicate, in *LogicalChannelConfig*, the SR configuration to which a logical channel is mapped and to indicate, in *SchedulingRequestresourceConfig*, the SR configuration for which a scheduling request resource is used.
sr-ProhibitTimer Timer for SR transmission on PUCCH in TS 38.321 [3]. Value is in ms. Value *ms1* corresponds to 1ms, value *ms2* corresponds to 2ms, and so on. When the field is absent, the UE applies the value 0.
sr-TransMax Maximum number of SR transmissions as described in TS 38.321 [3]. Value *n4* corresponds to 4, value *n8* corresponds to 8, and so on.

– *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,
        sl1                                     NULL,                       -- Recurs in every slot
        sl2                                     INTEGER (0..1),
        sl4                                     INTEGER (0..3),
        sl5                                     INTEGER (0..4),
        sl8                                     INTEGER (0..7),
        sl10                                    INTEGER (0..9),
```

```
        sl16                                INTEGER (0..15),
        sl20                                INTEGER (0..19),
        sl40                                INTEGER (0..39),
        sl80                                INTEGER (0..79),
        sl160                               INTEGER (0..159),
        sl320                               INTEGER (0..319),
        sl640                               INTEGER (0..639)
    }                                                                   OPTIONAL,   -- Need M
    resource                            PUCCH-ResourceId                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
```

***SCS-SpecificCarrier* field descriptions**
carrierBandwidth Width of this carrier in number of PRBs (using the *subcarrierSpacing* defined for this carrier) (see TS 38.211 [16], clause 4.4.2).
offsetToCarrier 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 subcarrierSpacing defined for this carrier). The maximum value corresponds to 275*8-1. See TS 38.211 [16], clause 4.4.2.
txDirectCurrentLocation 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 *ServingCellConfigCommon* and *ServingCellConfigCommonSIB*, 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 *ServingCellConfig* or for uplink carriers.
subcarrierSpacing Subcarrier spacing of this carrier. It is used to convert the offsetToCarrier into an actual frequency. Only the values 15 kHz, 30 kHz or 60 kHz (FR1), and 60 kHz or 120 kHz (FR2) are applicable.

– *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 ::=                 SEQUENCE {
    pdu-Session                     PDU-SessionID,
    sdap-HeaderDL                   ENUMERATED {present, absent},
    sdap-HeaderUL                   ENUMERATED {present, absent},
    defaultDRB                      BOOLEAN,
    mappedQoS-FlowsToAdd            SEQUENCE (SIZE (1..maxNrofQFIs)) OF QFI                 OPTIONAL, -- Need N
    mappedQoS-FlowsToRelease        SEQUENCE (SIZE (1..maxNrofQFIs)) OF QFI                 OPTIONAL, -- Need N
    ...
}

QFI ::=                         INTEGER (0..maxQFI)

PDU-SessionID ::=               INTEGER (0..255)

-- TAG-SDAP-CONFIG-STOP
-- ASN1STOP
```

***SDAP-Config* field descriptions**
defaultDRB Indicates whether or not this is the default DRB for this PDU session. Among all configured instances of *SDAP-Config* with the same value of *pdu-Session*, this field shall be set to *true* in at most one instance of SDAP-Config and to *false* in all other instances.
mappedQoS-FlowsToAdd 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 *SDAP-Config* with the same value of *pdu-Session*. For QoS flow remapping, the QFI value of the remapped QoS flow is only included in *mappedQoS-FlowsToAdd* in *sdap-Config* corresponding to the new DRB and not included in *mappedQoS-FlowsToRelease* in *sdap-Config* corresponding to the old DRB.
mappedQoS-FlowsToRelease 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.
pdu-Session Identity of the PDU session whose QoS flows are mapped to the DRB.
sdap-HeaderUL 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 *present* if the field *defaultDRB* is set to *true*.
sdap-HeaderDL 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.

– *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.

***SearchSpace* information element**

```
-- ASN1START
-- TAG-SEARCHSPACE-START

SearchSpace ::=                         SEQUENCE {
    searchSpaceId                           SearchSpaceId,
    controlResourceSetId                    ControlResourceSetId                                    OPTIONAL,   -- Cond SetupOnly
    monitoringSlotPperiodicityAndOffset     CHOICE {
        sl1                                     NULL,
        sl2                                     INTEGER (0..1),
        sl4                                     INTEGER (0..3),
        sl5                                     INTEGER (0..4),
        sl8                                     INTEGER (0..7),
        sl10                                    INTEGER (0..9),
        sl16                                    INTEGER (0..15),
        sl20                                    INTEGER (0..19),
        sl40                                    INTEGER (0..39),
        sl80                                    INTEGER (0..79),
        sl160                                   INTEGER (0..159),
        sl320                                   INTEGER (0..319),
        sl640                                   INTEGER (0..639),
        sl1280                                  INTEGER (0..1279),
        sl2560                                  INTEGER (0..2559)
    }                                                                                               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 {sl1, sl2, sl4, sl5, sl8, sl10, sl16, sl20}  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 {
```

```
            dci-Format2-4-r16                   SEQUENCE {
                nrofCandidates-CI-r16               SEQUENCE {
                    aggregationLevel1-r16               ENUMERATED {n1, n2}             OPTIONAL,   -- Need R
                    aggregationLevel2-r16               ENUMERATED {n1, n2}             OPTIONAL,   -- Need R
                    aggregationLevel4-r16               ENUMERATED {n1, n2}             OPTIONAL,   -- Need R
                    aggregationLevel8-r16               ENUMERATED {n1, n2}             OPTIONAL,   -- Need R
                    aggregationLevel16-r16              ENUMERATED {n1, n2}             OPTIONAL    -- Need R
                },
                ...
            }                                                                           OPTIONAL,   -- Need R
            dci-Format2-5-r16                   SEQUENCE {
                nrofCandidates-IAB-r16              SEQUENCE {
                    aggregationLevel1-r16               ENUMERATED {n1, n2}             OPTIONAL,   -- Need R
                    aggregationLevel2-r16               ENUMERATED {n1, n2}             OPTIONAL,   -- Need R
                    aggregationLevel4-r16               ENUMERATED {n1, n2}             OPTIONAL,   -- Need R
                    aggregationLevel8-r16               ENUMERATED {n1, n2}             OPTIONAL,   -- Need R
                    aggregationLevel16-r16              ENUMERATED {n1, n2}             OPTIONAL    -- Need R
                },
                ...
            }                                                                           OPTIONAL,   -- Need R
            dci-Format2-6-r16                   SEQUENCE {
                ...
            }                                                                           OPTIONAL,   -- Need R
            ...
        }
    }                                                                                   OPTIONAL,    -- Cond Setup3
    searchSpaceGroupIdList-r16              SEQUENCE (SIZE (1.. 2)) OF INTEGER (0..1)   OPTIONAL,    -- Need R
    freqMonitorLocations-r16                BIT STRING (SIZE (5))                       OPTIONAL     -- Need R
}

-- TAG-SEARCHSPACE-STOP
-- ASN1STOP
```

***SearchSpace* field descriptions**
common Configures this search space as common search space (CSS) and DCI formats to monitor.
controlResourceSetId The CORESET applicable for this SearchSpace. Value 0 identifies the common CORESET#0 configured in MIB and in *ServingCellConfigCommon*. Values 1..*maxNrofControlResourceSets-1* identify CORESETs configured in System Information or by dedicated signalling. The CORESETs with *non-zero controlResourceSetId* are configured in the same BWP as this *SearchSpace*. If the field *controlResourceSetId-r16* is present, UE shall ignore the *controlResourceSetId* (without suffix).
dummy1, dummy2 This field is not used in the specification. If received it shall be ignored by the UE.
dci-Format0-0-AndFormat1-0 If configured, the UE monitors the DCI formats 0_0 and 1_0 according to TS 38.213 [13], clause 10.1.
dci-Format2-0 If configured, UE monitors the DCI format 2_0 according to TS 38.213 [13], clause 10.1, 11.1.1.
dci-Format2-1 If configured, UE monitors the DCI format 2_1 according to TS 38.213 [13], clause 10.1, 11.2.
dci-Format2-2 If configured, UE monitors the DCI format 2_2 according to TS 38.213 [13], clause 10.1, 11.3.
dci-Format2-3 If configured, UE monitors the DCI format 2_3 according to TS 38.213 [13], clause 10.1, 11.4
dci-Format2-4 If configured, UE monitors the DCI format 2_4 according to TS 38.213 [13], clause 11.2A.
dci-Format2-5 If configured, IAB-MT monitors the DCI format 2_5 according to TS 38.213 [13], clause 14.
dci-Format2-6 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.
dci-Formats Indicates whether the UE monitors in this USS for DCI formats 0-0 and 1-0 or for formats 0-1 and 1-1.
dci-FormatsExt If this field is present, the field *dci-Formats* is ignored and *dci-FormatsExt* 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).
dci-Formats-MT Indicates whether the IAB-MT monitors the DCI formats 2-5 according to TS 38.213 [13], clause 14.
dci-FormatsSL 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.
duration Number of consecutive slots that a SearchSpace lasts in every occasion, i.e., upon every period as given in the *periodicityAndOffset*. 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 periodicity-1 (periodicity as given in the *monitoringSlotPeriodicityAndOffset*). 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 *periodicityAndOffset*. 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 UE ignores this field for DCI format 2_0 and DCI format 2_5. The maximum valid duration is periodicity-1 (periodicity as given in the *monitoringSlotPeriodicityAndOffset*).
freqMonitorLocations 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 + *rb-Offset* provided by the associated CORESET.

monitoringSlotPeriodicityAndOffset 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). 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). If the UE is configured to monitor DCI format 2_4, only the values 'sl1', 'sl2', 'sl4', 'sl5', 'sl8' and 'sl10' are applicable.
monitoringSymbolsWithinSlot The first symbol(s) for PDCCH monitoring in the slots configured for PDCCH monitoring (see *monitoringSlotPeriodicityAndOffset* and *duration*). 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 . For DCI format 2_0, the first one symbol applies if the *duration* of CORESET (in the IE *ControlResourceSet*) identified by *controlResourceSetId* indicates 3 symbols, the first two symbols apply if the *duration* of CORESET identified by *controlResourceSetId* indicates 2 symbols, and the first three symbols apply if the *duration* of CORESET identified by *controlResourceSetId* indicates 1 symbol. See TS 38.213 [13], clause 10.
nrofCandidates-CI 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).
nrofCandidates-SFI 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).
nrofCandidates 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 *searchSpaceType*). If configured in the *SearchSpace* 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).
searchSpaceGroupIdList 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.
searchSpaceId Identity of the search space. SearchSpaceId = 0 identifies the *searchSpaceZero* configured via PBCH (MIB) or *ServingCellConfigCommon* and may hence not be used in the *SearchSpace* IE. The *searchSpaceId* is unique among the BWPs of a Serving Cell. In case of cross carrier scheduling, search spaces with the same *searchSpaceId* 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 ControlResearchSet. For a scheduled cell in the case of cross carrier scheduling, except for nrofCandidates, all the optional fields are absent.
searchSpaceType Indicates whether this is a common search space (present) or a UE specific search space as well as DCI formats to monitor for.
ue-Specific 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)

Conditional Presence	Explanation
Setup	This field is mandatory present upon creation of a new *SearchSpace*. It is optionally present, Need M, otherwise.
Setup2	This field is mandatory present when a new *SearchSpace* is set up, if the same *SearchSpace* ID is not included in *searchSpacesToAddModListExt-r16* of the parent IE with the field *searchSpaceType-r16* included. Otherwise it is optionally present, Need M.
Setup3	This field is mandatory present when a new *SearchSpace* is set up, if the same *SearchSpace* ID is not included in *searchSpacesToAddModListExt* (without suffix) of the parent IE with the field *searchSpaceType* (without suffix) included. Otherwise it is optionally present, Need M.
SetupOnly	This field is mandatory present upon creation of a new *SearchSpace*. It is absent, Need M, otherwise.
SetupOnly2	In PDCCH-Config, the field is optionally present upon creation of a new SearchSpace and absent, Need M upon reconfiguration of an existing SearchSpace. 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 accces 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
```

***SemiStaticChannelAccessConfig* field descriptions**
period 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.

– *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
```

***Sensor-LocationInfo* field descriptions**
sensor-MeasurementInformation This field provides barometric pressure measurements as *Sensor-MeasurementInformation* defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.
sensor-MotionInformation This field provides motion sensor measurements as *Sensor-MotionInformation* defined in TS 37.355 [49]. The first/leftmost bit of the first octet contains the most significant bit.

– *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
    pdcch-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)
    }                                                                                                       OPTIONAL,   -- Cond AsyncCA
    channelAccessConfig-r16             SetupRelease { ChannelAccessConfig-r16 }                            OPTIONAL,   -- Need M
    intraCellGuardBandsUL-r16           IntraCellGuardBands-r16                                             OPTIONAL,   -- Need S
    intraCellGuardBandsDL-r16           IntraCellGuardBands-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
    enableTwoDefaultTCIStates-r16       ENUMERATED {enabled}                                                OPTIONAL,   -- Need R
    enableDefaultTCIStatePerCoresetPoolIndex-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
    ]],
    [[
    enablePLRS-UpdateForPUSCH-SRS-r16   ENUMERATED {enabled}                                                OPTIONAL,   -- Need R
    enableDefaultBeamPL-ForPUSCH0-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
    ]]
}

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
}
```

```
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
```

***ServingCellConfig* field descriptions**
absenceOfAnyOtherTechnology 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.
bwp-InactivityTimer 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.
ca-SlotOffset 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 *SCS-SpecificCarrierList* in *ServingCellConfig* and this serving cell's lowest SCS among all the configured SCSs in DL/UL *SCS-SpecificCarrierList* in *ServingCellConfig*). 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.
cbg-TxDiffTBsProcessingType1, cbg-TxDiffTBsProcessingType2 Indicates whether processing types 1 and 2 based CBG based operation is enabled according to Rel-16 UE capabilities.
channelAccessConfig List of parameters used for access procedures of operation with shared spectrum channel access (see TS 37.213 [48).
crossCarrierSchedulingConfig Indicates whether this serving cell is cross-carrier scheduled by another serving cell or whether it cross-carrier schedules another serving cell.
csi-RS-ValidationWith-DCI Determines how the UE performs periodic and semi-persistent CSI-RS reception in a slot if the UE does not detect a DCI format indicating aperiodic CSI-RS or PDSCH in the set of symbols (see TS 38.213 [13], clause 11.1).
crs-RateMatch-PerCORESETPoolIndex 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.
defaultDownlinkBWP-Id 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).
dormantBWP-Config The dormant BWP configuration for an SCell. This field can be included only for a (non-PUCCH) SCell.
downlinkBWP-ToAddModList List of additional downlink bandwidth parts to be added or modified. (see TS 38.213 [13], clause 12).
downlinkBWP-ToReleaseList List of additional downlink bandwidth parts to be released. (see TS 38.213 [13], clause 12).
downlinkChannelBW-PerSCS-List 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 *scs-SpecificCarrierList* in *DownlinkConfigCommon* / *DownlinkConfigCommonSIB*. 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].
enableBeamSwitchTiming 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].
enableDefaultTCIStatePerCoresetPoolIndex 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.

enableTwoDefaultTCIStates 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
energyDetectionThresholdOffset 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].
firstActiveDownlinkBWP-Id 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 *firstActiveDownlinkBWP-Id* and *firstActiveUplinkBWP-Id* to the same value.
initialDownlinkBWP 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
intraCellGuardBandsDL, intraCellGuardBandsUL List of intra-cell guard bands in a serving cell. For each entry in the list, *startCRB* indicates the starting RB of the guard band and *nrofCRBs* indicates the length of the guard band in RBs. For *intraCellGuardBandsUL,* when *nrofCRBs* is 0, zero-size or no guard band is used. If not configured, the guard bands are defined according the TS 38.104 [12] and 38.101-1 [15].
lte-CRS-PatternList 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 *lte-CRS-ToMatchAround* simultaneously.
lte-CRS-PatternList2 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 lte-CRS-PatternList, The second LTE CRS pattern in this list shall be fully overlapping in frequency with the second LTE CRS pattern in lte-CRS-PatternList, and so on. Network configures this field only if the field *lte-CRS-ToMatchAround* is not configured and there is at least one ControlResourceSet in one DL BWP of this serving cell with *coresetPoolIndex* set to 1.
lte-CRS-ToMatchAround Parameters to determine an LTE CRS pattern that the UE shall rate match around.
maxEnergyDetectionThreshold 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].
pathlossReferenceLinking 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).
pdsch-ServingCellConfig PDSCH related parameters that are not BWP-specific.
rateMatchPatternToAddModList 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.
sCellDeactivationTimer SCell deactivation timer in TS 38.321 [3]. If the field is absent, the UE applies the value infinity.

servingCellMO *measObjectId* of the *MeasObjectNR* in *MeasConfig* which is associated to the serving cell. For this *MeasObjectNR*, the following relationship applies between this MeasObjectNR and *frequencyInfoDL* in *ServingCellConfigCommon* of the serving cell: if *ssbFrequency* is configured, its value is the same as the *absoluteFrequencySSB* and if *csi-rs-ResourceConfigMobility* is configured, the value of its *subcarrierSpacing* is present in one entry of the *scs-SpecificCarrierList*, *csi-RS-CellListMobility* includes an entry corresponding to the serving cell (with *cellId* equal to *physCellId* in *ServingCellConfigCommon*) and the frequency range indicated by the *csi-rs-MeasurementBW* of the entry in *csi-RS-CellListMobility* is included in the frequency range indicated by in the entry of the *scs-SpecificCarrierList*.
supplementaryUplink Network may configure this field only when *supplementaryUplinkConfig* is configured in *ServingCellConfigCommon* or *ServingCellConfigCommonSIB*.
supplementaryUplinkRelease If this field is included, the UE shall release the uplink configuration configured by *supplementaryUplink*. The network only includes either *supplementaryUplinkRelease* or *supplementaryUplink* at a time.
tag-Id Timing Advance Group ID, as specified in TS 38.321 [3], which this cell belongs to.
tdd-UL-DL-ConfigurationDedicated-iab-mt 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 *TDD-UL-DL ConfigurationCommon*.
ul-toDL-COT-SharingED-Threshold Maximum energy detection threshold that the UE should use to share channel occupancy with gNB for DL transmission with length no longer than 2, 4, and 8 OFDM symbols for 15Khz, 30Khz, 60KHz SCS respectively, as specified in TS 37.213 [48].
uplinkConfig Network may configure this field only when *uplinkConfigCommon* is configured in *ServingCellConfigCommon* or *ServingCellConfigCommonSIB*. Addition or release of this field can only be done upon SCell addition or release (respectively).

***UplinkConfig* field descriptions**
carrierSwitching Includes parameters for configuration of carrier based SRS switching (see TS 38.214 [19], clause 6.2.1.3.
enableDefaultBeamPlForPUSCH0_0, enableDefaultBeamPlForPUCCH, enableDefaultBeamPlForSRS 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 9.2.2The network only configures these parameters for FR2.
enablePLRSupdateForPUSCHSRS 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 *sri-PUSCH-PowerControl*.
firstActiveUplinkBWP-Id 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 BandiwdthPartId = 0.
initialUplinkBWP 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 *uplinkConfig*, 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
powerBoostPi2BPSK If this field is set to *true*, 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.
pusch-ServingCellConfig PUSCH related parameters that are not BWP-specific.
uplinkBWP-ToAddModList The additional bandwidth parts for uplink to be added or modified. In case of TDD uplink- and downlink BWP with the same *bandwidthPartId* are considered as a BWP pair and must have the same center frequency.
uplinkBWP-ToReleaseList The additional bandwidth parts for uplink to be released.
uplinkChannelBW-PerSCS-List 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 *scs-SpecificCarrierList* in *UplinkConfigCommon* / *UplinkConfigCommonSIB*. 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].
uplinkTxSwitchingPeriodLocation Indicates whether the location of UL Tx switching period is configured in this uplink carrier in case of inter-band UL CA, SUL, or 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 EN-DC, network always configures this field to TRUE for NR carrier (i.e. with EN-DC, the UL switching period always occurs on the NR carrier).
uplinkTxSwitchingCarrier 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 EN-DC, network always configures the NR carrier as carrier 2.

***DormantBWP-Config* field descriptions**
dormancyGroupWithinActiveTime 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].
dormancyGroupOutsideActiveTime 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].
dormantBWP-Id 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 *defaultDownlinkBWP-Id*, and at least one of the *withinActiveTimeConfig* and *outsideActiveTimeConfig* should be configured.
firstOutsideActiveTimeBWP-Id This field contains the ID of the downlink bandwidth part to be activated when receiving a DCI indication for SCell dormancy outside active time.
firstWithinActiveTimeBWP-Id This field contains the ID of the downlink bandwidth part to be activated when receiving a DCI indication for SCell dormancy within active time.
outsideActiveTimeConfig 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 present when the cell group the SCell belongs to is configured with *dcp-Config*.
withinActiveTimeConfig This field contains the configuration to be used for SCell dormancy within active time, as specified in TS 38.213 [13].

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
AsyncCA	This field is mandatory present for SCells whose slot offset between the SpCell is not 0. Otherwise it is absent, Need S.
MeasObject	This field is mandatory present for the SpCell if the UE has a *measConfig*, and it is optionally present, Need M, for SCells.
SCellOnly	This field is optionally present, Need R, for SCells. It is absent otherwise.
ServingCellWithoutPUCCH	This field is optionally present, Need S, for SCells except PUCCH SCells. It is absent otherwise.
SyncAndCellAdd	This field is mandatory present for a SpCell upon PCell change and PSCell addition/change and upon *RRCSetup*/*RRCResume*. The field is mandatory present for an SCell upon addition. For SpCell, the field is optionally present, Need N, upon reconfiguration without *reconfigurationWithSync*. In all other cases the field is absent.
TDD	This field is optionally present, Need R, for TDD cells. It is absent otherwise.
TDD_IAB	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))
    }                                                                                               OPTIONAL, -- Cond AbsFreqSSB
    ssb-periodicityServingCell          ENUMERATED { ms5, ms10, ms20, ms40, ms80, ms160, spare2, spare1 }   OPTIONAL, -- Need S
    dmrs-TypeA-Position                 ENUMERATED {pos2, pos3},
    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
    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                             NULL,
        semiStatic                          SemiStaticChannelAccessConfig
    }                                                                                               OPTIONAL, -- Cond SharedSpectrum
    discoveryBurstWindowLength-r16          ENUMERATED {ms0dot5, ms1, ms2, ms3, ms4, ms5}           OPTIONAL, -- Need M
    ssb-PositionQCL-r16                     SSB-PositionQCL-Relation-r16                            OPTIONAL, -- Cond SharedSpectrum
    highSpeedConfig-r16                     HighSpeedConfig-r16                                     OPTIONAL  -- Need R
    ]]
}

-- TAG-SERVINGCELLCONFIGCOMMON-STOP
-- ASN1STOP
```

***ServingCellConfigCommon* field descriptions**
channelAccessMode 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.
dmrs-TypeA-Position 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).
downlinkConfigCommon 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 *controlResourceSetZero* and *searchSpaceZero* which can be configured in *ServingCellConfigCommon* even if MIB indicates that they are absent.
discoveryBurstWindowLength Indicates the window length of the discovery burst in ms (see TS 37.213 [48]).
longBitmap Bitmap when maximum number of SS/PBCH blocks per half frame equals to 64 as defined in TS 38.213 [13], clause 4.1.
lte-CRS-ToMatchAround Parameters to determine an LTE CRS pattern that the UE shall rate match around.
mediumBitmap Bitmap when maximum number of SS/PBCH blocks per half frame equals to 8 as defined in TS 38.213 [13], clause 4.1.
n-TimingAdvanceOffset 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.
rateMatchPatternToAddModList 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).
semiStaticChannelAccessConfig The parameters for semi-static channel access.
shortBitmap Bitmap when maximum number of SS/PBCH blocks per half frame equals to 4 as defined in TS 38.213 [13], clause 4.1.
ss-PBCH-BlockPower 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.
ssb-periodicityServingCell 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)
ssb-PositionQCL Indicates the QCL relationship between SSB positions for this serving cell as specified in TS 38.213 [13], clause 4.1.
ssb-PositionsInBurst 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 ServingCellConfigCommonSIB. For operation with shared spectrum channel access, only *mediumBitmap* is used and the UE assumes that one or more SS/PBCH blocks indicated by *ssb-PositionsInBurst* may be transmitted within the discovery burst transmission window and have candidate SS/PBCH blocks indexes corresponding to SS/PBCH block indexes provided by *ssb-PositionsInBurst* (see TS 38.213 [13], clause 4.1). If the k-th bit of *ssb-PositionsInBurst* 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 *ssb-PositionQCL* is configured, the UE expects that the k-th bit is set to 0, where k > *ssb-PositionQCL* 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 *ServingCellConfigCommonSIB*.

ssbSubcarrierSpacing Subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable.
supplementaryUplinkConfig The network configures this field only if *uplinkConfigCommon* is configured. If this field is absent, the UE shall release the *supplementaryUplinkConfig* and the *supplementaryUplink* configured in *ServingCellConfig* of this serving cell, if configured.
tdd-UL-DL-ConfigurationCommon A cell-specific TDD UL/DL configuration, see TS 38.213 [13], clause 11.1.

Conditional Presence	Explanation
AbsFreqSSB	The field is absent when *absoluteFrequencySSB* in frequencyInfoDL is absent, otherwise the field is mandatory present.
HOAndServCellAdd	This field is mandatory present upon SpCell change and upon serving cell (PSCell/SCell) addition. Otherwise, the field is absent.
HOAndServCellWithSSB	This field is mandatory present upon SpCell change and upon serving cell (SCell with SSB or PSCell) addition. Otherwise, the field is absent.
SharedSpectrum	This field is mandatory present if this cell operates with shared spectrum channel access. Otherwise, it is absent, Need R.
TDD	The field is optionally present, Need R, for TDD cells; otherwise it is absent.

– *ServingCellConfigCommonSIB*

The IE *ServingCellConfigCommonSIB* is used to configure cell specific parameters of a UE's serving cell in SIB1.

ServingCellConfigCommonSIB information element

```
-- ASN1START
-- TAG-SERVINGCELLCONFIGCOMMONSIB-START

ServingCellConfigCommonSIB ::=      SEQUENCE {
    downlinkConfigCommon                DownlinkConfigCommonSIB,
    uplinkConfigCommon                  UplinkConfigCommonSIB                                   OPTIONAL, -- Need R
    supplementaryUplink                 UplinkConfigCommonSIB                                   OPTIONAL, -- Need R
    n-TimingAdvanceOffset               ENUMERATED { n0, n25600, n39936 }                       OPTIONAL, -- Need S
    ssb-PositionsInBurst                SEQUENCE {
        inOneGroup                          BIT STRING (SIZE (8)),
        groupPresence                       BIT STRING (SIZE (8))                               OPTIONAL  -- Cond FR2-Only
    },
    ssb-PeriodicityServingCell          ENUMERATED {ms5, ms10, ms20, ms40, ms80, ms160},
    tdd-UL-DL-ConfigurationCommon       TDD-UL-DL-ConfigCommon                                  OPTIONAL, -- Cond TDD
    ss-PBCH-BlockPower                  INTEGER (-60..50),
    ...,
    [[
    channelAccessMode-r16               CHOICE {
        dynamic                             NULL,
        semiStatic                          SemiStaticChannelAccessConfig
    }                                                                                           OPTIONAL, -- Cond SharedSpectrum
    discoveryBurstWindowLength-r16      ENUMERATED {ms0dot5, ms1, ms2, ms3, ms4, ms5}           OPTIONAL, -- Need R
    highSpeedConfig-r16                 HighSpeedConfig-r16                                     OPTIONAL  -- Need R
    ]]
```

```
}

-- TAG-SERVINGCELLCONFIGCOMMONSIB-STOP
-- ASN1STOP
```

***ServingCellConfigCommonSIB* field descriptions**
channelAccessMode 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"t, the UE shall apply the channel access procedures in TS 37.213, with the exception of subclause 4.3 of TS 37.213.
discoveryBurstWindowLength Indicates the window length of the discovery burst in ms (see TS 37.213 [48]).
groupPresence 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 *inOneGroup* are absent. Value 1 indicates that the SS/PBCH blocks are transmitted in accordance with *inOneGroup*.
inOneGroup 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.
n-TimingAdvanceOffset 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.
semiStaticChannelAccessConfig The parameters for semi-static channel access.
ssb-PositionsInBurst 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 *mediumBitmap* is used. The UE assumes that a bit at position k > N_{SSB}^{QCL} is 0, where N_{SSB}^{QCL} is obtained from *MIB* as specified in TS 38.213 [13], clause 4.1. For operation with shared spectrum channel access, only *inOneGroup* is used and the UE interprets this field same as *mediumBitmap* in *ServingCellConfigCommon*.
ss-PBCH-BlockPower 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
FR2-Only	This field is mandatory present for an FR2 carrier frequency. It is absent otherwise and UE releases any configured value.
SharedSpectrum	This field is mandatory present if this cell operates with shared spectrum channel access. Otherwise, it is absent, Need R.
TDD	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-RequestConfi information element

```
-- ASN1START
-- TAG-SI-REQUESTCONFIG-START

SI-RequestConfig::=                 SEQUENCE {
    rach-OccasionsSI                    SEQUENCE {
        rach-ConfigSI                       RACH-ConfigGeneric,
        ssb-perRACH-Occasion                ENUMERATED {oneEighth, oneFourth, oneHalf, one, two, four, eight, sixteen}
    }                                                                                       OPTIONAL,   -- Need R
    si-RequestPeriod                    ENUMERATED {one, two, four, six, eight, ten, twelve, sixteen}       OPTIONAL,   -- Need R
    si-RequestResources                 SEQUENCE (SIZE (1..maxSI-Message)) OF SI-RequestResources
}

SI-RequestResources ::=             SEQUENCE {
    ra-PreambleStartIndex               INTEGER (0..63),
    ra-AssociationPeriodIndex           INTEGER (0..15)                                     OPTIONAL,   -- Need R
    ra-ssb-OccasionMaskIndex            INTEGER (0..15)                                     OPTIONAL    -- Need R
}

-- ASN1STOP
-- TAG-SI-REQUESTCONFIG-STOP
```

SI-RequestConfig field descriptions
rach-OccasionsSI Configuration of dedicated RACH Occassions 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 1st entry in the list corresponds to the first SI message in *schedulingInfoList* for which *si-BroadcastStatus* is set to *notBroadcasting*, 2nd 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 ::=               SEQUENCE {
    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 ::=                  SEQUENCE {
    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 ::=                    SEQUENCE {
    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-BroadcastStat*us 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 > = 1, for the i-th SSB (i=0, …, 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.

***SI-SchedulingInfo* field descriptions**
si-RequestConfig Configuration of Msg1 resources that the UE uses for requesting SI-messages for which *si-BroadcastStatus* is set to notBroadcasting.
si-RequestConfigSUL Configuration of Msg1 resources that the UE uses for requesting SI-messages for which *si-BroadcastStatus* is set to notBroadcasting.
si-WindowLength The length of the SI scheduling window. Value *s5* corresponds to 5 slots, value *s10* corresponds to 10 slots and so on. The network always configures *si-WindowLength* to be shorter than or equal to the *si-Periodicity*.
systemInformationAreaID Indicates the system information area that the cell belongs to, if any. Any SIB with *areaScope* within the SI is considered to belong to this *systemInformationAreaID*. The systemInformationAreaID is unique within a PLMN.

Conditional presence	Explanation
MSG-1	The field is optionally present, Need R, if *si-BroadcastStatus* is set to *notBroadcasting* for any SI-message included in *SchedulingInfo*. It is absent otherwise.
SIB-TYPE	The field is mandatory present if the SIB type is different from *SIB6*, *SIB7* or *SIB8*. For *SIB6*, *SIB7* and *SIB8* it is absent.
SUL-MSG-1	The field is optionally present, Need R, if this serving cell is configured with a supplementary uplink and if *si-BroadcastStatus* is set to *notBroadcasting* for any SI-message included in *SchedulingInfo*. 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
```

***SlotFormatCombination* field descriptions**
slotFormatCombinationId This ID is used in the DCI payload to dynamically select this *SlotFormatCombination* (see TS 38.213 [13], clause 11.1.1).
slotFormats 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).

***SlotFormatCombinationsPerCell* field descriptions**
enableConfiguredUL 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).
positionInDCI 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).
servingCellId The ID of the serving cell for which the slotFormatCombinations are applicable.
slotFormatCombinations A list with *SlotFormatCombinations*. Each *SlotFormatCombination* comprises of one or more *SlotFormats* (see TS 38.211 [16], clause 4.3.2). The total number of *slotFormats* in the *slotFormatCombinations* list does not exceed 512.
subcarrierSpacing2 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, *subcarrierSpacing* (SFI-scs) is the reference SCS for non-SUL carrier and *subcarrierSpacing2* (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.
subcarrierSpacing 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).

– *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
    searchSpaceSwitchTriggerToAddModList-r16     SEQUENCE (SIZE(1..4)) OF SearchSpaceSwitchTrigger-r16                    OPTIONAL, -- Need N
    searchSpaceSwitchTriggerToReleaseList-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).
searchSpaceSwitchTriggerToAddModList A list of *SearchSpaceSwitchingTrigger* objects. Each *SearchSpaceSwitchingTrigger* object provides position in DCI of the bit field indicating search space switching flag for a serving cell or, if *CellGroupsForSwitching-r16* is configured, group of serving cells (see TS 38.213 [13], clause 11.5.2).
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).

***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.

***CO-DurationsPerCell* field descriptions**
co-DurationList A list of Channel Occupancy duration in symbols.
positionInDCI 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).
servingCellId The ID of the serving cell for which the configuration is applicable.
subcarrierSpacing Reference subcarrier spacing for the list of Channel Occupancy durations (see TS 38.213 [13], clause 11.1.1).

***SearchSpaceSwitchTrigger* field descriptions**
positionInDCI The position of the bit within DCI payload containing a search space switching flag (see TS 38.213 [13], clause 11.5.2).
servingCellId The ID of the serving cell for which the configuration is applicable or the group of serving cells as indicated by *CellGroupsForSwitching-r16* containing this *servingCellId*.

– *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
```

***S-NSSAI* field descriptions**
sst Indicates the S-NSSAI consisting of Slice/Service Type, see TS 23.003 [21].
sst-SD 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 ::=                  SEQUENCE {
    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
```

***SPS-Config* field descriptions**
harq-CodebookID Indicates the HARQ-ACK codebook index for the corresponding HARQ-ACK codebook for SPS PDSCH and ACK for SPS PDSCH release.
harq-ProcID-Offset Indicates the offset used in deriving the HARQ process IDs, see TS 38.321 [3], clause 5.3.1.
mcs-Table 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].
n1PUCCH-AN HARQ resource for PUCCH for DL SPS. The network configures the resource either as format0 or format1. The actual *PUCCH-Resource* is configured in *PUCCH-Config* and referred to by its ID. See TS 38.213 [13], clause 9.2.3.
nrofHARQ-Processes Number of configured HARQ processes for SPS DL (see TS 38.321 [3], clause 5.8.1).
pdsch-AggregationFactor 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 signalled in PDSCH-Config.
periodicity Periodicity for DL SPS (see TS 38.214 [19] and TS 38.321 [3], clause 5.8.1).
periodicityExt 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 *periodicity* is ignored. The following periodicities are supported depending on the configured subcarrier spacing [slots]: 15 kHz: *periodicityExt*, where *periodicityExt* has a value between 1 and 640. 30 kHz: *periodicityExt*, where *periodicityExt* has a value between 1 and 1280. 60 kHz with normal CP: *periodicityExt*, where *periodicityExt* has a value between 1 and 2560. 60 kHz with ECP: *periodicityExt*, where *periodicityExt* has a value between 1 and 2560. 120 kHz: *periodicityExt*, where *periodicityExt* has a value between 1 and 5120.
sps-ConfigIndex Indicates the index of one of multiple SPS configurations.

Conditional Presence	Explanation
SPS-List	The field is mandatory present when included in *sps-ConfigToAddModList-r16*, 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
    }                                                                                           OPTIONAL,   -- Need M
    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
```

***SRS-CC-SetIndex* field descriptions**
cc-IndexInOneCC-Set 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 *srs-TPC-PDCCH-Group* is set to *typeA.* The network does not configure this field to 3 in this release of specification.
cc-SetIndex 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 *srs-TPC-PDCCH-Group* is set to *typeA.*

***SRS-CarrierSwitching* field descriptions**
monitoringCells 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).
srs-SwitchFromServCellIndex 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).
srs-TPC-PDCCH-Group Network configures the UE with either typeA-SRS-TPC-PDCCH-Group or typeB-SRS-TPC-PDCCH-Group, if any.
typeA 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 *typeA*, and the first entry corresponds to the uplink carrier in which the *SRS-CarrierSwitching* field is configured.
typeB Type B trigger configuration for SRS transmission on a PUSCH-less SCell (see TS 38.213 [13], clause 11.4).

***SRS-TPC-PDCCH-Config* field descriptions**
srs-CC-SetIndexlist A list of pairs of [cc-SetIndex; cc-IndexInOneCC-Set] (see TS 38.212 [17], TS 38.213 [13], clause 7.3.1, 11.4). The network does not configure this field for *typeB*.

– *SRS-Config*

The IE *SRS-Config* is used to configure sounding reference signal transmissions or to configure sounding reference signal measurements for CLI. 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 ::=                          SEQUENCE {
    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-RequestForDCI-Format1-2-r16         INTEGER (1..2)                                                                  OPTIONAL,   -- Need
S
    srs-RequestForDCI-Format0-2-r16         INTEGER (1..2)                                                                  OPTIONAL,   -- Need
S
    srs-ResourceSetToAddModListForDCI-Format0-2-r16 SEQUENCE (SIZE(1..maxNrofSRS-ResourceSets)) OF SRS-ResourceSet          OPTIONAL, -- Need N
    srs-ResourceSetToReleaseListForDCI-Format0-2-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 ::=                     SEQUENCE {
    srs-ResourceSetId                       SRS-ResourceSetId,
    srs-ResourceIdList                      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 ::=          CHOICE {
    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                     SEQUENCE {
        startPosition                       INTEGER (0..5),
        nrofSymbols                         ENUMERATED {n1, n2, n4},
        repetitionFactor                    ENUMERATED {n1, n2, n4}
    },
    freqDomainPosition                  INTEGER (0..67),
    freqDomainShift                     INTEGER (0..268),
    freqHopping                         SEQUENCE {
        c-SRS                               INTEGER (0..63),
        b-SRS                               INTEGER (0..3),
        b-hop                               INTEGER (0..3)
    },
    groupOrSequenceHopping              ENUMERATED { neither, groupHopping, sequenceHopping },
    resourceType                        CHOICE {
        aperiodic                           SEQUENCE {
            ...
        },
        semi-persistent                     SEQUENCE {
            periodicityAndOffset-sp                 SRS-PeriodicityAndOffset,
            ...
        },
        periodic                            SEQUENCE {
            periodicityAndOffset-p                  SRS-PeriodicityAndOffset,
            ...
        }
    },
    sequenceId                          INTEGER (0..1023),
    spatialRelationInfo                 SRS-SpatialRelationInfo                             OPTIONAL,   -- Need R
    ...,
    [[
    resourceMapping-r16                 SEQUENCE {
        startPosition-r16                   INTEGER (0..13),
        nrofSymbols-r16                     ENUMERATED {n1, n2, n4},
        repetitionFactor-r16                ENUMERATED {n1, n2, n4}
    }                                                                                           OPTIONAL    -- Need R
    ]]

}

SRS-PosResource-r16::=              SEQUENCE {
```

```
    srs-PosResourceId-r16                   SRS-PosResourceId-r16,
    transmissionComb-r16                    CHOICE {
        n2-r16                                  SEQUENCE {
            combOffset-n2-r16                       INTEGER (0..1),
            cyclicShift-n2-r16                      INTEGER (0..7)
        },
        n4-r16                                  SEQUENCE {
            combOffset-n4-16                        INTEGER (0..3),
            cyclicShift-n4-r16                      INTEGER (0..11)
        },
        n8-r16                                  SEQUENCE {
            combOffset-n8-r16                       INTEGER (0..7),
            cyclicShift-n8-r16                      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             SRS-PeriodicityAndOffset-r16,
            ...
        },
        periodic-r16                            SEQUENCE {
            periodicityAndOffset-p-r16              SRS-PeriodicityAndOffset-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
                },
                uplinkBWP-r16                           BWP-Id
            }
        }
    },
    ssb-Ncell-r16                           SSB-InfoNcell-r16,
    dl-PRS-r16                              DL-PRS-Info-r16
}

SSB-Configuration-r16  ::=          SEQUENCE {
    ssb-Freq-r16                     ARFCN-ValueNR,
    halfFrameIndex-r16                  ENUMERATED {zero, one},
    ssbSubcarrierSpacing-r16            SubcarrierSpacing,
    ssb-Periodicity-r16                 ENUMERATED { ms5, ms10, ms20, ms40, ms80, ms160, spare2,spare1 }   OPTIONAL, -- Need S
    sfn0-Offset-r16                     SEQUENCE {
        sfn-Offset-r16                      INTEGER (0..1023),
        integerSubframeOffset-r16           INTEGER (0..9)                                                  OPTIONAL  -- Need R
    }                                                                                                       OPTIONAL, -- Need R
    sfn-SSB-Offset-r16                  INTEGER (0..15),
    ss-PBCH-BlockPower-r16              INTEGER (-60..50)                                                   OPTIONAL  -- Cond Pathloss
}

SSB-InfoNcell-r16  ::=              SEQUENCE {
    physicalCellId-r16                  PhysCellId,
    ssb-IndexNcell-r16                  SSB-Index                                                           OPTIONAL, -- Need S
    ssb-Configuration-r16               SSB-Configuration-r16                                               OPTIONAL  -- Need S
}

DL-PRS-Info-r16  ::=                SEQUENCE {
    dl-PRS-ID-r16                      INTEGER (0..255),
    dl-PRS-ResourceSetId-r16           INTEGER (0..7),
    dl-PRS-ResourceId-r16              INTEGER (0..63)                                                     OPTIONAL  -- Need S
}

SRS-ResourceId ::=                      INTEGER (0..maxNrofSRS-Resources-1)
SRS-PosResourceId-r16 ::=               INTEGER (0..maxNrofSRS-PosResources-1-r16)

SRS-PeriodicityAndOffset ::=            CHOICE {
    sl1                                     NULL,
    sl2                                     INTEGER(0..1),
    sl4                                     INTEGER(0..3),
```

```
    sl5                                     INTEGER(0..4),
    sl8                                     INTEGER(0..7),
    sl10                                    INTEGER(0..9),
    sl16                                    INTEGER(0..15),
    sl20                                    INTEGER(0..19),
    sl32                                    INTEGER(0..31),
    sl40                                    INTEGER(0..39),
    sl64                                    INTEGER(0..63),
    sl80                                    INTEGER(0..79),
    sl160                                   INTEGER(0..159),
    sl320                                   INTEGER(0..319),
    sl640                                   INTEGER(0..639),
    sl1280                                  INTEGER(0..1279),
    sl2560                                  INTEGER(0..2559)
}

SRS-PeriodicityAndOffset-r16 ::=        CHOICE {
    sl1                                     NULL,
    sl2                                     INTEGER(0..1),
    sl4                                     INTEGER(0..3),
    sl5                                     INTEGER(0..4),
    sl8                                     INTEGER(0..7),
    sl10                                    INTEGER(0..9),
    sl16                                    INTEGER(0..15),
    sl20                                    INTEGER(0..19),
    sl32                                    INTEGER(0..31),
    sl40                                    INTEGER(0..39),
    sl64                                    INTEGER(0..63),
    sl80                                    INTEGER(0..79),
    sl160                                   INTEGER(0..159),
    sl320                                   INTEGER(0..319),
    sl640                                   INTEGER(0..639),
    sl1280                                  INTEGER(0..1279),
    sl2560                                  INTEGER(0..2559),
    sl5120                                  INTEGER(0..5119),
    sl10240                                 INTEGER(0..10239),
    sl40960                                 INTEGER(0..40959),
    sl81920                                 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).

***SRS-Resource* field descriptions**
cyclicShift-n2 Cyclic shift configuration (see TS 38.214 [19], clause 6.2.1).
cyclicShift-n4 Cyclic shift configuration (see TS 38.214 [19], clause 6.2.1).
freqHopping 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 *b-hop* > *b-SRS*.
groupOrSequenceHopping 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'.
nrofSRS-Ports Number of ports. For CLI SRS-RSRP measurement, the network always configures this parameter to 'port1'.
periodicityAndOffset-p Periodicity and slot offset for this SRS resource. All values are in "number of slots". Value *sl1* corresponds to a periodicity of 1 slot, value *sl2* corresponds to a periodicity of 2 slots, and so on. For each periodicity the corresponding offset is given in number of slots. For periodicity *sl1* the offset is 0 slots (see TS 38.214 [19], clause 6.2.1). For CLI SRS-RSRP measurement, *sl1280* and *sl2560* cannot be configured.
periodicityAndOffset-sp Periodicity and slot offset for this SRS resource. All values are in "number of slots". Value *sl1* corresponds to a periodicity of 1 slot, value *sl2* corresponds to a periodicity of 2 slots, and so on. For each periodicity the corresponding offset is given in number of slots. For periodicity *sl1* the offset is 0 slots (see TS 38.214 [19], clause 6.2.1).
ptrs-PortIndex The PTRS port index for this SRS resource for non-codebook based UL MIMO. This is only applicable when the corresponding *PTRS-UplinkConfig* is set to CP-OFDM. The *ptrs-PortIndex* configured here must be smaller than the *maxNrofPorts* configured in the *PTRS-UplinkConfig* (see TS 38.214 [19], clause 6.2.3.1). This parameter is not applicable to CLI SRS-RSRP measurement.
resourceMapping OFDM symbol location of the SRS resource within a slot including *nrofSymbols* (number of OFDM symbols), *startPosition* (value 0 refers to the last symbol, value 1 refers to the second last symbol, and so on) and *repetitionFactor* (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 *resourceMapping-r16* is signalled, UE shall ignore the *resourceMapping* (without suffix). For CLI SRS-RSRP measurement, the network always configures *nrofSymbols* and *repetitionFactor* to 'n1'.
resourceType 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 *resourceType*.
sequenceId Sequence ID used to initialize pseudo random group and sequence hopping (see TS 38.214 [19], clause 6.2.1).
servingCellId 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.
spatialRelationInfo 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.
spatialRelationInfoPos 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).
srs-RequestForDCI-Format0-2 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 *srs-RequestForDCI-Format0-2* 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 *supplementaryUplink*, an extra bit (the first bit of the SRS request field) is used for the non-SUL/SUL indication.

srs-RequestForDCI-Format1-2 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-ResourceSetToAddModListForDCI-Format0-2 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-ResourceSetToReleaseListForDCI-Format0-2 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).

***SRS-ResourceSet* field descriptions**
alpha 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.
aperiodicSRS-ResourceTriggerList 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 6.1.1.2). When the field is not included during a reconfiguration of *SRS-ResourceSet* of *resourceType* set to *aperiodic*, UE maintains this value based on the Need M; that is, this list is not considered as an extension of *aperiodicSRS-ResourceTrigger* for purpose of applying the general rule for extended list in clause 6.1.3.
aperiodicSRS-ResourceTrigger 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).
associatedCSI-RS 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).
csi-RS ID of CSI-RS resource associated with this SRS resource set. (see TS 38.214 [19], clause 6.1.1.2).
csi-RS-IndexServingcell Indicates CSI-RS index belonging to a serving cell
p0 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).
pathlossReferenceRS 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).
pathlossReferenceRS-Pos 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).
pathlossReferenceRSList 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 *pathlossReferenceRS* is not configured in the same *SRS-ResourceSet*.
resourceSelection Indicates whether the configured SRS spatial relation resource is a *SRS-Resource* or *SRS-PosResource*.
resourceType 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.
slotOffset An offset in number of slots between the triggering DCI and the actual transmission of this *SRS-ResourceSet*. If the field is absent the UE applies no offset (value 0).
srs-PowerControlAdjustmentStates Indicates whether hsrs,c(i) = fc(i,1) or hsrs,c(i) = fc(i,2) (if twoPUSCH-PC-AdjustmentStates are configured) or separate close loop is configured for SRS. This parameter is applicable only for Uls 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).
srs-ResourceIdList The IDs of the SRS-Resources used in this *SRS-ResourceSet*. If this *SRS-ResourceSet* is configured with usage set to codebook, the *srs-ResourceIdList* contains at most 2 entries. If this *SRS-ResourceSet* is configured with *usage* set to *nonCodebook*, the *srs-ResourceIdList* contains at most 4 entries.
srs-ResourceSetId The ID of this resource set. It is unique in the context of the BWP in which the parent *SRS-Config* is defined.
ssb-IndexSevingcell Indicates SSB index belonging to a serving cell
ssb-NCell This field indicates a SSB configuration from neighboring cell
usage 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.

***SSB-InfoNCell* field descriptions**
physicalCellId This field specifies the physical cell ID of the neighbour cell for which SSB configuration is provided.
ssb-IndexNcell 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 *ssb-IndexNcell* of the *physicalCellId* based on its SSB measurement from the cell.
ssb-Configuration This field specifies the full configuration of the SSB. If this field is absent, the UE obtains the configuration for the SSB from *nr-SSB-Config* 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 *physicalCellId*.

***DL-PRS-Info* field descriptions**
dl-PRS-ID This field specifies the UE specific TRP ID for which PRS configuration is provided.
dl-PRS-ResourceSetId This field specifies the PRS-ResourceSet ID of a PRS resourceSet.
Dl-PRS-ResourceId This field specifies the PRS-Resource ID of a PRS resource. If this field is absent, the UE determines the *dl-PRS-ResourceID* based on its PRS measurement from the TRP and DL PRS Resource Set.

***SSB-Configuration* field descriptions**
halfFrameIndex 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.
integerSubframeOffset Indicates the subframe boundary offset of the cell in which SSB is transmited.
sfn0-Offset Indiactes the time offset of the SFN0 slot 0 for the cell with respect to SFN0 slot 0 of serving cell.
sfn-Offset Indicates the 4 LSBs of the SFN of the cell in which SSB is transmitted.
ssb-Freq Indicates the frequency of the SSB.
ssb-PBCH-BlockPower 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.
ssb-Periodicity 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)
ssbSubcarrierSpacing Subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable.

Conditional Presence	Explanation
Setup	This field is mandatory present upon configuration of *SRS-ResourceSet* or *SRS-Resource* and optionally present, Need M, otherwise.
NonCodebook	This field is optionally present, Need M, in case of non-codebook based transmission, otherwise the field is absent.
Pathloss	The field is mandatory present if the IE *SSB-InfoNcell* is included in *pathlossReferenceRS-Pos*; 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
```

***SRS-TPC-CommandConfig* field descriptions**
fieldTypeFormat2-3 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.
startingBitOfFormat2-3 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).
startingBitOfFormat2-3SUL 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).

– *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 }
}
```

```
SSB-MTC2 ::=                        SEQUENCE {
    pci-List                            SEQUENCE (SIZE (1..maxNrofPCIsPerSMTC)) OF PhysCellId                   OPTIONAL,   -- Need M
    periodicity                         ENUMERATED {sf5, sf10, sf20, sf40, sf80, spare3, spare2, spare1}
}

SSB-MTC2-LP-r16 ::=                 SEQUENCE {
    pci-List                            SEQUENCE (SIZE (1..maxNrofPCIsPerSMTC)) OF PhysCellId                   OPTIONAL,   -- Need R
    periodicity                         ENUMERATED {sf10, sf20, sf40, sf80, sf160, spare3, spare2, spare1}
}

SSB-MTC3-r16 ::=                    SEQUENCE {
    periodicityAndOffset-r16            CHOICE {
        sf5-r16                                 INTEGER (0..4),
        sf10-r16                                INTEGER (0..9),
        sf20-r16                                INTEGER (0..19),
        sf40-r16                                INTEGER (0..39),
        sf80-r16                                INTEGER (0..79),
        sf160-r16                               INTEGER (0..159),
        sf320-r16                               INTEGER (0..319),
        sf640-r16                               INTEGER (0..639),
        sf1280-r16                              INTEGER (0..1279)
    },
    duration-r16                        ENUMERATED {sf1, sf2, sf3, sf4, sf5},
    pci-List-r16                        SEQUENCE (SIZE (1..maxNrofPCIsPerSMTC)) OF PhysCellId                   OPTIONAL,   -- Need M
    ssb-ToMeasure-r16                   SetupRelease { SSB-ToMeasure }                                          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.

***SSB-MTC3* field descriptions**
duration 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).
pci-List PCIs that are known to follow this SMTC, used for IAB-node discovery.
periodicityAndOffsetPeriodicity 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.
ssb-ToMeasure 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 *smtc* are not to be measured. See TS 38.215 [9] clause 5.1.1.

– *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
```

***SSB-ToMeasure* field descriptions**
longBitmap Bitmap when maximum number of SS/PBCH blocks per half frame equals to 64 as defined in TS 38.213 [13], clause 4.1.
mediumBitmap 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 *ssb-PositionQCL* is configured, the UE expects that the k-th bit is set to 0, where k > *ssb-PositionQCL* and the number of actually transmitted SS/PBCH blocks is not larger than the number of 1's in the bitmap.
shortBitmap Bitmap when maximum number of SS/PBCH blocks per half frame equals to 4 as defined in TS 38.213 [13], clause 4.1.

– *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
```

***SS-RSSI-Measurement* field descriptions**
endSymbol Within a slot that is configured for RSSI measurements (see *measurementSlots*) the UE measures the RSSI from symbol 0 to symbol *endSymbol*. This field identifies the entry in Table 5.1.3-1 in TS 38.215 [9], which determines the actual end symbol.
measurementSlots 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.

– *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 ::=                       SEQUENCE {
    tci-StateId                         TCI-StateId,
    qcl-Type1                           QCL-Info,
    qcl-Type2                           QCL-Info                                        OPTIONAL,   -- Need R
    ...
}

QCL-Info ::=                        SEQUENCE {
    cell                                ServCellIndex                                   OPTIONAL,   -- Need R
    bwp-Id                              BWP-Id                                          OPTIONAL, -- Cond CSI-RS-Indicated
    referenceSignal                     CHOICE {
        csi-rs                              NZP-CSI-RS-ResourceId,
        ssb                                 SSB-Index
    },
    qcl-Type                            ENUMERATED {typeA, typeB, typeC, typeD},
    ...
}

-- TAG-TCI-STATE-STOP
-- ASN1STOP
```

***QCL-Info* field descriptions**
bwp-Id The DL BWP which the RS is located in.
cell The UE's serving cell in which the *referenceSignal* is configured. If the field is absent, it applies to the serving cell in which the *TCI-State* is configured. The RS can be located on a serving cell other than the serving cell in which the *TCI-State* is configured only if the *qcl-Type* is configured as *typeC* or *typeD*. See TS 38.214 [19] clause 5.1.5.
referenceSignal Reference signal with which quasi-collocation information is provided as specified in TS 38.214 [19] subclause 5.1.5.
qcl-Type QCL type as specified in TS 38.214 [19] subclause 5.1.5.

Conditional Presence	Explanation
CSI-RS-Indicated	This field is mandatory present if *csi-rs* 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 using 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. See TS 38.213 [13], clause 11.1.

***TDD-UL-DL-Pattern* field descriptions**
dl-UL-TransmissionPeriodicity Periodicity of the DL-UL pattern, see TS 38.213 [13], clause 11.1. If the *dl-UL-TransmissionPeriodicity-v1530* is signalled, UE shall ignore the *dl-UL-TransmissionPeriodicity* (without suffix).
nrofDownlinkSlots 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.
nrofDownlinkSymbols Number of consecutive DL symbols in the beginning of the slot following the last full DL slot (as derived from *nrofDownlinkSlots*). The value 0 indicates that there is no partial-downlink slot. (see TS 38.213 [13], clause 11.1).
nrofUplinkSlots 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.
nrofUplinkSymbols Number of consecutive UL symbols in the end of the slot preceding the first full UL slot (as derived from *nrofUplinkSlots*). 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
        }
    }
}
```

```
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 FFS
            nrofUplinkSymbols-r16                   INTEGER (1..maxNrofSymbols-1)                   OPTIONAL  -- Need FFS
        },
        explicit-IAB-MT-r16                     SEQUENCE {
            nrofDownlinkSymbols-r16                 INTEGER (1..maxNrofSymbols-1)                   OPTIONAL, -- Need FFS
            nrofUplinkSymbols-r16                   INTEGER (1..maxNrofSymbols-1)                   OPTIONAL  -- Need FFS
        }
    }
}

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*.

***TDD-UL-DL-SlotConfig* field descriptions**
nrofDownlinkSymbols Number of consecutive DL symbols in the beginning of the slot identified by *slotIndex*. If the field is absent the UE assumes that there are no leading DL symbols. (see TS 38.213 [13], clause 11.1).
nrofUplinkSymbols Number of consecutive UL symbols in the end of the slot identified by *slotIndex*. If the field is absent the UE assumes that there are no trailing UL symbols. (see TS 38.213 [13], clause 11.1).
slotIndex Identifies a slot within a slot configuration period given in *tdd-UL-DL-configurationCommon*, see TS 38.213 [13], clause 11.1.
symbols The direction (downlink or uplink) for the symbols in this slot. Value *allDownlink* indicates that all symbols in this slot are used for downlink; value *allUplink* indicates that all symbols in this slot are used for uplink; value *explicit* indicates explicitly how many symbols in the beginning and end of this slot are allocated to downlink and uplink, respectively.

***TDD-UL-DL-SlotConfig-IAB-MT* field descriptions**
symbols-IAB-MT The *Symbols-IAB-MT* is used to configure an IAB-MT with the SlotConfig applicable for one serving cell. Value *allDownlink* indicates that all symbols in this slot are used for downlink; value *allUplink* indicates that all symbols in this slot are used for uplink; value *explicit* indicates explicitly how many symbols in the beginning and end of this slot are allocated to downlink and uplink, respectively; value *explicit-{IAB-MT}* indicates explicitly how many symbols in the beginning and end of this slot are allocated to uplink and downlink, respectively.

– *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 $\text{Treselection}_{\text{RAT}}$ 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
    }                                                                                   OPTIONAL     -- Need S
}

-- TAG-UAC-BARRINGPERPLMN-LIST-STOP
-- ASN1STOP
```

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-PaylaodSize* 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).

***CI-ConfigurationPerServingCell* field descriptions**
ci-PayloadSize Configures the field size for each UL cancelation indicator of this serving cell (servingCellId) (see TS 38.213 [13], clause 11.2A).
deltaOffset 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).
frequencyRegionForCI 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 *locationAndBandwidth*.
positionInDCI Starting position (in number of bit) of the *ci-PayloadSize* bit CI value applicable for this serving cell (servingCellId) within the DCI payload (see TS 38.213 [13], clause 11.2A).
positionInDCI-ForSUL Starting position (in number of bit) of the *ci-PayloadSize* bit CI value applicable for SUL of this serving cell (servingCellId) within the DCI payload (see TS 38.213 [13], clause 11.2A).
timeDurationForCI 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 *monitoringSlotPeriodicityAndOffset* 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,
timeFrequencyRegion 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).
timeGranularityForCI Configures the number of partitions within the time region of this serving cell (servingCellId) (see TS 38.213 [13], clause 11.2A).
uplinkCancellationPriority 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
SUL-Only	The field is optionally present, Need R, if this serving cell is configured with a supplementary uplink (SUL). It is absent otherwise.
SymbolPeriodicity	This field is mandatory present if the configured UL CI monitoring periodicity indicated by *monitoringSlotPeriodicityAndOffset* 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 ::=              SEQUENCE {
    frequencyInfoUL                     FrequencyInfoUL                                 OPTIONAL,   -- Cond InterFreqHOAndServCellAdd
    initialUplinkBWP                    BWP-UplinkCommon                                OPTIONAL,   -- Cond ServCellAdd
    dummy                               TimeAlignmentTimer
```

```
}

-- TAG-UPLINKCONFIGCOMMON-STOP
-- ASN1STOP
```

***UplinkConfigCommon* field descriptions**
frequencyInfoUL Absolute uplink frequency configuration and subcarrier specific virtual carriers.
initialUplinkBWP The initial uplink BWP configuration for a serving cell (see TS 38.213 [13], clause 12).

Conditional Presence	Explanation
InterFreqHOAndServCellAdd	This field is mandatory present for inter-frequency handover and upon serving cell (PSCell/SCell) addition. Otherwise, the field is optionally present, Need M.
ServCellAdd	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 ::=               SEQUENCE {
    frequencyInfoUL                         FrequencyInfoUL-SIB,
    initialUplinkBWP                        BWP-UplinkCommon,
    timeAlignmentTimerCommon                TimeAlignmentTimer
}

-- TAG-UPLINKCONFIGCOMMONSIB-STOP
-- ASN1STOP
```

***UplinkConfigCommonSIB* field descriptions**
frequencyInfoUL Absolute uplink frequency configuration and subcarrier specific virtual carriers.
InitialUplinkBWP 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.

***UplinkTxDirectCurrentCell* field descriptions**
servCellIndex The serving cell ID of the serving cell corresponding to the *uplinkDirectCurrentBWP*.
uplinkDirectCurrentBWP The Tx Direct Current locations for all the uplink BWPs configured at the corresponding serving cell.
uplinkDirectCurrentBWP-SUL 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
```

***ZP-CSI-RS-Resource* field descriptions**
periodicityAndOffset 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).
resourceMapping OFDM symbol and subcarrier occupancy of the ZP-CSI-RS resource within a slot.
zp-CSI-RS-ResourceId ZP CSI-RS resource configuration ID (see TS 38.214 [19], clause 5.1.4.2).

Conditional Presence	Explanation
PeriodicOrSemiPersistent	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-ResourceId*s.

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
```

***ZP-CSI-RS-ResourceSet* field descriptions**
zp-CSI-RS-ResourceIdList
The list of *ZP-CSI-RS-ResourceId* identifying the *ZP-CSI-RS-Resource* 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 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
}

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,
    ...
}

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 ::=                      CHOICE {
```

```
    eutra                               SEQUENCE {
        bandEUTRA                           FreqBandIndicatorEUTRA,
        ca-BandwidthClassDL-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 ::=            SEQUENCE {
    srs-CarrierSwitch                   CHOICE {
        nr                                  SEQUENCE {
            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 ::=        SEQUENCE {
    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,
    intraFreqDAPS-Parameters-r16     SEQUENCE {
        intraFreqDiffSCS-DAPS-r16                       ENUMERATED {supported}  OPTIONAL,
        intraFreqDAPS-r16                               ENUMERATED {supported}  OPTIONAL,
        intraFreqAsyncDAPS-r16                          ENUMERATED {supported}  OPTIONAL,
        intraFreqMultiUL-TransmissionDAPS-r16           ENUMERATED {supported}  OPTIONAL,
        intraFreqTwoTAGs-DAPS-r16                       ENUMERATED {supported}  OPTIONAL,
        intraFreqSemiStaticPowerSharingDAPS-Mode1-r16   ENUMERATED {supported}  OPTIONAL,
        intraFreqSemiStaticPowerSharingDAPS-Mode2-r16   ENUMERATED {supported}  OPTIONAL,
        intraFreqDynamicPowersharingDAPS-r16            ENUMERATED {short, long} OPTIONAL
    }                                                                           OPTIONAL
}

-- TAG-BANDCOMBINATIONLIST-STOP
-- ASN1STOP
```

***BandCombination* field descriptions**
BandCombinationList-v1540, BandCombinationList-v1550, BandCombinationList-v1560, BandCombinationList-v1570, BandCombinationList-v1580, BandCombinationList-v1590, BandCombinationList-r16 The UE shall include the same number of entries, and listed in the same order, as in *BandCombinationList* (without suffix). If the field is included in *supportedBandCombinationListNEDC-Only-v1610*, the UE shall include the same number of entries, and listed in the same order, as in *BandCombinationList* of *supportedBandCombinationListNEDC-Only* (without suffix) field. If the field is included in *supportedBandCombinationListNEDC-Only-v15a0*, the UE shall include the same number of entries, and listed in the same order, as in *BandCombinationList* (without suffix) of *supportedBandCombinationListNEDC-Only* (without suffix) field.
ca-ParametersNRDC 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.
ne-DC-BC 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.
srs-SwitchingTimesListNR 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: - For the first NR band, the UE shall include the same number of entries for NR bands as in *bandList*, i.e. first entry corresponds to first NR band in *bandList* and so on, - For the second NR band, the UE shall include one entry less, i.e. first entry corresponds to the second NR band in *bandList* and so on - And so on
srs-SwitchingTimesListEUTRA 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: - For the first E-UTRA band, the UE shall include the same number of entries for E-UTRA bands as in *bandList,* i.e. first entry corresponds to first E-UTRA band in *bandList* and so on, - 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 *bandList* and so on - And so on
srs-TxSwitch Indicates supported SRS antenna switch capability for the associated band. If the UE indicates support of *SRS-SwitchingTimeNR*, the UE is allowed to set this field for a band with associated *FeatureSetUplinkId* set to 0 for SRS carrier switching.

– *BandCombinationListSidelink*

The IE *BandCombinationListSidelink* contains a list of V2X sidelink and NR sidelink band combinations.

BandCombinationListSidelink information element

```
-- ASN1START
-- TAG-BANDCOMBINATIONLISTSIDELINK-START

BandCombinationListSidelink-r16 ::=  SEQUENCE {
    supportedBandCombinationListSidelink-r16              SupportedBandCombinationListSidelink-r16           OPTIONAL,
    supportedBandCombinationListSidelinkEUTRA-r16         SupportedBandCombinationListSidelinkEUTRA-r16      OPTIONAL,
    supportedBandCombinationListSidelinkEUTRA-NR-r16      SupportedBandCombinationListSidelinkEUTRA-NR-r16   OPTIONAL,
    ...
}

SupportedBandCombinationListSidelink-r16 ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombinationParametersSidelink-r16
```

```
BandCombinationParametersSidelink-r16 ::= SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BandParametersSidelink-r16

BandParametersSidelink-r16 ::= SEQUENCE {
    freqBandSidelink-r16            FreqBandIndicatorNR
}

SupportedBandCombinationListSidelinkEUTRA-r16 ::= SEQUENCE {
    bandCombinationListEUTRA1-r16               OCTET STRING                        OPTIONAL,
    bandCombinationListEUTRA2-r16               OCTET STRING                        OPTIONAL
}

SupportedBandCombinationListSidelinkEUTRA-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
```

***BandCombinationSidelink* field descriptions**
bandParametersSidelinkEUTRA1, bandParametersSidelinkEUTRA2 This field includes the *V2X-BandParameters-r14* and *V2X-BandParameters-v1530* IE as specified in 36.331 [10]. It is used for reporting the per-band capability for V2X sidelink communication.
bandCombinationListEUTRA1, bandCombinationListEUTRA2 This field includes the *V2X-SupportedBandCombination-r14* and *V2X-SupportedBandCombination-v1530* IE as specified in 36.331 [10]. It is used for reporting the band combination list 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 ::=                          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 ::=                    SEQUENCE {
    fd-MIMO-TotalWeightedLayers                     INTEGER (2..128)                            OPTIONAL
}

CA-ParametersEUTRA-v1570 ::=                    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 ::=                 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
    }                                                                                   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 {supported}           OPTIONAL,
    -- R1 18-7: CA with non-aligned frame boundaries for inter-band CA
    interCA-NonAlignedFrame-r16                     ENUMERATED {supported}           OPTIONAL,
    simul-SRS-Trans-InterBandCA-r16                 INTEGER (1..2)                   OPTIONAL,
    daps-Parameters-r16                   SEQUENCE {
        asyncDAPS-r16                         ENUMERATED {supported}                 OPTIONAL,
        interFreqDAPS-r16                     ENUMERATED {supported}                 OPTIONAL,
        interFreqDiffSCS-DAPS-r16             ENUMERATED {supported}                 OPTIONAL,
        multiUL-TransmissionDAPS-r16          ENUMERATED {supported}                 OPTIONAL,
        semiStaticPowerSharingDAPS-Mode1-r16  ENUMERATED {supported}                 OPTIONAL,
        semiStaticPowerSharingDAPS-Mode2-r16  ENUMERATED {supported}                 OPTIONAL,
        dynamicPowersharingDAPS-r16           ENUMERATED {short, long}               OPTIONAL,
        ul-TransCancellationDAPS-r16          ENUMERATED {supported}                 OPTIONAL
    }                                                                                OPTIONAL,
    codebookParametersPerBC-r16           CodebookParameters-v1610                   OPTIONAL
}

-- TAG-CA-PARAMETERSNR-STOP
-- ASN1STOP
```

– *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 ::=                       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 mode1 between MCG and SCG cells of same FR for NR dual connectivity
    intraFR-NR-DC-PwrSharingMode1-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
}

-- 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
    }                                                                                                       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
}

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 Feature Set (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 ::=              SEQUENCE {
    featureSetListPerDownlinkCC         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-DifferentTB-PerSlot    SEQUENCE {
        scs-15kHz        ENUMERATED {one-pdsch, upto2, upto4, upto7} OPTIONAL,
        scs-30kHz        ENUMERATED {one-pdsch, upto2, upto4, upto7} OPTIONAL,
        scs-60kHz        ENUMERATED {one-pdsch, upto2, upto4, upto7} OPTIONAL,
        scs-120kHz       ENUMERATED {one-pdsch, 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-DifferentTB-PerSlot    SEQUENCE {
        scs-15kHz        ENUMERATED {one-pdsch, upto2, upto4, upto7} OPTIONAL,
        scs-30kHz        ENUMERATED {one-pdsch, upto2, upto4, upto7} OPTIONAL,
        scs-60kHz        ENUMERATED {one-pdsch, upto2, upto4, upto7} OPTIONAL,
        scs-120kHz       ENUMERATED {one-pdsch, upto2, upto4, upto7} OPTIONAL
     } 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
}

-- 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 4th 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
    ]]
}

-- 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
    }                                                                                                           OPTIONAL,
    dummy2                              DummyF                                                                  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
}

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 ::=               SEQUENCE {
    supportedSubcarrierSpacingUL            SubcarrierSpacing,
    supportedBandwidthUL                    SupportedBandwidth,
    channelBW-90mhz                         ENUMERATED {supported}                  OPTIONAL,
    mimo-CB-PUSCH                           SEQUENCE {
        maxNumberMIMO-LayersCB-PUSCH            MIMO-LayersUL                           OPTIONAL,
        maxNumberSRS-ResourcePerSet             INTEGER (1..2)
    }                                                                               OPTIONAL,
    maxNumberMIMO-LayersNonCB-PUSCH         MIMO-LayersUL                           OPTIONAL,
    supportedModulationOrderUL              ModulationOrder                         OPTIONAL
}
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 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 *FreqSeparationClas*s 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 {c1, c2, c3, ...}

-- TAG-FREQSEPARATIONCLASS-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 convery 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 {
    mfbi-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,
    secondaryDRX-Group                       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
    ]]
}

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 {
        licensedBand-r16            MinTimeGap-r16                      OPTIONAL,
    unlicensedBand-r16              MinTimeGap-r16                      OPTIONAL
    }                                                                   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,
    ...
}

MinTimeGap-r16 ::=    SEQUENCE {
    scs-15kHz-r16                       ENUMERATED {sl1, sl3}       OPTIONAL,
```

```
    scs-30kHz-r16                       ENUMERATED {sl1, sl6}       OPTIONAL,
    scs-60kHz-r16                       ENUMERATED {sl1, sl12}      OPTIONAL,
    scs-120kHz-r16                      ENUMERATED {sl2, sl24}      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 ::=                SEQUENCE {
    measAndMobParametersCommon              MeasAndMobParametersCommon              OPTIONAL,
    measAndMobParametersXDD-Diff                MeasAndMobParametersXDD-Diff        OPTIONAL,
    measAndMobParametersFRX-Diff                MeasAndMobParametersFRX-Diff        OPTIONAL
}

MeasAndMobParametersCommon ::=          SEQUENCE {
    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,
    handoverFR1-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
    ]]

}

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
    ]],
    [[
    condHandoverParametersXDD-Diff-r16  SEQUENCE {
        condHandover-r16                    ENUMERATED {supported}                 OPTIONAL,
        condHandoverFailure-r16             ENUMERATED {supported}                 OPTIONAL,
        condHandoverTwoTriggerEvents-r16    ENUMERATED {supported}                 OPTIONAL
    }                                                                              OPTIONAL,
    pcellT312-r16                       ENUMERATED {supported}                     OPTIONAL,
    handoverIntraF-IAB-r16              ENUMERATED {supported}                     OPTIONAL,
    eutra-AutonomousGaps-r16            ENUMERATED {supported}                     OPTIONAL,
    eutra-AutonomousGapsNEDC-r16        ENUMERATED {supported}                     OPTIONAL,
    eutra-AutonomousGapsNRDC-r16        ENUMERATED {supported}                     OPTIONAL,
    nr-AutonomousGaps-r16               ENUMERATED {supported}                     OPTIONAL,
    nr-AutonomousGaps-ENDC-r16          ENUMERATED {supported}                     OPTIONAL,
    nr-AutonomousGapsNEDC-r16           ENUMERATED {supported}                     OPTIONAL,
    nr-AutonomousGapsNRDC-r16           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-CSI-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,
    handoverUTRA-FDD-r16                            ENUMERATED {supported}          OPTIONAL,
    cli-RSSI-Meas-r16                               ENUMERATED {supported}          OPTIONAL,
    cli-SRS-RSRP-Meas-r16                           ENUMERATED {supported}          OPTIONAL,
    condHandoverParametersFRX-Diff-r16              SEQUENCE {
        condHandover-r16                                ENUMERATED {supported}      OPTIONAL,
        condHandoverFailure-r16                         ENUMERATED {supported}      OPTIONAL,
        condHandoverTwoTriggerEvents-r16                ENUMERATED {supported}      OPTIONAL
    }                                                                               OPTIONAL,
    pcellT312-r16                                   ENUMERATED {supported}          OPTIONAL,
    interFrequencyMeas-Nogap-r16                    ENUMERATED {supported}          OPTIONAL,
    simultaneousRxDataSSB-DiffNumerology-Inter-r16  ENUMERATED {supported}          OPTIONAL,
    handoverIntraF-IAB-r16                          ENUMERATED {supported}          OPTIONAL,
    idleInactiveNR-MeasReport-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,
    measAndMobParametersMRDC-XDD-Diff-v1610    MeasAndMobParametersMRDC-XDD-Diff-v1610      OPTIONAL,
    measAndMobParametersMRDC-FRX-Diff-v1610    MeasAndMobParametersMRDC-FRX-Diff-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
}

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-XDD-Diff-v1610 ::=    SEQUENCE {
    condPSCellChangeParametersXDD-Diff-r16      SEQUENCE {
        condPSCellChange-r16                        ENUMERATED {supported}               OPTIONAL,
        condPSCellChangeTwoTriggerEvents-r16        ENUMERATED {supported}               OPTIONAL
    }                                                                                    OPTIONAL,
    pscellT312-r16                              ENUMERATED {supported}                   OPTIONAL
}

MeasAndMobParametersMRDC-FRX-Diff ::=          SEQUENCE {
    simultaneousRxDataSSB-DiffNumerology        ENUMERATED {supported}                   OPTIONAL
}

MeasAndMobParametersMRDC-FRX-Diff-v1610 ::=    SEQUENCE {
    condPSCellChangeParametersFRX-Diff-r16      SEQUENCE {
        condPSCellChange-r16                        ENUMERATED {supported}               OPTIONAL,
        condPSCellChangeTwoTriggerEvents-r16        ENUMERATED {supported}               OPTIONAL
    }                                                                                    OPTIONAL,
    pscellT312-r16                              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
    }                                                                                                       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
    }                                                                                                               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
```

```
    ]]

}

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}                                    OPTIONAL,
    maxNumberAperiodicCSI-RS-Resource   ENUMERATED {n0, n1, n4, n8, n16, n32, n64}
}

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)
}

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
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
    ]],
    [[
    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
    }       OPTIONAL
    ]]
}

MRDC-Parameters-v1580 ::= SEQUENCE {
    dynamicPowerSharingNEDC             ENUMERATED {supported}              OPTIONAL
}

MRDC-Parameters-v1590 ::=   SEQUENCE {
```

```
    interBandContiguousMRDC             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 ::=                  SEQUENCE {
    phy-ParametersCommon                Phy-ParametersCommon                    OPTIONAL,
    phy-ParametersXDD-Diff              Phy-ParametersXDD-Diff                  OPTIONAL,
    phy-ParametersFRX-Diff              Phy-ParametersFRX-Diff                  OPTIONAL,
    phy-ParametersFR1                   Phy-ParametersFR1                       OPTIONAL,
    phy-ParametersFR2                   Phy-ParametersFR2                       OPTIONAL
}

Phy-ParametersCommon ::=            SEQUENCE {
    csi-RS-CFRA-ForHO                   ENUMERATED {supported}                  OPTIONAL,
    dynamicPRB-BundlingDL               ENUMERATED {supported}                  OPTIONAL,
    sp-CSI-ReportPUCCH                  ENUMERATED {supported}                  OPTIONAL,
    sp-CSI-ReportPUSCH                  ENUMERATED {supported}                  OPTIONAL,
```

```
    nzp-CSI-RS-IntefMgmt                ENUMERATED {supported}                  OPTIONAL,
    type2-SP-CSI-Feedback-LongPUCCH     ENUMERATED {supported}                  OPTIONAL,
    precoderGranularityCORESET          ENUMERATED {supported}                  OPTIONAL,
    dynamicHARQ-ACK-Codebook            ENUMERATED {supported}                  OPTIONAL,
    semiStaticHARQ-ACK-Codebook         ENUMERATED {supported}                  OPTIONAL,
    spatialBundlingHARQ-ACK             ENUMERATED {supported}                  OPTIONAL,
    dynamicBetaOffsetInd-HARQ-ACK-CSI   ENUMERATED {supported}                  OPTIONAL,
    pucch-Repetition-F1-3-4             ENUMERATED {supported}                  OPTIONAL,
    ra-Type0-PUSCH                      ENUMERATED {supported}                  OPTIONAL,
    dynamicSwitchRA-Type0-1-PDSCH       ENUMERATED {supported}                  OPTIONAL,
    dynamicSwitchRA-Type0-1-PUSCH       ENUMERATED {supported}                  OPTIONAL,
    pdsch-MappingTypeA                  ENUMERATED {supported}                  OPTIONAL,
    pdsch-MappingTypeB                  ENUMERATED {supported}                  OPTIONAL,
    interleavingVRB-ToPRB-PDSCH         ENUMERATED {supported}                  OPTIONAL,
    interSlotFreqHopping-PUSCH          ENUMERATED {supported}                  OPTIONAL,
    type1-PUSCH-RepetitionMultiSlots    ENUMERATED {supported}                  OPTIONAL,
    type2-PUSCH-RepetitionMultiSlots    ENUMERATED {supported}                  OPTIONAL,
    pusch-RepetitionMultiSlots          ENUMERATED {supported}                  OPTIONAL,
    pdsch-RepetitionMultiSlots          ENUMERATED {supported}                  OPTIONAL,
    downlinkSPS                         ENUMERATED {supported}                  OPTIONAL,
    configuredUL-GrantType1             ENUMERATED {supported}                  OPTIONAL,
    configuredUL-GrantType2             ENUMERATED {supported}                  OPTIONAL,
    pre-EmptIndication-DL               ENUMERATED {supported}                  OPTIONAL,
    cbg-TransIndication-DL              ENUMERATED {supported}                  OPTIONAL,
    cbg-TransIndication-UL              ENUMERATED {supported}                  OPTIONAL,
    cbg-FlushIndication-DL              ENUMERATED {supported}                  OPTIONAL,
    dynamicHARQ-ACK-CodeB-CBG-Retx-DL   ENUMERATED {supported}                  OPTIONAL,
    rateMatchingResrcSetSemi-Static     ENUMERATED {supported}                  OPTIONAL,
    rateMatchingResrcSetDynamic         ENUMERATED {supported}                  OPTIONAL,
    bwp-SwitchingDelay                  ENUMERATED {type1, type2}               OPTIONAL,
    ...,
    [[
    dummy                               ENUMERATED {supported}                  OPTIONAL
    ]],
    [[
    maxNumberSearchSpaces               ENUMERATED {n10}                        OPTIONAL,
    rateMatchingCtrlResrcSetDynamic     ENUMERATED {supported}                  OPTIONAL,
    maxLayersMIMO-Indication            ENUMERATED {supported}                  OPTIONAL
    ]],
    [[
    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 symbok 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 {
        licensedBand-r16                            ENUMERATED {supported}          OPTIONAL,
        unlicensedBand-r16                          ENUMERATED {supported}          OPTIONAL
    }                                                                               OPTIONAL,
    maxNumberSRS-PosPathLossEstimateAllServingCells-r16  ENUMERATED {n1, n4, n8, n16}        OPTIONAL,
    maxNumberSRS-PosSpatialRelationsAllServingCells-r16  ENUMERATED {n0, n1, n2, n4, n8, n16} OPTIONAL,
    extendedCG-Periodicities-r16                ENUMERATED {supported}              OPTIONAL,
    extendedSPS-Periodicities-r16               ENUMERATED {supported}              OPTIONAL,
    codebookVariantsList-r16                    CodebookVariantsList-r16            OPTIONAL
    ]]
}

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,
    pdcch-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
    } 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
    ]],
```

```
    [[
    pdcch-BlindDetectionNRDC                SEQUENCE {
        pdcch-BlindDetectionMCG-UE              INTEGER (1..15),
        pdcch-BlindDetectionSCG-UE              INTEGER (1..15)
    }                                                                       OPTIONAL,
    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,
    -- 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,
    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
    ]]

}

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
    ]]
}

-- 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 ::=              SEQUENCE {
    naics-Capability-List               SEQUENCE (SIZE (1..maxNrofNAICS-Entries)) OF NAICS-Capability-Entry         OPTIONAL,
    ...,
    [[
    spCellPlacement                     CarrierAggregationVariant                                                   OPTIONAL
    ]]
}

NAICS-Capability-Entry ::=          SEQUENCE {
    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
    }                                                                  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,
    supportedBandCombinationListSidelink-r16  BandCombinationListSidelink-r16       OPTIONAL,
    supportedBandCombinationList-UplinkTxSwitch-r16  BandCombinationList-UplinkTxSwitch-r16 OPTIONAL
    ]]
}

BandNR ::=                          SEQUENCE {
    bandNR                              FreqBandIndicatorNR,
    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                       CHOICE {
        fr1                                 SEQUENCE {
            scs-15kHz                           BIT STRING (SIZE (10))                      OPTIONAL,
            scs-30kHz                           BIT STRING (SIZE (10))                      OPTIONAL,
            scs-60kHz                           BIT STRING (SIZE (10))                      OPTIONAL
        },
        fr2                                 SEQUENCE {
            scs-60kHz                           BIT STRING (SIZE (3))                       OPTIONAL,
            scs-120kHz                          BIT STRING (SIZE (3))                       OPTIONAL
        }
    }                                                                                       OPTIONAL,
    channelBWs-UL                       CHOICE {
        fr1                                 SEQUENCE {
            scs-15kHz                           BIT STRING (SIZE (10))                      OPTIONAL,
            scs-30kHz                           BIT STRING (SIZE (10))                      OPTIONAL,
            scs-60kHz                           BIT STRING (SIZE (10))                      OPTIONAL
        },
        fr2                                 SEQUENCE {
            scs-60kHz                           BIT STRING (SIZE (3))                       OPTIONAL,
            scs-120kHz                          BIT STRING (SIZE (3))                       OPTIONAL
        }
    }                                                                                       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
        }
    }                                                                               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
        }
    }                                                                               OPTIONAL
    ]],
    [[
    asymmetricBandwidthCombinationSet     BIT STRING (SIZE (1..32))           OPTIONAL
    ]],
    [[
    -- R1 10: NR-unlicensed
    unlicensedParametersPerBand-r16         UnlicensedParametersPerBand-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)
    }                                                                               OPTIONAL,
    -- 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
    oneShotPeriodicTRS-r16                  ENUMERATED {supported}                  OPTIONAL,
    olpc-SRS-Pos-r16                        OLPC-SRS-Pos-r16                        OPTIONAL,
    spatialRelationsSRS-Pos-r16             SpatialRelationsSRS-Pos-r16             OPTIONAL,
    simul-SRS-Trans-IntraBandCA-r16         INTEGER (1..2)                          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
        }
    }                                                                               OPTIONAL,
    channelBW-UL-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
```

```
        }
    }                                                                   OPTIONAL,
    rasterShift7dot5-IAB-r16            ENUMERATED {supported}          OPTIONAL,
    ue-PowerClass-v1610                 ENUMERATED {pc1dot5}            OPTIONAL
    ]]
}

-- TAG-RF-PARAMETERS-STOP
-- ASN1STOP
```

***RF-Parameters* 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*. The UE does not include this field if the UE capability is requested by E-UTRAN and the network request includes the field *eutra-nr-only* [10].
supportedBandCombinationList A list of band combinations that the UE supports for NR (and NR-DC, if requested). The *FeatureSetCombinationId*:s in this list refer to the *FeatureSetCombination* entries in the *featureSetCombinations* list in the *UE-NR-Capability* IE. The UE does not include this field if the UE capability is requested by E-UTRAN and the network request includes the field *eutra-nr-only* [10].
supportedBandCombinationList-UplinkTxSwitch A list of band combinations that the UE supports dynamic uplink Tx switching for NR UL CA and SUL. The *FeatureSetCombinationId*:s in this list refer to the *FeatureSetCombination* entries in the *featureSetCombinations* list in the *UE-NR-Capability* IE. The UE does not include this field if the UE capability is requested by E-UTRAN and the network request includes the field *eutra-nr-only* [10].

– *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 ::=                   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
    }                                                                           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 *FeatureSetCombinationId*:s 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 *FeatureSetCombinationId*:s 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 EN-DC. The *FeatureSetCombinationId*:s 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,
    ...
}

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}
    }                                                                                                   OPTIONAL,
    -- R1 15-9: Transmitting LTE sidelink mode 4 configured by NR Uu
    gnb-ScheduledMode4SidelinkEUTRA-r16     ENUMERATED {supported}                                      OPTIONAL
}

-- 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                              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 ::=            SEQUENCE {
    mrdc-Request                                SEQUENCE {
        omitEN-DC                                   ENUMERATED {true}                   OPTIONAL,    -- Need N
        includeNR-DC                                ENUMERATED {true}                   OPTIONAL,    -- Need N
        includeNE-DC                                ENUMERATED {true}                   OPTIONAL     -- Need N
    }                                                                                 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
    }                                                                                  OPTIONAL,    -- Need N
    uplinkTxSwitchRequest-r16       ENUMERATED {true}                                  OPTIONAL     -- Need N
    ]]
}

-- TAG-UE-CAPABILITYREQUESTFILTERCOMMON-STOP
-- ASN1STOP
```

UE-CapabilityRequestFilterCommon field descriptions
codebookTypeRequest Only if this field is present, the UE includes *SupportedCSI-RS-Resource* 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 *codebookVariantsList*, *codebookParametersPerBand* and *codebookParametersPerBC*. If this field is present and none of the codebook types is requested within this field (i.e. empty field), the UE includes *SupportedCSI-RS-Resource* supported for all codebook types into *codebookVariantsList*, *codebookParametersPerBand* and *codebookParametersPerBC*.
includeNE-DC 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 *supportedBandCombinationList*, band combinations supporting only NE-DC shall be included in *supportedBandCombinationListNEDC-Only*.
includeNR-DC 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.
omitEN-DC Only if this field is present, the UE shall omit band combinations and feature set combinations which are only applicable to (NG)EN-DC.
uplinkTxSwitchRequest 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 EN-DC.

– *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 ::=              SEQUENCE {
    measAndMobParametersMRDC            MeasAndMobParametersMRDC                                                    OPTIONAL,
    phy-ParametersMRDC-v1530            Phy-ParametersMRDC                                                          OPTIONAL,
    rf-ParametersMRDC                   RF-ParametersMRDC,
    generalParametersMRDC               GeneralParametersMRDC-XDD-Diff                                              OPTIONAL,
    fdd-Add-UE-MRDC-Capabilities        UE-MRDC-CapabilityAddXDD-Mode                                               OPTIONAL,
    tdd-Add-UE-MRDC-Capabilities        UE-MRDC-CapabilityAddXDD-Mode                                               OPTIONAL,
    fr1-Add-UE-MRDC-Capabilities        UE-MRDC-CapabilityAddFRX-Mode                                               OPTIONAL,
    fr2-Add-UE-MRDC-Capabilities        UE-MRDC-CapabilityAddFRX-Mode                                               OPTIONAL,
    featureSetCombinations              SEQUENCE (SIZE (1..maxFeatureSetCombinations)) OF FeatureSetCombination     OPTIONAL,
    pdcp-ParametersMRDC-v1530           PDCP-ParametersMRDC                                                         OPTIONAL,
    lateNonCriticalExtension            OCTET STRING                                                                OPTIONAL,
    nonCriticalExtension                UE-MRDC-Capability-v1560                                                    OPTIONAL
}

UE-MRDC-Capability-v1560 ::=        SEQUENCE {
    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 ::=        SEQUENCE {
    measAndMobParametersMRDC-v1610      MeasAndMobParametersMRDC-v1610                                              OPTIONAL,
    generalParametersMRDC-v1610         GeneralParametersMRDC-v1610                                                 OPTIONAL,
    pdcp-ParametersMRDC-v1610           PDCP-ParametersMRDC-v1610                                                   OPTIONAL,
    nonCriticalExtension                SEQUENCE {}                                                                 OPTIONAL
}

UE-MRDC-CapabilityAddXDD-Mode ::=   SEQUENCE {
    measAndMobParametersMRDC-XDD-Diff       MeasAndMobParametersMRDC-XDD-Diff                                       OPTIONAL,
    generalParametersMRDC-XDD-Diff          GeneralParametersMRDC-XDD-Diff                                          OPTIONAL
}

UE-MRDC-CapabilityAddXDD-Mode-v1560 ::=    SEQUENCE {
    measAndMobParametersMRDC-XDD-Diff-v1560    MeasAndMobParametersMRDC-XDD-Diff-v1560                          OPTIONAL
}

UE-MRDC-CapabilityAddFRX-Mode ::=   SEQUENCE {
    measAndMobParametersMRDC-FRX-Diff       MeasAndMobParametersMRDC-FRX-Diff
}


GeneralParametersMRDC-XDD-Diff ::= SEQUENCE {
    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 {
    f1c-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 ::=            SEQUENCE {
    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 ::=              SEQUENCE {
    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,
```

```
    delayBudgetReporting                    ENUMERATED {supported}                                  OPTIONAL,
    nonCriticalExtension                    UE-NR-Capability-v1540                                  OPTIONAL
}

UE-NR-Capability-v1540 ::=              SEQUENCE {
    sdap-Parameters                         SDAP-Parameters                                         OPTIONAL,
    overheatingInd                          ENUMERATED {supported}                                  OPTIONAL,
    ims-Parameters                          IMS-Parameters                                          OPTIONAL,
    fr1-Add-UE-NR-Capabilities-v1540        UE-NR-CapabilityAddFRX-Mode-v1540                       OPTIONAL,
    fr2-Add-UE-NR-Capabilities-v1540        UE-NR-CapabilityAddFRX-Mode-v1540                       OPTIONAL,
    fr1-fr2-Add-UE-NR-Capabilities          UE-NR-CapabilityAddFRX-Mode                             OPTIONAL,
    nonCriticalExtension                    UE-NR-Capability-v1550                                  OPTIONAL
}

UE-NR-Capability-v1550 ::=              SEQUENCE {
    reducedCP-Latency                       ENUMERATED {supported}                                  OPTIONAL,
    nonCriticalExtension                    UE-NR-Capability-v1560                                  OPTIONAL
}

UE-NR-Capability-v1560 ::=              SEQUENCE {
    nrdc-Parameters                         NRDC-Parameters                                         OPTIONAL,
    receivedFilters                         OCTET STRING (CONTAINING UECapabilityEnquiry-v1560-IEs)  OPTIONAL,
    nonCriticalExtension                    UE-NR-Capability-v1570                                  OPTIONAL
}

UE-NR-Capability-v1570 ::=              SEQUENCE {
    nrdc-Parameters-v1570                   NRDC-Parameters-v1570                                   OPTIONAL,
    nonCriticalExtension                    UE-NR-Capability-v1610                                  OPTIONAL
}

UE-NR-Capability-v1610 ::=              SEQUENCE {
    inDeviceCoexInd-r16                     ENUMERATED {supported}                                  OPTIONAL,
    dl-DedicatedMessageSegmentation-r16     ENUMERATED {supported}                                  OPTIONAL,
    nrdc-Parameters-v1610                   NRDC-Parameters-v1610                                   OPTIONAL,
    powSav-Parameters-r16                   PowSav-Parameters-r16                                   OPTIONAL,
    fr1-Add-UE-NR-Capabilities-v1610        UE-NR-CapabilityAddFRX-Mode-v1610                       OPTIONAL,
    fr2-Add-UE-NR-Capabilities-v1610        UE-NR-CapabilityAddFRX-Mode-v1610                       OPTIONAL,
    bh-RLF-Indication-r16                   ENUMERATED {supported}                                  OPTIONAL,
    directSN-AdditionFirstRRC-IAB-r16       ENUMERATED {supported}                                  OPTIONAL,
    bap-Parameters-r16                      BAP-Parameters-r16                                      OPTIONAL,
    referenceTimeProvision-r16              ENUMERATED {supported}                                  OPTIONAL,
    sidelinkParameters-r16                  SidelinkParameters-r16                                  OPTIONAL,
    highSpeedParameters-r16                 HighSpeedParameters-r16                                 OPTIONAL,
    mac-Parameters-v1610                    MAC-Parameters-v1610                                    OPTIONAL,
    mcgRLF-RecoveryViaSCG-r16               ENUMERATED {supported}                                  OPTIONAL,
    resumeWithStoredMCG-SCells-r16          ENUMERATED {supported}                                  OPTIONAL,
    resumeWithStoredSCG-r16                 ENUMERATED {supported}                                  OPTIONAL,
    resumeWithSCG-Config-r16                ENUMERATED {supported}                                  OPTIONAL,
    ue-BasedPerfMeas-Parameters-r16         UE-BasedPerfMeas-Parameters-r16                         OPTIONAL,
    son-Parameters-r16                      SON-Parameters-r16                                      OPTIONAL,
    onDemandSIB-Connected-r16               ENUMERATED {supported}                                  OPTIONAL,
    nonCriticalExtension                    SEQUENCE {}                                             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*.

– *UnlicensedParametersPerBand*

The IE *UnlicensedParametersPerBand* is used to convey unlicensed operation related parameters specific for a certain unlicensed band (not per feature set or band combination).

UnlicensedParametersPerBand information element

```
-- ASN1START
-- TAG-UNLICENSEDPARAMETERSPERBAND-START

UnlicensedParametersPerBand-r16 ::=           SEQUENCE {
    -- 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 10-10: 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 10-8: 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
    vcsi-RS-RRM-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 10-24: 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-UNLICENSEDPARAMETERSPERBAND-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_{RB}" 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
```

***EUTRA-MBSFN-SubframeConfig* field descriptions**
radioframeAllocationOffset Field as defined in *MBSFN-SubframeConfig* in TS 36.331 [10].
radioframeAllocationPeriod Field as defined in *MBSFN-SubframeConfig* in TS 36.331 [10], where *SFN* refers to the SFN of the NR serving cell.
subframeAllocation1 Field as defined in *MBSFN-SubframeConfig* in TS 36.331 [10], where the UE assumes the duplex mode (FDD or TDD) of the NR cell for which the *E-UTRA-MBSFN-SubframeConfig* is provided.
subframeAllocation2 Field as defined in *MBSFN-SubframeConfig-v1430* in TS 36.331 [10], where the UE assumes the duplex mode (FDD or TDD) of the NR cell for which the *E-UTRA-MBSFN-SubframeConfig* 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}                 OPTIONAL    -- Need N
}

-- 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-PRESENCEANTENNAPORT1-START

EUTRA-PresenceAntennaPort1 ::=              BOOLEAN

-- TAG-EUTRA-PRESENCEANTENNAPORT1-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
```

***IAB-IP-Address* field descriptions**
iPv4-Address This field is used to provide the allocated IPv4 address.
iPv6-Address This field is used to provide the allocated IPv6 address.
iPv6-Prefix 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
```

***LogMeasResultListBT* field descriptions**
bt-Addr   This field indicates the Bluetooth public address of the Bluetooth beacon as defined in TS 37.355 [49].
rssi-BT   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,
                                         tenthsofnanoseconds,
... },
```

```
    rttAccuracy-r16                 INTEGER (0..255)            OPTIONAL,
    ...
}

-- ASN1STOP
-- TAG-LOGMEASRESULTLISTWLAN-STOP
```

***LogMeasResultListWLAN* field descriptions**
Bssid   Basic Service Set Identifier (BSSID) defined in IEEE 802.11-2012 [50].
Hessid   Homogenous Extended Service Set Identifier (HESSID) defined in IEEE 802.11-2012 [50].
rssiWLAN   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.
rtt-WLAN   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].
rttValue   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].
rttUnits   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].
rttAccuracy   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].
Ssid   Service Set Identifier (SSID) defined in IEEE 802.11-2012 [50].
Wlan-Identifiers   Indicates the WLAN parameters used for identification of the WLAN for which the measurement results are applicable.

– *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
```

***OtherConfig* field descriptions**
candidateServingFreqListNR Indicates for each candidate NR serving cells, the center frequency around which UE is requested to report IDC issues.
connectedReporting 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.
delayBudgetReportingProhibitTimer Prohibit timer for delay budget reporting. Value in seconds. Value *s0* means prohibit timer is set to 0 seconds, value *s0dot4* means prohibit timer is set to 0.4 seconds, and so on.
drx-PreferenceConfig Configuration for the UE to report assistance information to inform the gNB about the UE's DRX preferences for power saving.
drx-PreferenceProhibitTimer Prohibit timer for DRX preferences assistance information reporting. 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.
idc-AssistanceConfig Configuration for the UE to report assistance information to inform the gNB about UE detected IDC problem.
maxBW-PreferenceConfig Configuration for the UE to report assistance information to inform the gNB about the UE's preferred bandwidth for power saving.
maxBW-PreferenceProhibitTimer Prohibit timer for preferred bandwidth assistance information reporting. 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.
maxCC-PreferenceConfig Configuration for the UE to report assistance information to inform the gNB about the UE's preferred number of carriers for power saving.
maxCC-PreferenceProhibitTimer Prohibit timer for preferred number of carriers assistance information reporting. 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.
maxMIMO-LayerPreferenceConfig Configuration for the UE to report assistance information to inform the gNB about the UE's preferred number of MIMO layers for power saving.
maxMIMO-LayerPreferenceProhibitTimer Prohibit timer for preferred number of number of MIMO layers assistance information reporting. 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.
minSchedulingOffsetPreferenceConfig Configuration for the UE to report assistance information to inform the gNB about the UE's preferred *minimumSchedulingOffset* value for cross-slot scheduling for power saving.
minSchedulingOffsetPreferenceProhibitTimer Prohibit timer for preferred *minimumSchedulingOffset* assistance information reporting. 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.
obtainCommonLocation Requests the UE to attempt to have detailed location information available using GNSS. NR configures the field if *includeCommonLocationInfo* is configured for one or more measurements.
overheatingAssistanceConfig Configuration for the UE to report assistance information to inform the gNB about UE detected internal overheating.
overheatingIndicationProhibitTimer Prohibit timer for overheating assistance information reporting. 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.
referenceTimePreferenceReporting If present, the field indicates the UE is configured to provide reference time assistance information.

releasePreferenceConfig Configuration for the UE to report assistance information to inform the gNB about the UE's preference to leave RRC_CONNECTED state.
releasePreferenceProhibitTimer Prohibit timer for release preference assistance information reporting. 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. Value *infinity* means that once a UE has reported a release preference, the UE cannot report a release preference again during the RRC connection.
sensorNameList Configuration for the UE to report measurements from specific sensors.
sl-AssistanceConfigNR 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-PHYSCELLIDUTRA-FDD-START

PhysCellIdUTRA-FDD-r16 ::=        INTEGER (0..511)

-- TAG-PHYSCELLIDUTRA-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 Barometeric 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
```

– *UEMeasurementsAvailable-r16*

The IE *UEMeasurementsAvailable* is used to indicate all relevant available indicators for UE mesurements.

UEMeasurementsAvailable information element

```
-- ASN1START
-- TAG-UEMeasurementsAvailable-START

UEMeasurementsAvailable-r16 ::=             SEQUENCE {
    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-UEMeasurementsAvailable-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 outside NR. 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
            }
        }
    }                                        OPTIONAL,
    timeSpent-r16            INTEGER (0..4095),
    ...
}

-- TAG-VISITEDCELLINFOLIST-STOP
-- ASN1STOP
```

***VisitedCellInfoList* field descriptions**
timeSpent   This field indicates the duration of stay in the cell or outside NR 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 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                               BWP-Id,
    sl-BWP-Generic-r16                      SL-BWP-Generic-r16                                  OPTIONAL,    -- Need M
    sl-BWP-PoolConfig-r16                   SL-BWP-PoolConfig-r16                               OPTIONAL,    -- Need M
    ...
}

SL-BWP-Generic-r16 ::=                  SEQUENCE {
    sl-BWP-r16                              BWP                                                 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.

***SL-BWP-Generic* field descriptions**
sl-LengthSymbols   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.
sl-StartSymbol   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.
sl-TxDirectCurrentLocation   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
```

***SL-BWP-ConfigCommon* field descriptions**
genericParameters   This field indicates the generic parameters on the configured sidelink BWP.
sl-BWP-PoolConfigCommon   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
```

***SL-BWP-Pool-Config* field descriptions**
sl-RxPool 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.
sl-TxPoolExceptional 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.
sl-TxPoolScheduling 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.
sl-TxPoolSelectedNormal 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
HO	This field is optionally present, need M, in an *RRCReconfiguration* message including *reconfigurationWithSync* for the handover case; otherwise it is absent, Need M.

– *SL-BWP-PoolConfigCommon*

The IE *SL-BWP-PoolConfigCommon* is used to configure 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 communicaition.

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 -_Common_*TxConfigList* 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.

***SL-PHY-MAC-RLC-Config* field descriptions**
NetworkControlledSyncTx 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.
sl-maxNumConsecutiveDTX 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.
sl-FreqInfoToAddModList 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.
sl-RLC-BearerToAddModList This field indicates one or multiple sidelink RLC bearer configurations.
sl-ScheduledConfig Indicates the configuration for UE to transmit NR sidelink communication based on network scheduling.
sl-CSI-Acquisition Indicates whether CSI reporting is enabled in sidelink unicast. If the field is absent, sidelink CSI reporting is disabled.
sl-CSI-SchedulingRequestId If present, it indicates the scheduling request configuration applicable for sidelink CSI report MAC CE, as specified in TS 38.321 [3].
sl-SSB-PriorityNR This field indicates the priority of NR sidelink SSB transmission and reception.

– *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 ::=           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                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
    }                                                                                          OPTIONAL, -- Need M
    ...
}

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 {ms0, ms100, ms200, ms300, ms400, ms500, ms600, ms700, ms800, ms900, ms1000},
    sl-PeriodCG2-r16                INTEGER (1..99)
}

-- TAG-SL-CONFIGUREDGRANTCONFIG-STOP
-- ASN1STOP
```

***SL- ConfiguredGrantConfig* field descriptions**
sl-ConfigIndexCG This field indicates the ID to identify configured grant for sidelink.
sl-CG-MaxTransNumList This field indicates the maximum number of times that a TB can be transmitted using the resources provided by the configured grant. *sl-Priority* corresponds to the logical channel priority.
sl-FreqResourceCG-Type1 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 (joinly encoded) as resource indicator (RIV), as defined in TS 38.214 [19].
sl-N1PUCCH-AN 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.
sl-NrOfHARQ-Processes This field indicates the number of HARQ processes configured for a specific configured grant. It applies for both Type 1 and Type 2.
sl-PeriodCG This field indicates the period of sidelink configured grant in the unit of ms.
sl-PSFCH-ToPUCCH -CG-Type1 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.
sl-StartSubchannelCG-Type1 This field indicates the starting sub-channel of sidelink configured grant Type 1. An index giving valid sub-channel index.
sl-TimeResourceCG-Type1 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-TimeOffsetCG-Type1 This field indicates the time offset related to SFN=0.

– *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
```

***SL-FreqConfig* field descriptions**
frequencyShift7p5khzSL 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.
sl-AbsoluteFrequencyPointA Absolute frequency of the reference resource block (Common RB 0). Its lowest subcarrier is also known as Point A.
sl-AbsoluteFrequencySSB Indicates the frequency location of sidelink SSB. The transmission bandwidth for sidelink SSB is within the bandwidth of this sidelink BWP.
sl-BWP-ToAddModList 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 conmunication.
sl-BWP-ToReleaseList This field indicates the list of sidelink BWP(s) on which the NR sidelink communication configuration is to be released.
sl-SCS-SpecificCarrierList 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 *SCS-SpecificCarrier* is allowed to be configured for NR sidelink conmunication.
sl-SyncPriority This field indicates synchronization priority order, as specified in sub-clause 5.8.6.
valueN 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                                          OPTIONAL, -- Need R
    frequencyShift7p5khzSL-r16       ENUMERATED {true}                                      OPTIONAL, -- Cond V2X-SL-Shared
    valueN-r16                       INTEGER (-1..1),
    sl-BWP-List-r16                  SEQUENCE (SIZE (1..maxNrofSL-BWPs-r16)) OF SL-BWP-ConfigCommon-r16  OPTIONAL, -- Need R
    sl-SyncPriority-r16              ENUMERATED {gnss, gnbEnb}                              OPTIONAL, -- Need R
    sl-NbAsSync-r16                  BOOLEAN                                                OPTIONAL, -- Need R
    sl-SyncConfigList-r16            SL-SyncConfigList-r16                                  OPTIONAL, -- Need R
    ...
}
```

```
-- TAG-SL-FREQCONFIGCOMMON-STOP
-- ASN1STOP
```

***SL-FreqConfigCommon* field descriptions**
frequencyShift7p5khzSL 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.
sl-AbsoluteFrequencyPointA Absolute frequency of the reference resource block (Common RB 0). Its lowest subcarrier is also known as Point A.
sl-AbsoluteFrequencySSB Indicates the frequency location of sidelink SSB. The transmission bandwidth for sidelink SSB is within the bandwidth of this sidelink BWP.
sl-BWP-List 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 conmunication.
sl-NbAsSync This field indicates whether the network can be selected as synchronization reference directly/indirectly only, if *sl-SyncPriority* is set to gnss. If this filed is set to TRUE, the network is enabled to be selected as synchronization reference directly/indirectly. The field is only present in *SL-PreconfigurationNR*. Otherwise it is absent.
sl-SyncPriority This field indicates synchronization priority order, as specified in sub-clause 5.8.6..
sl-SyncConfigList This field indicates the configuration by which the UE is allowed to receive and transmit synchronisation information for NR sidelink communication. Network configures *sl-SyncConfig* including *txParameters* when configuring UEs to transmit synchronisation information.
valueN 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-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 ::=            SEQUENCE {
    sl-Priority-r16                            INTEGER (1..8),
    sl-PrioritisedBitRate-r16                  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}                                                    OPTIONAL,   -- Need R
```

```
    sl-HARQ-FeedbackEnabled-r16             ENUMERATED {enabled, disabled }                                   OPTIONAL,   -- Need R
    sl-AllowedCG-List-r16                   SEQUENCE (SIZE (0.. maxNrofCG-SL-r16-1)) OF SL-ConfigIndexCG-r16
                                                                                                              OPTIONAL,   -- Need R
    sl-AllowedSCS-List-r16                  SEQUENCE (SIZE (1..maxSCSs)) OF SubcarrierSpacing                 OPTIONAL,   -- Need R
    sl-MaxPUSCH-Duration-r16                ENUMERATED {ms0p02, ms0p04, ms0p0625, ms0p125, ms0p25, ms0p5, spare2, spare1}
                                                                                                              OPTIONAL,   -- Need R
    sl-LogicalChannelGroup-r16              INTEGER (0..maxLCG-ID)                                            OPTIONAL,   -- Need R
    sl-SchedulingRequestId-r16              SchedulingRequestId                                               OPTIONAL,   -- Need R
    sl-LogicalChannelSR-DelayTimerApplied-r16 BOOLEAN                                                         OPTIONAL,   -- Need R
    ...
}
-- TAG-SL-LOGICALCHANNELCONFIG-STOP
-- ASN1STOP
```

***SL-LogicalChannelConfig field* descriptions**
sl-AllowedCG-List 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].
sl-AllowedSCS-List 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].
sl-BucketSizeDuration Value in ms. *ms5* corresponds to 5 ms, value *ms10* corresponds to 10 ms, and so on.
sl-ConfiguredGrantType1Allowed 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].
sl-HARQ-FeedbackEnabled 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 *disabled*, 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.
sl-LogicalChannelGroup ID of the sidelink logical channel group, as specified in TS 38.321 [3], which the sidelink logical channel belongs to.
sl-LogicalChannelSR-DelayTimerApplied Indicates whether to apply the delay timer for SR transmission for this sidelink logical channel. Set to false if *logicalChannelSR-DelayTimer* is not included in *sl-BSR-Config*.
sl-MaxPUSCH-Duration 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].
sl-PrioritisedBitRate Value in kiloBytes/s. Value *kBps0* corresponds to 0 kiloBytes/s, value *kBps8* corresponds to 8 kiloBytes/s, value *kBps16* corresponds to 16 kiloBytes/s, and so on. For SRBs, the value can only be set to *infinity*.
sl-Priority Sidelink logical channel priority, as specified in TS 38.321 [3].
sl-SchedulingRequestId If present, it indicates the scheduling request configuration applicable for this sidelink logical channel, as specified in TS 38.321 [3].

– *SL-MeasConfigCommon*

The IE *SL-MeasConfigCommon* is used to set the cell specific SL RSRP measurement configurations for unicast destionations.

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**
sl-MeasIdListCommon List of sidelink measurement identities
sl-MeasObjectListCommon List of sidelink measurement objects.
sl-QuantityConfigCommon Indicates the layer 3 filtering coefficient for sidelink measurement.
sl-ReportConfigListCommon 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-DestinationIndex-r16,
    sl-MeasConfig-r16                   SL-MeasConfig-r16,
    ...
}

SL-MeasConfig-r16 ::=               SEQUENCE {
    sl-MeasObjectToRemoveList-r16       SL-MeasObjectToRemoveList-r16                          OPTIONAL,   -- Need N
```

```
    sl-MeasObjectToAddModList-r16       SL-MeasObjectList-r16                                   OPTIONAL,   -- Need N
    sl-ReportConfigToRemoveList-r16     SL-ReportConfigToRemoveList-r16                         OPTIONAL,   -- Need N
    sl-ReportConfigToAddModList-r16     SL-ReportConfigList-r16                                 OPTIONAL,   -- Need N
    sl-MeasIdToRemoveList-r16           SL-MeasIdToRemoveList-r16                               OPTIONAL,   -- Need N
    sl-MeasIdToAddModList-r16           SL-MeasIdList-r16                                       OPTIONAL,   -- Need N
    sl-QuantityConfig-r16               SL-QuantityConfig-r16                                   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
```

***SL-MeasConfigInfo* field descriptions**
sl-MeasIdToAddModList List of sidelink measurement identities to add and/or modify.
sl-MeasIdToRemoveList List of sidelink measurement identities to remove.
sl-MeasObjectToAddModList List of sidelink measurement objects to add and/or modify.
sl-MeasObjectToRemoveList List of sidelink measurement objects to remove.
sl-QuantitiyConfig Indicates the layer 3 filtering coefficient for sidelink measurement.
sl-ReportConfigToAddModList List of sidelink measurement reporting configurations to add and/or modify.
sl-ReportConfigToRemoveList 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}                                  OPTIONAL, -- Cond Setup
    sl-PDCP-SN-Size-r16          ENUMERATED {len12bits, len18bits}                                              OPTIONAL, -- Cond Setup2
    sl-OutOfOrderDelivery         ENUMERATED { true }                                                           OPTIONAL,    -- Need R
    ...
}

-- TAG-SL-PDCP-CONFIG-STOP
-- ASN1STOP
```

***SL-PDCP-Config* field descriptions**
sl-DiscardTimer Value in ms of *discardTimer* specified in TS 38.323 [5]. Value *ms50* corresponds to 50 ms, value *ms100* corresponds to 100 ms and so on.
sl-OutOfOrderDelivery 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 radio bearer is established.
sl-PDCP-SN-Size 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 18bits is applicable.

Conditional Presence	Explanation
Setup	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.
Setup2	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
```

***SL-PSBCH-Config* field descriptions**
dl-Alpha-PSBCH Indicates alpha value for DL pathloss based power control for PSBCH. When the field is absent the UE applies the value 1
dl-P0-PSBCH 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
```

***SL-PSSCH-TxConfigList* field descriptions**
sl-MaxTxTransNumPSSCH Indicates the maximum transmission number (including new transmission and retransmission) for PSSCH.
sl-MaxTxPower This filed indicates the maximum transmission power for transmission on PSSCH and PSCCH.
sl-MinMCS-PSSCH, sl-MaxMCS-PSSCH This field indicates the minimum and maximum MCS values used for transmissions on PSSCH.
sl-MinSubChannelNumPSSCH, sl-MaxSubChannelNumPSSCH This field indicates the minimum and maximum number of sub-channels which may be used for transmissions on PSSCH.
sl-TypeTxSync This filed indicates the synchronization reference type. For configurations by the eNB/gNB, only gnbEnb can be configured; and for pre-configuration or when this filed is absent, the configuration is applicable for all synchronization reference types.
sl-ThresUE-Speed This filed indicates a UE absolute speed threshold.

Conditional Presence	Explanation
CBR	The field is optionally present, Need R, when in *SL-CBR-CommonTxConfigList* in *SL-UE-SelectedConfig* in *SIB12* or *SL-PreconfigurationNR*; 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 filed 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 a destination.

SL-QuantityConfig information element

```
-- ASN1START
-- TAG-SL-QUANTITYCONFIG-START

SL-QuantityConfig-r16 ::=               SEQUENCE {
    sl-FilterCoefficientDMRS-r16            FilterCoefficient                           DEFAULT fc4,
    ...
}

-- TAG-SL-QuantityConfig-STOP
-- ASN1STOP
```

***SL-QuantityConfig* field descriptions**
sl-FilterCoefficientDMRS DMRS based L3 filter configuration: Specifies L3 fitler configuration for sidelink RSRP measurment result from the L1 fiter(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 ::=     SEQUENCE {
    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
```

***SL-RadioBearerCoonfig* field descriptions**
sl-PDCP-Config This field indicates the PDCP parameters for the sidelink DRB.
sl-SDAP-Config This field indicates how to map sidelink QoS flows to sidelink DRB.
slrb-Uu-ConfigIndex This field indicates the index of sidelink DRB configuration.
sl-TransRange This field indicates the transmission range of the sidelink DRB. The unit is meter.

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-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 {
            s1-Threshold-r16                     SL-MeasTriggerQuantity-r16,
            sl-ReportOnLeave-r16                 BOOLEAN,
            sl-Hysteresis-r16                    Hysteresis,
            sl-TimeToTrigger-r16                 TimeToTrigger,
            ...
        },
        eventS2-r16                          SEQUENCE {
            s2-Threshold-r16                     SL-MeasTriggerQuantity-r16,
            sl-ReportOnLeave-r16                 BOOLEAN,
            sl-Hysteresis-r16                    Hysteresis,
            sl-TimeToTrigger-r16                 TimeToTrigger,
            ...
        },
        ...
    },
    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                          RSRP-Range,
    ...
}

SL-MeasTriggerQuantity-r16 ::=       CHOICE {
    sl-RSRP-r16                          RSRP-Range,
    ...
}
```

```
SL-RS-Type-r16 ::=                  ENUMERATED {dmrs, spare3, spare2, spare1}

-- TAG-SL-REPORTCONFIGLIST-STOP
-- ASN1STOP
```

***SL-ReportConfig* field descriptions**
sl-ReportType Type of the configured sidelink measurement report.

***SL-EventTriggerConfig* field descriptions**
sl-EventId Choice of sidelink measurement event triggered reporting criteria.
sl-ReportAmount Number of sidelink measurement reports applicable for *sl-EventTriggered* report type.
sl-ReportInterval Indicates the interval between periodical reports (i.e., when sl-ReportAmount exceeds 1) for *sl-EventTriggered* report type.
sl-ReportOnLeave indicates whether or not the UE shall initiate the sidelink measurement reporting procedure when the leaving condition is meet for a frequency in *sl-FrequencyTriggeredList*, as specified in 5.8.10.4.1.
sl-ReportQuantity The sidelink measurement quantities to be included in the sidelink measurement report.
sl-TimeToTrigger Time during which specific criteria for the event needs to be met in order to trigger a sidelink measurement report.
sN-Threshold Threshold used for events S1 and S2 specified in subclauses 5.8.10.4.2 and 5.8.10.4.3, respectively.

***SL-PeriodicReportConfig* field descriptions**
sl-ReportAmount Number of sidelink measurement reports applicable for *sl-Periodical* report type.
sl-ReportInterval Indicates the interval between periodical reports (i.e., when sl-ReportAmount exceeds 1) for *sl-Periodical* report type.
sl-ReportQuantity 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, pl1, pl2, pl3, pl4, pl5, pl6, pl7, pl8}           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 M
    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, 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 {sl0, sl1, sl2, sl4}                             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 {sl2, sl3}                                       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 ::=                  SEQUENCE {
    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 ::=          SEQUENCE {
    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 ::=        CHOICE {
    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 ::=        SEQUENCE {
    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 ::=           SEQUENCE {
    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 ::=            SEQUENCE {
    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 M
    sl-P0-PSSCH-PSCCH-r16      INTEGER (-16..15)                                                                  OPTIONAL,   -- Need M
    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 M
    dl-P0-PSFCH-r16            INTEGER (-16..15)                                                                  OPTIONAL,   -- Need M
    ...
}

-- TAG-SL-RESOURCEPOOL-STOP
-- ASN1STOP
```

***SL-ZoneConfigMCR* field descriptions**
sl-TransRange Indicates the communication range requirement for the corresponding *sl-ZoneConfigMCR-Index*.
sl-ZoneConfig Indicates the zone configuration for the corresponding *sl-ZoneConfigMCR-Index*.
sl-ZoneConfigMCR-Index Indicates the codepoint of the communication range requirement field in SCI.

***SL-ResourcePool* field descriptions**
sl-FilterCoefficient
This field indicates the filtering coefficient for long-term measurement and reference signal power derivation used for sideilnk open-loop power control.
sl-Additional-MCS-Table
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
sl-NumSubchannel
Indicates the number of subchannels in the corresponding resource pool, which consists of contiguous PRBs only.
sl-PreemptionEnable
Indiates whether pre-emption is disabled or enabled in a resource pool. If enabled, a priority level p_preemption can be optionally configured. If the pre-emption is enabled but p_preemption is not configured, pre-emption is applicable to all levels.
sl-PriorityThreshold-UL-URLLC
Indicates the threshold used to determine whether SL V2X transmission or PUCCH transmission carrying SL HARQ is prioritized over uplink transmission of priority index 1 if they overlap in time.
sl-PriorityThreshold
Indicates the threshold used to determine whether SL V2X transmission or PUCCH transmission carrying SL HARQ is prioritized over uplink transmission of priority index 0 if they overlap in time.
sl-RB-Number
Indicates the number of PRBs in the corresponding resource pool, which consists of contiguous PRBs only.
sl-StartRB-Subchannel
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.
sl-SubchannelSize
Indicates the minimum granularity in frequency domain for the sensing for PSSCH resource selection in the unit of PRB.
sl-SyncAllowed
Indicates the allowed synchronization reference(s) which is (are) allowed to use the configured resource pool.
sl-SyncConfigIndex
Indicates the synchronisation configuration that is associated with a reception pool, by means of an index to the corresponding entry *SL-SyncConfigList* of in *SIB12* for NR sidelink communication.
sl-TDD-Configuration
Indicates the TDD configuration associated with the reception pool of the cell indicated by *sl-SyncConfigIndex*.
sl-ThreshS-RSSI-CBR
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 n to (-112 + n*2) dBm, and so on.
sl-TimeResource
Indicates the bitmap of the resource pool, which is defined by repeating the bitmap with a periodicity during a SFN or DFN cycle.
sl-TimeWindowSizeCBR
Indicates the time window size for CBR measurement.
sl-TimeWindowSizeCR
Indicates the time window size for CR evaluation.
sl-TxPercentageList
Indicates the portion of candidate single-slot PSSCH resources over the toal resources. Value p20 corresponds to 20%, and so on.
sl-X-Overhead
Accounts for overhead from CSI-RS, PT-RS. If the field is absent, the UE applies value xOh0 (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 sumbols 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 *sl0*, 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 $1*2^{\mu}$, value n5 corresponds to $5*2^{\mu}$, and so on, where μ = 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 ::=                 SEQUENCE {
    sl-RLC-BearerConfigIndex-r16                SL-RLC-BearerConfigIndex-r16,
    sl-ServedRadioBearer-r16                    SLRB-Uu-ConfigIndex-r16                 OPTIONAL,   -- Cond LCH-SetupOnly
    sl-RLC-Config-r16                           SL-RLC-Config-r16                       OPTIONAL,   -- Cond LCH-Setup
    sl-MAC-LogicalChannelConfig-r16             SL-LogicalChannelConfig-r16             OPTIONAL,   -- Cond LCH-Setup
    ...
}

-- TAG-SL-RLC-BEARERCONFIG-STOP
-- ASN1STOP
```

***SL-RLC-BearerCoonfig* field descriptions**
sl-MAC-LogicalChannelConfig The field is used to configure MAC SL logical channel paramenters.
sl-RLC-BearerConfigIndex The Index of the RLC bearer configuration.
sl-RLC-Config Determines the RLC mode (UM, AM) and provides corresponding parameters.
sl-ServedRadioBearer Associates the sidelink RLC Bearer with an sidelink DRB. It Indicates the index of SL radio bearer configuration, which is corresponding to the RLC bearer configuration.

Conditional Presence	Explanation
LCH-Setup	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.
LCH-SetupOnly	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 ::=                  SEQUENCE {
    sl-RNTI-r16                                 RNTI-Value,
    mac-MainConfigSL-r16                        MAC-MainConfigSL-r16                                OPTIONAL,    -- Need M
    sl-Timing-Config-r16                        SL-TimingConfig-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 ::=                    SEQUENCE {
    sl-BSR-Config-r16                           BSR-Config                                          OPTIONAL,    -- Need M
    ul-PrioritizationThres-r16                  INTEGER (1..16)                                     OPTIONAL,    -- Need M
    sl-PrioritizationThres-r16                  INTEGER (1..8)                                      OPTIONAL,    -- Need M
    ...

}

SL-TimingConfig-r16 ::=                     SEQUENCE {
    sl-DCI-ToSL-Trans-r16                       ENUMERATED{ffs}                                     OPTIONAL,    -- Need M
    ...
}

SL-ConfiguredGrantConfigList-r16 ::=        SEQUENCE {
    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-MinMCS-PSSCH, sl-MaxMCS-PSSCH Indicate the MCS range for PSSCH transmission as specified in TS 38.214 [19, and apply to a sidelink grant as specified in TS 38.321 [3]]. If both *sl-MinMCS-PSSCH* and *sl-MaxMCS-PSSCH* are configured, UE autonomously selects the MCS from the configured values; If either *sl-MinMCS-PSSCH* or *sl-MaxMCS-PSSCH* is configured, UE uses the configured MCS value for PSSCH transmission; If neither *sl-MinMCS-PSSCH* nor *sl-MaxMCS-PSSCH* is configured, the selection of MCS is up to UE implementation.
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].

***SL-TimingConfig* field descriptions**
sl-DCI-ToSL-Trans Indicate the time gap between DCI reception and the first sidelink transmission scheduled by the DCI.

– *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-16      SEQUENCE (SIZE (1..maxNrofSL-QFIs-r16)) OF SL-QoS-FlowIdentity-r16  OPTIONAL     -- Need N
}

-- TAG-SL-SDAP-CONFIG-STOP
-- ASN1STOP
```

***SL-SDAP-Config* field descriptions**
sl-DefaultRB Indicates whether or not this is the default sidelink DRB for this NR sidelink communication transmission destination. Among all configured instances of *SL-SDAP-Config* with the same value of *sl-DestinationIdentity*, this field shall be set to *true* in at most one instance of *SL-SDAP-Config* and to *false* in all other instances.
sl-MappedQoS-Flows Indicates QoS flows to be mapped to the sidelink DRB. If the field is included in dedicated signalling, it is set to *sl-MappedQoS-FlowsListDedicated*; otherwise, it is set fo *sl-MappedQoS-FlowsList*.
sl-MappedQoS-FlowsList Indicates the list of SL QoS flows ID of the NR sidelink communication transmission destination mapped to this sidelink DRB.
sl-MappedQoS-FlowsToAddList Indicates the list of SL QoS flows ID of the NR sidelink communication transmission destination to be additionally mapped to this sidelink DRB.
sl-MappedQoS-FlowsToReleaseList 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.
sl-SDAP-Header 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 *sl-DefaultRB* is set to *true*.

– *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 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, n5, 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**
gnss-Sync 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.
sl-SyncRefMinHyst Hysteresis when evaluating a SyncRef UE using absolute comparison.
sl-SyncRefDiffHyst Hysteresis when evaluating a SyncRef UE using relative comparison.
s***yncInfoReserved*** Reserved for future use.
sl-NumSSB-WithinPeriod 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
sl-TimeOffsetSSB Indicates the slot offset from the start of sidelink SSB period to the first sidelink SSB.
sl-TimeInterval 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.
sl-SSID Indicates the ID of sidelink synchronization signal assoicated with different synchronization priorities.
SL-RSRP-Range 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.

– *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
```

***SL-ThresPSSCH-RSRP-List* field descriptions**
SL-ThresPSSCH-RSRP Value 0 corresponds to minus infinity dBm, value 1 corresponds to -128dBm, value 2 corresponds to -126dBm, value n corresponds to (-128 + (n-1)*2) dBm and so on, value 66 corresponds to infinity dBm.

– *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                   NULL,
    txPower-r16                         INTEGER (-30..33)
}

-- 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 ::=                SEQUENCE {
    sl-PSSCH-TxConfigList-r16                   SL-PSSCH-TxConfigList-r16                                   OPTIONAL,    -- Need R
    sl-ProbResourceKeep-r16                     ENUMERATED {v0, v0dot2, v0dot4, v0dot6, v0dot8}             OPTIONAL,    -- Need R
    sl-ReselectAfter-r16                        ENUMERATED {n1, n2, n3, n4, n5, n6, n7, n8, n9}             OPTIONAL,    -- Need R
    sl-CBR-CommonTxConfigList-r16               SL-CBR-CommonTxConfigList-r16                               OPTIONAL,    -- Need R
    ul-PrioritizationThres-r16                  INTEGER (1..16)                                             OPTIONAL,    -- Need R
    sl-PrioritizationThres-r16                  INTEGER (1..8)                                              OPTIONAL,    -- Need R
    ...
}

-- TAG-SL-UE-SELECTEDCONFIG-STOP
-- ASN1STOP
```

***SL-UE-SelectedConfig* field descriptions**
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].
sl-ProbResourceKeep 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]).
sl-PSSCH-TxConfigList Indicates PSSCH TX parameters [such as MCS, PRB number, retransmission number], associated to different UE absolute speeds [and different synchronization reference types] for UE autonomous resource selection.
sl-ReselectAfter Indicates the number of consecutive skipped transmissions before triggering resource reselection for sidelink communication (see 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].

– *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
```

***SL-ZoneConfig* field descriptions**
sl-ZoneLength   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 nuber 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               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 ::= 65536   -- 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 frequncy 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 frequncy 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 resoure pool for NR sidelink measurement to measure for
                                                            -- each measurement object (for CBR)
maxFreqSL-NR-r16                        INTEGER ::= 8       -- Maximum number of NR anchor carrier frequncy 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 establisghment
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 poolfor NR sidelink communication
maxNrofTXPool-r16                       INTEGER ::= 8       -- Maximum number of Tx resourcepoolfor 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               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 CandidateBeamRSListExt
maxNrofPCIsPerSMTC                      INTEGER ::= 64      -- Maximun 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 suppoted by the UE
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 identites 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
maxRAReport-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	***systemInfoModification*** If set to 1: indication of a BCCH modification other than SIB6, SIB7 and SIB8.
2	***etwsAndCmasIndication*** If set to 1: indication of an ETWS primary notification and/or an ETWS secondary notification and/or a CMAS notification.
3	***stopPagingMonitoring*** If set to 1: stop monitoring PDCCH occasions(s) for paging in this Paging Occasion.
4 – 8	Not used in this release of the specification, and shall be ignored by UE if received.

If *stopPagingMonitoring* bit is set to 1, the UE may stop monitoring PDCCH monitoring occasion(s) for paging in that Paging Occasion (PO) as specified in TS 38.304 [20].

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,
    SupportedBandCombinationListSidelink-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 ::=          SEQUENCE {
    sl-TDD-Config-r16                           BIT STRING (SIZE (12)),
```

```
    inCoverage-r16                          BOOLEAN,
    directFrameNumber-r16                   BIT STRING (SIZE (10)),
    slotIndex-r16                           BIT STRING (SIZE (7)),
    reservedBits-r16                        BIT STRING (SIZE (2))
}

-- 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 ::=               SEQUENCE {
    criticalExtensions                          CHOICE {
        measurementReportSidelink-r16               MeasurementReportSidelink-IEs-r16,
        criticalExtensionsFuture                    SEQUENCE {}
    }
}

MeasurementReportSidelink-IEs-r16 ::=       SEQUENCE {
    sl-measResults-r16                          SL-MeasResults-r16,
    lateNonCriticalExtension                    OCTET STRING                                    OPTIONAL,
    nonCriticalExtension                        SEQUENCE{}                                      OPTIONAL
}
```

```
SL-MeasResults-r16 ::=                  SEQUENCE {
    sl-MeasId-r16                           SL-MeasId-r16,
    sl-MeasResult-r16                       SL-MeasResult-r16,
    ...
}

SL-MeasResult-r16 ::=                   SEQUENCE {
    sl-ResultDMRS-r16                       SL-MeasQuantityResult-r16                   OPTIONAL,
    ...
}

SL-MeasQuantityResult-r16 ::=           SEQUENCE {
    sl-RSRP-r16                             RSRP-Range                                  OPTIONAL,
    ...
}

-- TAG-MEASUREMENTREPORTSIDELINK-STOP
-- ASN1STOP
```

***MeasurementReportSidelink* field descriptions**
sl-MeasId Identifies the sidelink measurement identity for which the reporting is being performed.
sl-MeasResult 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 ::=          SEQUENCE {
    rrc-TransactionIdentifier-r16           RRC-TransactionIdentifier,
    criticalExtensions                      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-PFI-r16       OPTIONAL, -- Need N
    sl-MappedQoS-FlowsToReleaseList-r16     SEQUENCE (SIZE (1.. maxNrofSL-QFIsPerDest-r16)) OF SL-PFI-r16       OPTIONAL, -- Need N
    ...
}

SL-PDCP-ConfigPC5-r16 ::=               SEQUENCE {
    sl-PDCP-SN-Size-r16                     ENUMERATED {len12bits, len18bits}                                   OPTIONAL, -- Need M
    sl-OutOfOrderDelivery                   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           LogicalChannelIdentity,
    ...
```

```
}

SL-PFI-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))
    }                                                                                   OPTIONAL, -- Need M
    sl-CSI-RS-FirstSymbol-r16               INTEGER (3..12)                             OPTIONAL, -- Need M
    ...
}

-- TAG-RRCRECONFIGURATIONSIDELINK-STOP
-- ASN1STOP
```

***RRCReconfigurationSidelink* field descriptions**
sl-CSI-RS-FreqAllocation Indicates the frequency domain position for sidelink CSI-RS.
sl-CSI-RS-FirstSymbol Indicates the position of first symbol of sidelink CSI-RS.
sl-Resetconfig Indicates that the full configuration should be applicable for the *RRCReconfigurationSidelink* message.
sl-LatencyBoundCSI-Report Indicate the latency bound of SL CSI report from the associated SL CSI triggering in terms of number of slots.
sl-LogicalChannelIdentity Indicates the identity of the sidelink logical channel.
sl-MappedQoS-FlowsToAddList Indicate the QoS flows to be mapped to the configured sidelink DRB. Each entry is indicated by the SL-PFI, which is used between UEs, as defined in TS 23.287 [55].
sl-MappedQoS-FlowsToReleaseList Indicate the QoS flows to be released from the configured sidelink DRB. Each entry is indicated by the SL-PFI, which is used between UEs, as defined in TS 23.287 [55].
sl-MeasConfig Indicates the sidelink measurement configuration for the unicast destination.
sl-OutOfOrderDelivery 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 radio bearer is established.
sl-PDCP-SN-Size Indicates the PDCP SN size of the configured 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 {
    ueCapabilityRequestFilterSidelink-r16   UE-CapabilityRequestFilterSidelink-r16          OPTIONAL, -- Need N
    ue-CapabilityInformationSidelink-r16     OCTET STRING                                   OPTIONAL,
    lateNonCriticalExtension                OCTET STRING                                    OPTIONAL,
    nonCriticalExtension                    SEQUENCE{}                                      OPTIONAL
}

-- TAG-UECAPABILITYENQUIRYSIDELINK-STOP
-- ASN1STOP
```

***UECapabilityEnquirySidelink-IEs* field descriptions**
ue-CapabilityInformationSidelink
This filed 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,
    supportedBandCombinationListSidelink-r16    SupportedBandCombinationListSidelink-r16                    OPTIONAL,
    lateNonCriticalExtension                    OCTET STRING                                                OPTIONAL,
    nonCriticalExtension                        SEQUENCE{}                                                  OPTIONAL
}

AccessStratumReleaseSidelink-r16 ::= ENUMERATED { rel16, spare7, spare6, spare5, spare4, spare3, spare2, spare1, ... }

PDCP-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,
    ...
```

```
}

-- TAG-UECAPABILITYINFORMATIONSIDELINK-STOP
-- ASN1STOP
```

– *UE-CapabilityRequestFilterSidelink*

The IE *UE-CapabilityRequestFilterSidelink* is used to request filtered UE capabilities.

UE-CapabilityRequestFilterSidelink information element

```
-- ASN1START
-- TAG-UE-CAPABILITYREQUESTFILTERSIDELINK-START

UE-CapabilityRequestFilterSidelink-r16 ::=      SEQUENCE {
    frequencyBandListFilterSidelink-r16             FreqBandList                OPTIONAL,   -- Need N
    nonCriticalExtension                            SEQUENCE {}                 OPTIONAL
}

-- TAG-UE-CAPABILITYREQUESTFILTERSIDELINK-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 *RRCSetupRequest.*	Upon reception of *RRCSetup* or *RRCReject* 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 *RRCReestabilshmentRequest*	Upon reception of *RRCReestablishment* or *RRCSetup* message as well as when the selected cell becomes unsuitable	Go to RRC_IDLE
T302	Upon reception of *RRCReject* while performing RRC connection establishment or resume, upon reception of *RRCRelease* with *waitTime*.	Upon entering RRC_CONNECTED or RRC_IDLE, upon cell re-selection and upon reception of *RRCReject* message.	Inform upper layers about barring alleviation as specified in 5.3.14.4
T304	Upon reception of *RRCReconfiguration* message including *reconfigurationWithSync* or upon conditional reconfiguration execution i.e. when applying a stored *RRCReconfiguration* message including *reconfigurationWithSync*.	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 *reconfigurationWithSync* for that cell group, upon reception of *MobilityFromNRCommand*, upon the reconfiguration of *rlf-TimersAndConstant,* upon initiating the connection re-establishment procedure, 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
T312	If T312 is configured in MCG: Upon triggering a measurement report for a measurement identity for which T312 has been configured and *useT312* has been set to true, while T310 in PCell is running. If T312 is configured in SCG and *useT312* 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.	Upon receiving N311 consecutive in-sync indications from lower layers for the SpCell, receiving *RRCReconfiguration* with *reconfigurationWithSync* for that cell group, upon initiating the connection re-establishment procedure, upon the reconfiguration of *rlf-TimersAndConstant*, upon initiating the MCG failure information procedure, and upon the expiry of T310 in corresponding SpCell. Upon SCG release, if the T312 is kept in SCG	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. 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.
T316	Upon transmission of the *MCGFailureInformation* message	Upon receiving *RRCRelease*, *RRCReconfiguration* with *reconfigurationwithSync* for the PCell, *MobilityFromNRCommand,* or upon initiating the re-establishment procedure	Perform the actions as specified in 5.7.3b.5.

Timer	Start	Stop	At expiry
T319	Upon transmission of *RRCResumeRequest* or *RRCResumeRequest1.*	Upon reception of *RRCResume, RRCSetup, RRCRelease, RRCRelease* with *suspendConfig* or *RRCReject* message, cell re-selection and upon abortion of connection establishment by upper layers.	Perform the actions as specified in 5.3.13.5.
T320	Upon reception of *t320* 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 *RRCRelease*, 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 *measConfig* including a *reportConfig* with the purpose set to *reportCGI*	Upon acquiring the information needed to set all fields of *cgi-info*, upon receiving *measConfig* that includes removal of the *reportConfig* with the *purpose* set to *reportCGI* and upon detecting that a cell is not broadcasting SIB1.	Initiate the measurement reporting procedure, stop performing the related measurements.
T322	Upon receving *measConfig* including *reportConfigNR* with the purpose set to *reportSFTD* and *drx-SFTD-NeighMeas* is set to *true*.	Upon acquiring the SFTD measurement results, upon receiving *measConfig* that includes removal of the *reportConfig* with the *purpose* set to *reportSFTD*.	Initiate the measurement reporting procedure, stop performing the related measurements.
T325	Upon reception of *RRCRelease* message with *deprioritisationTimer*.		Stop deprioritisation of all frequencies or NR signalled by *RRCRelease.*
T330	Upon receiving *LoggedMeasurementConfiguration* message	Upon log volume exceeding the suitable UE memory, upon initiating the release of *LoggedMeasurementConfiguration* procedure	Perform the actions specified in 5.5a.1.4

Timer	Start	Stop	At expiry
T331	Upon receiving *RRCRelease* message with *measIdleDuration*	Upon receiving *RRCSetup, RRCResume*, *RRCRelease* with idle/inactive measurement configuration, upon cell selection/reselection to a cell that does not belong to the *validityArea* (if configured), or upon cell re-selection to another RAT.	Perform the actions as specified in 5.7.8.3.
T342	Upon transmitting *UEAssistanceInformation* message with *DelayBudgetReport*.	Upon initiating the connection re-establishment/resume procedures, and upon receiving *delayBudgetReportingConfig* set to *release.*	No action.
T345	Upon transmitting *UEAssistanceInformation* message with *overheatingAssistance*	Upon initiating the connection re-establishment procedure and upon initiating the connection resumption procedure	No action.
T346a	Upon transmitting *UEAssistanceInformation* message with *drx-Preference*. The UE maintains one instance of this timer per cell group.	Upon initiating the connection re-establishment/resume procedures, and upon receiving *drx-PreferenceConfig* set to *release.*	No action.
T346b	Upon transmitting *UEAssistanceInformation* message with *maxBW-Preference*. The UE maintains one instance of this timer per cell group.	Upon initiating the connection re-establishment/resume procedures, and upon receiving *maxBW-PreferenceConfig* set to *release.*	No action.
T346c	Upon transmitting *UEAssistanceInformation* message with *maxCC-Preference*. The UE maintains one instance of this timer per cell group.	Upon initiating the connection re-establishment/resume procedures, and upon receiving *maxCC-PreferenceConfig* set to *release.*	No action.
T346d	Upon transmitting *UEAssistanceInformation* message with *maxMIMO-LayerPreference*. The UE maintains one instance of this timer per cell group.	Upon initiating the connection re-establishment/resume procedures, and upon receiving *maxMIMO-LayerPreferenceConfig* set to *release.*	No action.

Timer	Start	Stop	At expiry
T346e	Upon transmitting *UEAssistanceInformation* message with *minSchedulingOffsetPreference*. The UE maintains one instance of this timer per cell group.	Upon initiating the connection re-establishment/resume procedures, and upon receiving *minSchedulingOffsetPreferenceConfig* set to *release.*	No action.
T346f	Upon transmitting *UEAssistanceInformation* message with *releasePreference*.	Upon initiating the connection re-establishment/resume procedures, and upon receiving *releasePreferenceConfig* set to *release.*	No action.
T350	Upon transmitting *DedicatedSIBRequest* message with *requestedSIB-List* and/or *requestedPosSIB-List*.	Upon acquiring the requested SIB(s) or posSIB(s), upon initiating the connection re-establishment procedures, upon receiving *onDemandSIB-Request* set to release, or upon successful change of PCell while in RRC_CONNECTED.	No action
T380	Upon reception of t380 in *RRCRelease.*	Upon reception of *RRCResume*, *RRCSetup* or *RRCRelease*.	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 *RRCReconfiguration* including *reconfigurationWithSync*, upon change of PCell while in RRC_CONNECTED, upon reception of *MobilityFromNRCommand*, or upon reception of *RRCRelease*.	Perform the actions as specified in 5.3.14.4.
T400	Upon transmission of RRCReconfigurationSidelink	Upon reception of RRCReconfigurationFailureSidelink or RRCReconfigurationCompleteSidelink	Perform the sidelink RRC reconfiguration failure procedure as specified in 5.8.9.1.4

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 *RRCReconfiguration* with *reconfigurationWithSync* 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 *RRCReconfiguration* with *reconfigurationWithSync* 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-VARCONNESTFAILREPORT-START

VarConnEstFailReport-r16 ::= SEQUENCE {
    connEstFailReport-r16        ConnEstFailReport-r16,
    plmn-Identity-r16            PLMN-Identity
}

-- TAG-VARCONNESTFAILREPORT-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 {
    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,
    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                           SL-MeasIdList-r16                       OPTIONAL,
    -- NR sidelink measurement objects
    sl-MeasObjectList-r16                       SL-MeasObjectList-r16                   OPTIONAL,
    -- NR sidelink reporting configurations
    sl-reportConfigList-r16                     SL-ReportConfigList-r16                 OPTIONAL,
    -- Other parameters
    sl-QuantityConfig-r16                       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 ::=                SEQUENCE {
    pendingRNA-Update                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-IdentityList-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
```

***VarShortMAC-Input* field descriptions**
targetCellIdentity An input variable used to calculate the *shortMAC-I*. Set to the *cellIdentity* of the first *PLMN-Identity* in the *PLMN-IdentityInfoList* broadcasted in *SIB1* of the target cell i.e. the cell the UE is trying to reestablish the connection.
source-c-RNTI Set to C-RNTI that the UE had in the PCell it was connected to prior to the reestablishment.
sourcePhysCellId 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.

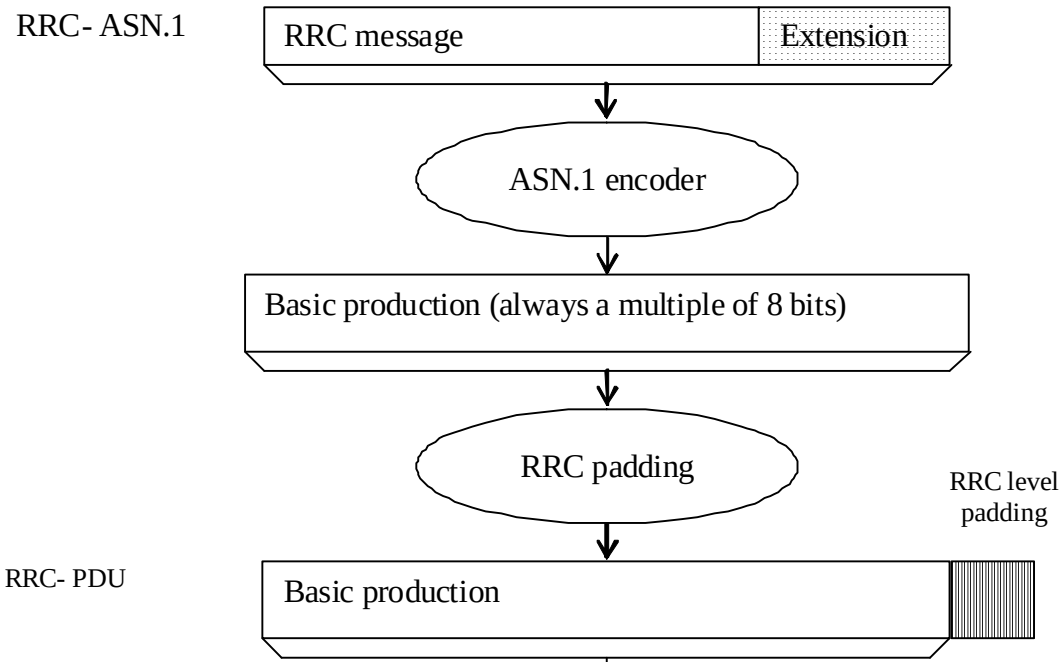

Figure 8.5-1: RRC level padding

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	18		
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	18	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		
PDCP-Config *>t-Reordering*	 infinity				
RLC-Config CHOICE	Am				
ul-RLC-Config *>sn-FieldLength* *>t-PollRetransmit* *>pollPDU* *>pollByte* *>maxRetxThreshold*	 size12 ms45 infinity infinity t8				
dl-RLC-Config *>sn-FieldLength* *>t-Reassembly* *>t-StatusProhibit*	 size12 ms35 ms0				
logicalChannelIdentity	1	2	3		
LogicalChannelConfig					
>priority	1	3	1		
>prioritisedBitRate	infinity				
>logicalChannelGroup	0				

9.2.2 Default MAC Cell Group configuration

Parameters

Name	Value	Semantics description	Ver
MAC Cell Group configuration			
bsr-Config			
>periodicBSR-Timer	sf10		
>retxBSR-Timer	sf80		
phr-Config			
>phr-PeriodicTimer	sf10		
>phr-ProhibitTimer	sf10		
>phr-Tx-PowerFactorChange	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.

SL-PreconfigurationNR information elements

```
-- ASN1START
-- TAG-SL-PRECONFIGURATIONNR-START

SL-PreconfigurationNR-r16 ::=            SEQUENCE {
    sidelinkPreconfigNR-r16                  SidelinkPreconfigNR-r16,
    ...
}

SidelinkPreconfigNR-r16 ::=                SEQUENCE {
```

```
    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 ::=                SEQUENCE {
    sl-TDD-Configuration-r16                   TDD-UL-DL-ConfigCommon                                                OPTIONAL,
    reservedBits-r16                           BIT STRING (SIZE (2))                                                 OPTIONAL,
    ...
}

SL-RoHC-Profiles-r16 ::=              SEQUENCE {
    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
```

***SL-PreconfigurationNR* field descriptions**
sl-OffsetDFN 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.
sl-PreconfigEUTRA-AnchorCarrierFreqList This field indicates the EUTRA anchor carrier frequency list, which can provide the NR sidelink communication configuration.
sl-PreconfigFreqInfoList 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.
sl-PreconfigNR-AnchorCarrierFreqList This field indicates the NR anchor carrier frequency list, which can provide the NR sidelink communication configuration.
sl-RadioBearerPreConfigList This field indicates one or multiple sidelink radio bearer configurations.
sl-RLC-BearerPreConfigList This field indicates one or multiple sidelink RLC bearer configurations.
sl-RoHC-Profiles This field indicates the supported RoHC profiles for NR sidelink communications.
sl-SSB-PriorityNR This field indicates the priority of NR sidelink SSB transmission and reception.

– 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)) OFItemInfo

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 additon group is not regarded as a level on its own. E.g. in the ASN.1 extract in the previous, a error regarding the conditionality of *field3* would result in the entire itemInfo entry to be ignored (rather than just the extension addition group containing *field3* and *field4*);

- a traditional *nonCriticalExtension* is not regarded as a level on its own. E.g. in the ASN.1 extract in the previous, 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
```

***HandoverCommand* field descriptions**
handoverCommandMessage Contains the *RRCReconfiguration* 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 ::=                           SEQUENCE {
    rrcReconfiguration                      OCTET STRING (CONTAINING RRCReconfiguration),
    ...,
    [[
    sourceRB-SN-Config                      OCTET STRING (CONTAINING RadioBearerConfig)     OPTIONAL,
    sourceSCG-NR-Config                     OCTET STRING (CONTAINING RRCReconfiguration)    OPTIONAL,
    sourceSCG-EUTRA-Config                  OCTET STRING                                    OPTIONAL
    ]],
    [[
    sourceSCG-Configured                    ENUMERATED {true}                               OPTIONAL
    ]]

}

AS-Context ::=                          SEQUENCE {
    reestablishmentInfo                     ReestablishmentInfo                             OPTIONAL,
    configRestrictInfo                      ConfigRestrictInfoSCG                           OPTIONAL,
    ...,
    [[  ran-NotificationAreaInfo            RAN-NotificationAreaInfo                        OPTIONAL
    ]],
    [[  ueAssistanceInformation             OCTET STRING (CONTAINING UEAssistanceInformation)  OPTIONAL   -- Cond HO2
    ]],
    [[
    selectedBandCombinationSN               BandCombinationInfoSN                           OPTIONAL
    ]],
    [[
    configRestrictInfoDAPS-r16              ConfigRestrictInfoDAPS-r16                      OPTIONAL,
    sidelinkUEInformationNR-r16             OCTET STRING                                    OPTIONAL,
    sidelinkUEInformationEUTRA-r16          OCTET STRING                                    OPTIONAL,
    ueAssistanceInformationEUTRA-r16        OCTET STRING                                    OPTIONAL,
    ueAssistanceInformationSCG-r16          OCTET STRING (CONTAINING UEAssistanceInformation)  OPTIONAL,   -- Cond HO2
    needForGapsInfoNR-r16                   NeedForGapsInfoNR-r16                           OPTIONAL
    ]]
}

ConfigRestrictInfoDAPS-r16 ::=          SEQUENCE {
    powerCoordination-r16                   SEQUENCE {
        p-DAPS-Source-r16                       P-Max,
        p-DAPS-Target-r16                       P-Max,
        uplinkPowerSharingDAPS-Mode-r16          ENUMERATED {semi-static-mode1, semi-static-mode2, dynamic }
    }                                                                                       OPTIONAL
}

ReestablishmentInfo ::=             SEQUENCE {
    sourcePhysCellId                        PhysCellId,
    targetCellShortMAC-I                    ShortMAC-I,
    additionalReestabInfoList               ReestabNCellInfoList                            OPTIONAL
}

ReestabNCellInfoList ::=             SEQUENCE ( SIZE (1..maxCellPrep) ) OF ReestabNCellInfo

ReestabNCellInfo::= SEQUENCE{
```

```
    cellIdentity                        CellIdentity,
    key-gNodeB-Star                     BIT STRING (SIZE (256)),
    shortMAC-I                          ShortMAC-I
}

RRM-Config ::=              SEQUENCE {
    ue-InactiveTime             ENUMERATED {
                                    s1, s2, s3, s5, s7, s10, s15, s20,
                                    s25, s30, s40, s50, min1, min1s20, min1s40,
                                    min2, min2s30, min3, min3s30, min4, min5, min6,
                                    min7, min8, min9, min10, min12, min14, min17, min20,
                                    min24, min28, min33, min38, min44, min50, hr1,
                                    hr1min30, hr2, hr2min30, hr3, hr3min30, hr4, hr5, hr6,
                                    hr8, hr10, hr13, hr16, hr20, day1, day1hr12, day2,
                                    day2hr12, day3, day4, day5, day7, day10, day14, day19,
                                    day24, day30, dayMoreThan30}                    OPTIONAL,
    candidateCellInfoList       MeasResultList2NR                                   OPTIONAL,
    ...,
    [[
    candidateCellInfoListSN-EUTRA      MeasResultServFreqListEUTRA-SCG              OPTIONAL
    ]]
}

-- TAG-HANDOVER-PREPARATION-INFORMATION-STOP
-- ASN1STOP
```

***HandoverPreparationInformation* field descriptions**
as-Context Local RAN context required by the target gNB or DU.
configRestrictInfoDAPS Includes fields for which souce cell explictly indicates the restriction to be observed by target cell during DAPS handover.
rrm-Config Local RAN context used mainly for RRM purposes.
sourceConfig The radio resource configuration as used in the source cell.
ue-CapabilityRAT-List 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.
ue-InactiveTime Duration while UE has not received or transmitted any user data. Thus the timer is still running in case e.g., UE measures the neighbour cells for the HO purpose. Value *s1* corresponds to 1 second, *s2* corresponds to 2 seconds and so on. Value *min1* corresponds to 1 minute, value *min1s20* corresponds to 1 minute and 20 seconds, value *min1s40* corresponds to 1 minute and 40 seconds and so on. Value *hr1* corresponds to 1 hour, *hr1min30* corresponds to 1 hour and 30 minutes and so on.

***AS-Config* field descriptions**
rrcReconfiguration Contains the *RRCReconfiguration* configuration as generated entirely by the MN.
sourceRB-SN-Config Contains the IE *RadioBearerConfig* as generated entirely by the SN. This field is only used when the UE is configured with SN terminated RB(s).
sourceSCG-Configured Value *true* 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 *sourceSCG-NR-Config* and *sourceSCG-EUTRA-Config* are absent.
sourceSCG-EUTRA-Config Contains the current dedicated SCG configuration in *RRCConnectionReconfiguration* message as specified in TS 36.331 [10] and generated entirely by the SN. In this version of the specification, the E-UTRA *RRCConnectionReconfiguration* message can only include the field *scg-Configuration* . This field is only used in NE-DC.
sourceSCG-NR-Config Contains the current dedicated SCG configuration in *RRCReconfiguration* message as generated entirely by the SN. In this version of the specification, the *RRCReconfiguration* message can only include fields *secondaryCellGroup* and *measConfig*. This field is only used in NR-DC.

***AS-Context* field descriptions**
needForGapsInfoNR Includes measurement gap requirement information of the UE for NR target bands.
selectedBandCombinationSN Indicates the band combination selected by SN in (NG)EN-DC, NE-DC, and NR-DC.
sidelinkUEInformationEUTRA This field includes *SidelinkUEInformation* IE as specified in TS 36.331 [10].
sidelinkUEInformationNR This field includes *SidelinkUEInformationNR* IE.
ueAssistanceInformation Includes for each UE assistance feature the information last reported by the UE, if any.
ueAssistanceInformationSCG Includes for each UE assistance feature associated with the SCG, the information last reported by the UE for the SCG, if any.

***RRM-Config* field descriptions**
candidateCellInfoList A list of the best cells on each frequency for which measurement information was available
candidateCellInfoListSN-EUTRA 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.

Conditional Presence	Explanation
HO	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.
HO2	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 capabilites	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 *radioBearerConfig* is included in the *RRCReconfiguration*.	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 ::=                   SEQUENCE {
    criticalExtensions                  CHOICE {
        c1                                  CHOICE{
            cg-Config                           CG-Config-IEs,
            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 ::=             SEQUENCE {
    pSCellFrequency                     ARFCN-ValueNR                               OPTIONAL,
    reportCGI-RequestNR                 SEQUENCE {
        requestedCellInfo                   SEQUENCE {
            ssbFrequency                        ARFCN-ValueNR,
            cellForWhichToReportCGI             PhysCellId
        }                                                                           OPTIONAL
    }                                                                               OPTIONAL,
    ph-InfoSCG                          PH-TypeListSCG                              OPTIONAL,
    nonCriticalExtension                CG-Config-v1560-IEs                         OPTIONAL
}

CG-Config-v1560-IEs ::=             SEQUENCE {
    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
        }                                                                           OPTIONAL
    }                                                                               OPTIONAL,
    nonCriticalExtension                CG-Config-v1590-IEs                         OPTIONAL
}

CG-Config-v1590-IEs ::=             SEQUENCE {
    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 ::=             SEQUENCE {
    drx-InfoSCG2                        DRX-Info2                                   OPTIONAL,
    nonCriticalExtension                SEQUENCE {}                                 OPTIONAL
}

PH-TypeListSCG ::=                  SEQUENCE (SIZE (1..maxNrofServingCells)) OF PH-InfoSCG

PH-InfoSCG ::=                      SEQUENCE {
    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
    ]]
}

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

-- TAG-CG-CONFIG-STOP
-- ASN1STOP
```

***CG-Config* field descriptions**
candidateCellInfoListSN Contains information regarding cells that the source secondary node suggests the target secondary gNB to consider configuring.
candidateCellInfoListSN-EUTRA Includes the *MeasResultList3EUTRA* 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.
candidateServingFreqListNR, candidateServingFreqListEUTRA Indicates frequencies of candidate serving cells for In-Device Co-existence Indication (see TS 36.331 [10]).
configRestrictModReq 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.
drx-ConfigSCG This field contains the complete DRX configuration of the SCG. This field is only used in NR-DC.
drx-InfoSCG This field contains the DRX long and short cycle configuration of the SCG. This field is used in (NG)EN-DC and NE-DC.
drx-InfoSCG2 This field contains the drx-onDurationTimer configuration of the SCG. This field is only used in (NG)EN-DC.
fr-InfoListSCG Contains information of FR information of serving cells that include PScell and SCells configured in SCG.
measuredFrequenciesSN Used by SN to indicate a list of frequencies measured by the UE.
needForGaps In NE-DC, indicates wheter the SN requests gNB to configure measurements gaps.
ph-InfoSCG Power headroom information in SCG that is needed in the reception of PHR MAC CE of MCG
ph-SupplementaryUplink 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 configued for a serving cell and one UL carrier reports type1 PH while the other reports type 3 PH.
ph-Type1or3 Type of power headroom for a certain serving cell in SCG (PSCell and activated SCells). Value *type1* refers to type 1 power headroom, value *type3* refers to type 3 power headroom. (See TS 38.321 [3]).
ph-Uplink Power headroom information for uplink.
pSCellFrequency, pSCellFrequencyEUTRA Indicates the frequency of PSCell in NR (i.e., *pSCellFrequency*) or E-UTRA (i.e., *pSCellFrequencyEUTRA*). In this version of the specification, *pSCellFrequency* is not used in NE-DC whereas *pSCellFrequencyEUTRA* is only used in NE-DC.
reportCGI-RequestNR, reportCGI-RequestEUTRA Used by SN to indicate to MN about configuring *reportCGI* procedure. The request may optionally contain information about the cell for which SN intends to configure *reportCGI* procedure. In this version of the specification, the *reportCGI-RequestNR* is used in (NG)EN-DC and NR-DC whereas *reportCGI-RequestEUTRA* is used only for NE-DC.
requestedBC-MRDC Used to request configuring a band combination and corresponding feature sets which are forbidden to use by MN (i.e. outside of the *allowedBC-ListMRDC*) to allow re-negotiation of the UE capabilities for SCG configuration.
requestedMaxInterFreqMeasIdSCG Used to request the maximum number of allowed measurement identities to configure for inter-frequency measurement. This field is only used in NR-DC.

requestedMaxIntraFreqMeasIdSCG
Used to request the maximum number of allowed measurement identities to configure for intra-frequency measurement on each serving frequency.

requestedPDCCH-BlindDetectionSCG
Requested value of the reference number of cells for PDCCH blind detection allowed to be configured for the SCG.

requestedP-MaxEUTRA
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.

requestedP-MaxFR1
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.

requestedP-MaxFR2
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.

scellFrequenciesSN-EUTRA, scellFrequenciesSN-NR
Indicates the frequency of all SCells configured in SCG. The field *scellFrequenciesSN-EUTRA* is used in NE-DC; the field *scellFrequenciesSN-NR* is used in (NG)EN-DC and NR-DC. In (NG)EN-DC, the field is optionally provided to the MN.

scg-CellGroupConfig
Contains the *RRCReconfiguration* message (containing only *secondaryCellGroup* and/or *measConfig* and/or *otherConfig*):
- 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 *RRCReconfiguration* message in accordance with clause 6 e.g. regarding the "Need" or "Cond" statements.

or

- 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 *RRCReconfiguration* message in accordance with clause 11.2.3.

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.

scg-CellGroupConfigEUTRA
Includes the E-UTRA *RRCConnectionReconfiguration* message as specified in TS 36.331 [10]. In this version of the specification, the E-UTRA RRC message can only include the field *scg-Configuration*. 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.

scg-RB-Config
Contains the IE *RadioBearerConfig*:
- 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 *RadioBearerConfig* in accordance with clause 6, e.g. regarding the "Need" or "Cond" statements.

or

- 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 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 *RadioBearerConfig* in accordance with clause 11.2.3.

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 RB (re)configuration.

selectedBandCombination
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 *allowedBC-ListMRDC*)

***BandCombinationInfoSN* field descriptions**
bandCombinationIndex In case of NR-DC, this field indicates the position of a band combination in the *supportedBandCombinationList*. In case of NE-DC, this field indicates the position of a band combination in the *supportedBandCombinationList* and/or *supportedBandCombinationListNEDC-Only*. In case of (NG)EN-DC, this field indicates the position of a band combination in the *supportedBandCombinationList* and/or *supportedBandCombinationList-UplinkTxSwitch*. Band combination entries in *supportedBandCombinationList* are referred by an index which corresponds to the position of a band combination in the *supportedBandCombinationList*. Band combination entries in *supportedBandCombinationListNEDC-Only* are referred by an index which corresponds to the position of a band combination in the *supportedBandCombinationListNEDC-Only* increased by the number of entries in *supportedBandCombinationList*. Band combination entries in *supportedBandCombinationList-UplinkTxSwitch* are referred by an index which corresponds to the position of a band combination in the *supportedBandCombinationList-UplinkTxSwitch* increased by the number of entries in *supportedBandCombinationList*.
requestedFeatureSets The position in the *FeatureSetCombination* which identifies one *FeatureSetUplink/Downlink* for each band entry in the associated band combination

– *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             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
    }                                                                                       OPTIONAL,
    servCellIndexRangeSCG           SEQUENCE {
        lowBound                        ServCellIndex,
        upBound                         ServCellIndex
    }                                                                                       OPTIONAL,   -- Cond SN-AddMod
    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
    }                                                                                       OPTIONAL,
    nrdc-PC-mode-FR1-r16    ENUMERATED {semi-static-mode1, semi-static-mode2, dynamic}      OPTIONAL,
    nrdc-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
    ]]
}

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-Type1or3                         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, utra-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
```

***CG-ConfigInfo* field descriptions**
alignedDRX-Indication
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).
allowedBC-ListMRDC
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 *supportedBandCombinationList* and *supportedBandCombinationList-UplinkTxSwitch* in the *UE-MRDC-Capability* (in case of (NG)EN-DC), or according to *supportedBandCombinationList* and *supportedBandCombinationListNEDC-Only* in the *UE-MRDC-Capability* (in case of NE-DC), or according to *supportedBandCombinationList* in the UE-NR-Capability (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.
allowedReducedConfigForOverheating
Indicates the reduced configuration that the SCG is allowed to configure. *reducedMaxCCs* in *allowedReducedConfigForOverheating* 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. *reducedMaxBW-FR1* and *reducedMaxBW-FR2* in *allowedReducedConfigForOverheating* 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. *reducedMaxMIMO-LayersFR1* and *reducedMaxMIMO-LayersFR2* in *allowedReducedConfigForOverheating* 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.
candidateCellInfoListMN, ***candidateCellInfoListSN***
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 *candidateCellInfoListMN* is not supported in this version of the specification. For NR-DC, including SSB and/or CSI-RS measurement results in *candidateCellInfoListMN* is supported.
candidateCellInfoListMN-EUTRA, ***candidateCellInfoListSN-EUTRA***
Includes the *MeasResultList3EUTRA* 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.
configRestrictInfo
Includes fields for which SgNB is explictly indicated to observe a configuration restriction.
drx-ConfigMCG
This field contains the complete DRX configuration of the MCG. This field is only used in NR-DC.
drx-InfoMCG
This field contains the DRX long and short cycle configuration of the MCG. This field is used in (NG)EN-DC and NE-DC.
drx-InfoMCG2
This field contains the *drx-onDurationTimer* configuration of the MCG and a DRX alignment indication. This field is only used in (NG)EN-DC.
fr-InfoListMCG
Contains information of FR information of serving cells that include PCell and SCell(s) configured in MCG.
dummy
This field is not used in the specification and SN ignores the received value.
maxInterFreqMeasIdentitiesSCG
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.
maxIntraFreqMeasIdentitiesSCG
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.
maxMeasCLI-ResourceSCG
Indicates the maximum number of CLI RSSI resources that the SCG is allowed to configure.

maxMeasFreqsSCG Indicates the maximum number of NR inter-frequency carriers the SN is allowed to configure with PSCell for measurements.
maxMeasSRS-ResourceSCG Indicates the maximum number of SRS resources that the SCG is allowed to configure for CLI measurement.
maxNumberROHC-ContextSessionsSN Indicates the maximum number of ROHC context sessions allowed to SN terminated bearer, excluding context sessions that leave all headers uncompressed.
maxNumberEHC-ContextsSN 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].
measuredFrequenciesMN Used by MN to indicate a list of frequencies measured by the UE.
measGapConfig Indicates the FR1 and perUE measurement gap configuration configured by MN.
measGapConfigFR2 Indicates the FR2 measurement gap configuration configured by MN.
mcg-RB-Config Contains all of the fields in the IE *RadioBearerConfig* 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.
measResultReportCGI, measResultReportCGI-EUTRA Used by MN to provide SN with CGI-Info for the cell as per SN's request. In this version of the specification, the *measResultReportCGI* is used for (NG)EN-DC and NR-DC and the *measResultReportCGI-EUTRA* is used only for NE-DC.
measResultSCG-EUTRA This field includes the *MeasResultSCG-FailureMRDC* IE as specified in TS 36.331 [10]. This field is only used in NE-DC.
measResultSFTD-EUTRA SFTD measurement results between the PCell and the E-UTRA PScell in NE-DC. This field is only used in NE-DC.
mrdc-AssistanceInfo Contains the IDC assistance information for MR-DC reported by the UE (see TS 36.331 [10]).
nrdc-PC-mode-FR1 Indicates the uplink power sharing mode that the UE uses in NR-DC FR1 (see TS 38.213 [13], clause 7.6).
nrdc-PC-mode-FR2 Indicates the uplink power sharing mode that the UE uses in NR-DC FR2 (see TS 38.213 [13], clause 7.6).
overheatingAssistanceSCG Contains the UE's preference on reduced configuration for NR SCG to address overheating. This field is only used in (NG)EN-DC.
p-maxEUTRA 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.
p-maxNR-FR1 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.
p-maxUE-FR1 Indicates the maximum total transmit power to be used by the UE across all serving cells in frequency range 1 (FR1).
p-maxNR-FR1-MCG 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.

p-maxNR-FR2-SCG 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.
p-maxUE-FR2 Indicates the maximum total transmit power to be used by the UE across all serving cells in frequency range 2 (FR2).
p-maxNR-FR2-MCG 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.
pdcch-BlindDetectionSCG Indicates the maximum value of the reference number of cells for PDCCH blind detection allowed to be configured for the SCG.
ph-InfoMCG Power headroom information in MCG that is needed in the reception of PHR MAC CE in SCG.
ph-SupplementaryUplink Power headroom information for supplementary uplink. For UE in (NG)EN-DC, this field is absent.
ph-Type1or3 Type of power headroom for a serving cell in MCG (PCell and activated SCells). *type1* refers to type 1 power headroom, *type3* refers to type 3 power headroom. (See TS 38.321 [3]).
ph-Uplink Power headroom information for uplink.
powerCoordination-FR1 Indicates the maximum power that the UE can use in FR1.
powerCoordination-FR2 Indicates the maximum power that the UE can use in frequency range 2 (FR2). This field is only used in NR-DC.
scgFailureInfo 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 *measResultPerMOList*. This field is used in (NG)EN-DC and NR-DC.
scgFailureInfoEUTRA Contains SCG failure type and measurement results of the EUTRA secondary cell group. This field is only used in NE-DC.
scg-RB-Config 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.
selectedBandEntriesMNList A list of indices referring to the position of a band entry selected by the MN, in each band combination entry in *allowedBC-ListMRDC* IE. *BandEntryIndex* 0 identifies the first band in the *bandList* of the *BandCombination*, *BandEntryIndex* 1 identifies the second band in the *bandList* of the *BandCombination*, and so on. This *selectedBandEntriesMNList* includes the same number of entries, and listed in the same order as in *allowedBC-ListMRDC*. The SN uses this information to determine which bands out of the NR band combinations in *allowedBC-ListMRDC* it can configure in SCG. This field is only used in NR-DC.
servCellIndexRangeSCG Range of serving cell indices that SN is allowed to configure for SCG serving cells.
servFrequenciesMN-NR Indicates the frequency of all serving cells that include PCell and SCell(s) configured in MCG. This field is only used in NR-DC.
sftdFrequencyList-NR Includes a list of SSB frequencies. Each entry identifies the SSB frequency of a PSCell, which corresponds to one *MeasResultCellSFTD-NR* entry in the *MeasResultCellListSFTD-NR*.
sftdFrequencyList-EUTRA Includes a list of E-UTRA frequencies. Each entry identifies the carrier frequency of a PSCell, which corresponds to one *MeasResultSFTD-EUTRA* entry in the *MeasResultCellListSFTD-EUTRA*.

sidelinkUEInformationEUTRA This field includes SidelinkUEInformation IE as specified in TS 36.331 [10].
sourceConfigSCG 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 *RRCReconfiguration* message, i.e. including *secondaryCellGroup* and *measConfig*. The field is signalled upon change of SN, unless MN uses full configuration option. Otherwise, the field is absent.
sourceConfigSCG-EUTRA Includes the E-UTRA *RRCConnectionReconfiguration* message as specified in TS 36.331 [10]. In this version of the specification, the E-UTRA RRC message can only include the field *scg-Configuration.* 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.
ue-CapabilityInfo Contains the IE *UE-CapabilityRAT-ContainerList* 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**
allowedFeatureSetsList Defines a subset of the entries in a *FeatureSetCombination*. Each index identifies a position in the *FeatureSetCombination*, which corresponds to one *FeatureSetUplink*/*Downlink* for each band entry in the associated band combination.
bandCombinationIndex In case of NR-DC, this field indicates the position of a band combination in the *supportedBandCombinationList*. In case of NE-DC, this field indicates the position of a band combination in the *supportedBandCombinationList* and/or *supportedBandCombinationListNEDC-Only*. In case of (NG)EN-DC, this field indicates the position of a band combination in the *supportedBandCombinationList* and/or *supportedBandCombinationList-UplinkTxSwitch*. Band combination entries in *supportedBandCombinationList* are referred by an index which corresponds to the position of a band combination in the *supportedBandCombinationList*. Band combination entries in *supportedBandCombinationListNEDC-Only* are referred by an index which corresponds to the position of a band combination in the *supportedBandCombinationListNEDC-Only* increased by the number of entries in *supportedBandCombinationList*. Band combination entries in *supportedBandCombinationList-UplinkTxSwitch* are referred by an index which corresponds to the position of a band combination in the *supportedBandCombinationList-UplinkTxSwitch* increased by the number of entries in *supportedBandCombinationList*.

Conditional Presence	Explanation
SN-AddMod	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 source RAT whether RAT capabilities are included or not in *ue-CapabilityInfo*.

Source RAT	NR capabilities	E-UTRA capabilities	MR-DC capabilities
E-UTRA	Included	Not included	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
    }                                                                                       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.

***MeasurementTimingConfiguration* field descriptions**
campOnFirstSSB Value *true* indicates that the SSB indicated in the first instance of *MeasTiming* in the *measTiming* list can be used for camping and for a PCell configuration (i.e. in *spCellConfigCommon* of the *masterCellGroup*).
csi-RS-CellMobility 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 *refSSBFreq*.
csi-RS-SubcarrierSpacing Indicates the subcarrier spacing of the CSI-RS resources included in *csi-rs-CellMobility*.
measTiming 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.
physCellId Physical Cell Identity of the SSB on the ARFCN indicated by *carrierFreq*.
psCellOnlyOnFirstSSB Value *true* indicates that only the SSB indicated in the first instance of *MeasTiming* in the *measTiming* list can be used for a PSCell configuration (i.e. in *spCellConfigCommon* of the *secondaryCellGroup*).
ssb-ToMeasure The set of SS blocks to be measured within the SMTC measurement duration (see TS 38.215 [9]).

– *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 {}                                             OPTIONAL
}
```

```
-- 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.

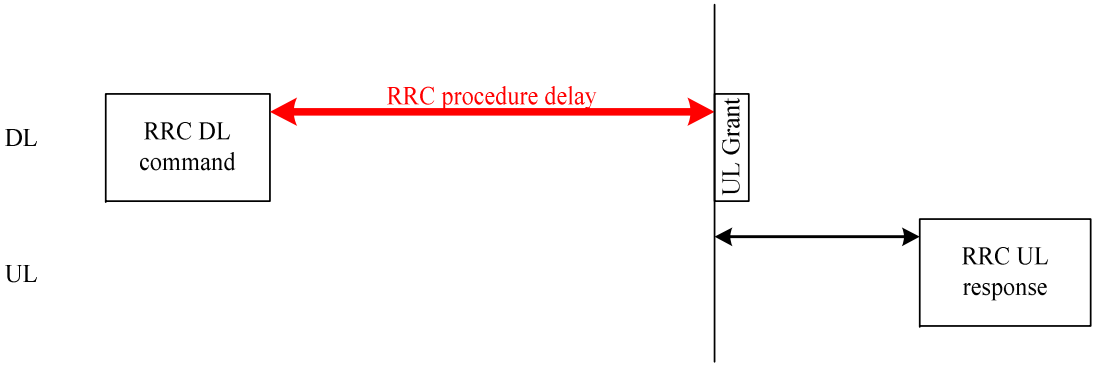

Figure 12.1-1: Illustration of RRC procedure delay

Table 12.1-1: UE performance requirements for RRC procedures for UEs

Procedure title:	Network -> UE	UE -> Network	Value [ms]	Notes
RRC Connection Control Procedures				
RRC reconfiguration	*RRCReconfiguration*	*RRCReconfigurationComplete*	10	
RRC reconfiguration (scell addition/release)	*RRCReconfiguration*	*RRCReconfigurationComplete*	16	
RRC reconfiguration (SCG establishment/ modification/ release)	*RRCReconfiguration*	*RRCReconfigurationComplete*	16	
RRC setup	*RRCSetup*	*RRCSetupComplete*	10	
RRC Release	*RRCRelease*		NA	
RRC re-establishment	*RRCReestablishment*	*RRCReestablishmentComplete*	10	
RRC resume	*RRCResume*	*RRCResumeComplete*	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 *RRCResumeComplete* 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)	*RRCResume*	*RRCResumeComplete*	16	
Initial AS security activation	*SecurityModeCommand*	*SecurityModeComplete/SecurityModeFailure*	5	
Other procedures				
UE assistance information		*UEAssistanceInformation*	NA	

Procedure title:	Network -> UE	UE -> Network	Value [ms]	Notes
UE capability transfer	*UECapabilityEnquiry*	*UECapabilityInformation*	80	
Counter check	*CounterCheck*	*CounterCheckResponse*	5	
UE information	*UEInformationRequest*	*UEInformationResponse*	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 *RRCConnectionModificationCommand*, 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 ::=            SEQUENCE {
    ul-SpecificParameters               SEQUENCE {
        priority                            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 ::=                   SEQUENCE {
    field1                                  InformationElement1,
    field2                                  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 ::=                 SEQUENCE {
    rootSequenceIndex                   INTEGER (0..1023),
    prach-ConfigInfo                    PRACH-ConfigInfo
}

PRACH-Config ::=                    SEQUENCE {
    rootSequenceIndex                   INTEGER (0..1023),
    prach-ConfigInfo                    PRACH-ConfigInfo                    OPTIONAL    -- Need N
}

PRACH-ConfigInfo ::=                SEQUENCE {
    prach-ConfigIndex                   ENUMERATED {ffs},
    highSpeedFlag                       ENUMERATED {ffs},
    zeroCorrelationZoneConfig           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 ::=                    SEQUENCE {
    numberOfRA-Preambles                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 ::=                    SEQUENCE {
    rootSequenceIndex                   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 ::=            SEQUENCE {
    ul-SpecificParameters               SEQUENCE {
        priority                            INTEGER (0),
        ...
    }       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 compiler with 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
}                                                                   OPTIONAL,   -- Need M

-- /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., "*RRCConnectionReconfiguration-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 ::=                          SEQUENCE {
    rrc-TransactionIdentifier               RRC-TransactionIdentifier,
    criticalExtensions                      CHOICE {
        c1                                      CHOICE{
            rrcMessage-r8                           RRCMessage-r8-IEs,
            spare3 NULL, spare2 NULL, spare1 NULL
        },
        criticalExtensionsFuture                SEQUENCE {}
    }
}

-- ASN1STOP
```

```
-- /example/ ASN1START                  -- Later release

RRCMessage ::=                          SEQUENCE {
    rrc-TransactionIdentifier               RRC-TransactionIdentifier,
    criticalExtensions                          CHOICE {
        c1                                          CHOICE{
            rrcMessage-r8                               RRCMessage-r8-IEs,
            rrcMessage-r10                              RRCMessage-r10-IEs,
            rrcMessage-r11                              RRCMessage-r11-IEs,
            rrcMessage-r14                              RRCMessage-r14-IEs
        },
        later                                       CHOICE {
            c2                                          CHOICE{
                rrcMessage-r16                              RRCMessage-r16-IEs,
                spare7 NULL, spare6 NULL, spare5 NULL, spare4 NULL,
                spare3 NULL, spare2 NULL, spare1 NULL
            },
            criticalExtensionsFuture                SEQUENCE {}
        }
    }
}

-- 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 ::=                          SEQUENCE {
    rrc-TransactionIdentifier               RRC-TransactionIdentifier,
    criticalExtensions                      CHOICE {
        c1                                      CHOICE{
            rrcMessage-r8                           RRCMessage-r8-IEs,
            spare3 NULL, spare2 NULL, spare1 NULL
        },
        criticalExtensionsFuture            SEQUENCE {}
    }
}

RRCMessage-rN-IEs ::= SEQUENCE {
    field1-rN                           ENUMERATED {
                                            value1, value2, value3, value4}     OPTIONAL,   -- Need N
    field2-rN                           InformationElement2-rN                  OPTIONAL,   -- Need N
    nonCriticalExtension                RRCConnectionReconfiguration-vMxy-IEs   OPTIONAL
}

RRCConnectionReconfiguration-vMxy-IEs ::= SEQUENCE {
    field2-rM                               InformationElement2-rM          OPTIONAL, -- Cond NoField2rN
    nonCriticalExtension                    SEQUENCE {}                     OPTIONAL
```

```
}

-- 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 ::=             SEQUENCE {
    field1                              ENUMERATED {
                                            value1, value2, value3, value4-v880,
                                            ..., value5-v960 },
    field2                              CHOICE {
        field2a                             BOOLEAN,
        field2b                             InformationElement2b,
        ...,
        field2c-v960                        InformationElement2c-r9
    },
    ...,
    [[
    field3-r9                           InformationElement3-r9      OPTIONAL        -- Need R
    ]],
    [[
    field3-v9a0                         InformationElement3-v9a0    OPTIONAL,       -- Need R
    field4-r9                           InformationElement4         OPTIONAL        -- Need R
    ]]
}

InformationElement1-r10 ::=         SEQUENCE {
    field1                              ENUMERATED {
                                            value1, value2, value3, value4-v880,
                                            value5-v960, value6-v1170, spare2, spare1, ... },
    field2                              CHOICE {
        field2a                             BOOLEAN,
        field2b                             InformationElement2b,
        field2c-v960                        InformationElement2c-r9,
        ...,
        field2d-v12b0                       INTEGER (0..63)
    },
    field3-r9                           InformationElement3-r10         OPTIONAL,   -- Need R
    field4-r9                           InformationElement4             OPTIONAL,   -- Need R
    field5-r10                          BOOLEAN,
    field6-r10                          InformationElement6-r10         OPTIONAL,   -- Need R
    ...,
    [[
    field3-v1170                        InformationElement3-v1170       OPTIONAL    -- Need R
    ]]
}

-- ASN1STOP
```

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

RRCMessage-r8-IEs ::=           SEQUENCE {
    field1                          InformationElement1,
    field2                          InformationElement2,
    field3                          InformationElement3                 OPTIONAL,   -- Need N
    nonCriticalExtension            RRCMessage-v860-IEs                 OPTIONAL
}

RRCMessage-v860-IEs ::=         SEQUENCE {
    field4-v860                     InformationElement4                 OPTIONAL,   -- Need S
    field5-v860                     BOOLEAN                             OPTIONAL,   -- Cond C54
    nonCriticalExtension            RRCMessage-v940-IEs                 OPTIONAL
}

RRCMessage-v940-IEs ::=         SEQUENCE {
    field6-v940                     InformationElement6-r9              OPTIONAL,   -- Need R
    nonCriticalExtensions           SEQUENCE {}                         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
ConfigF	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                             NULL,
    setup                               SEQUENCE {
        -- Root encoding
    }
}

ChildIE2-WithoutEM-vNx0 ::=         SEQUENCE {
    chIE2-NewField-rN                   INTEGER (0..31)                 OPTIONAL    -- Cond ConfigF
}

-- ASN1STOP
```

Conditional presence	Explanation
ConfigF	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
FieldAsetToX	The field is mandatory present if fieldA is included and set to valueX. Otherwise the field is optionally present, need R.
FieldCsetToY	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
CounterCheck	-	-	-	
CounterCheckResponse	-	-	-	
DedicatedSIBRequest	+	-	-	
DLDedicatedMessageSegment	NOTE 1			
DLInformationTransfer	+	-	-	
DLInformationTransferMRDC	-	-	-	
FailureInformation	-	-	-	
LocationMeasurementIndication	-	-	-	
MCGFailureInformation	-	-	-	
MIB	+	+	+	
MeasurementReport	-	-	-	Measurement configuration may be sent prior to AS security activation. But: In order to protect privacy of UEs, *MeasurementReport* is only sent from the UE after successful AS security activation.
MobilityFromNRCommand	-	-	-	
Paging	+	+	+	
RRCReconfiguration	+	-	-	The message shall not be sent unprotected before AS security activation if it is used to perform handover or to establish SRB2 and DRBs.
RRCReconfigurationComplete	+	-	-	Unprotected, if sent as response to *RRCReconfiguration* which was sent before AS security activation.
RRCReestablishment	-	-	+	Integrity protection applied, but no ciphering.
RRCReestablishmentComplete	-	-	-	
RRCReestablishmentRequest	-	-	+	This message is not protected by PDCP operation. However, a *shortMAC-I* is included.
RRCReject	+	+	+	Justification for A-I and A-C: the message can be sent in SRB0 in RRC_INACTIVE state, after the AS security is activated.
RRCRelease	+	-	-	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. *RRCRelease* message sent before AS security activation cannot include *deprioritisationReq, suspendConfig, redirectedCarrierInfo, cellReselectionPriorities* information fields.
RRCResume	-	-	-	
RRCResumeComplete	-	-	-	
RRCResumeRequest	-	-	+	This message is not protected by PDCP operation. However, a *resumeMAC-I* is included.
RRCResumeRequest1	-	-	+	This message is not protected by PDCP operation. However, a *resumeMAC-I* is included.
RRCSetup	+	+	+	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.
RRCSetupComplete	+	NA	NA	
RRCSetupRequest	+	NA	NA	
RRCSystemInfoRequest	+	+	+	Justification for A-I and A-C: the message can be sent in SRB0 in RRC_INACTIVE state, after the AS security is activated.
SIB1	+	+	+	
SCGFailureInformation	-	-	-	
SCGFailureInformationEUTRA	-	-	-	
SecurityModeCommand	+	NA	NA	Integrity protection applied, but no ciphering (integrity verification done after the message received by RRC).
SecurityModeComplete	-	-	+	The message is sent after AS security activation. Integrity protection applied, but no ciphering. Ciphering is applied after completing the procedure.
SecurityModeFailure	+	NA	NA	Neither integrity protection nor ciphering applied.

Message	P	A-I	A-C	Comment
SystemInformation	+	+	+	
UEAssistanceInformation	-	-	-	
UECapabilityEnquiry	+	-	-	The network should retrieve UE capabilities only after AS security activation.
UECapabilityInformation	+	-	-	
ULDedicatedMessageSegment	+	-	-	
UEInformationRequest	-	-	-	
UEInformationResponse	-	-	-	In order to protect privacy of UEs, *UEInformationResponse* is only sent from the UE after successful security activation
ULInformationTransfer	+	-	-	
ULInformationTransferMRDC	-	-	-	
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).

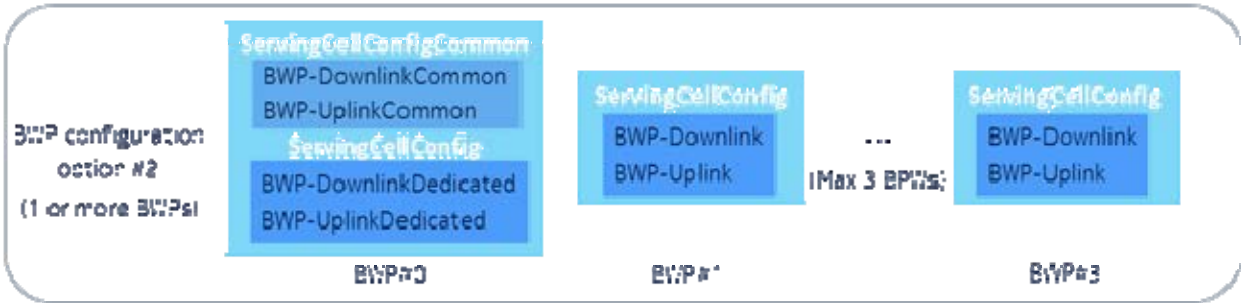

Figure B2-2: BWP#0 configuration with dedicated configuration

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

TDoc Number (RP-xxxxxx): CR Title	CR Number(s)	CR Revision Number(s)	Earliest Implementable Release	Additional Information
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	

Annex D (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	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 contens 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#II611)	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 procedual text corrections	15.4.0
	RP-82	RP-182651	0344	1	F	Clarification for absense 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 decriptions 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 RadioLinkMonitoringRS 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

03/2019	RP-83	RP-190541	0416	4	F	Clarification on hopping parameters for PUSCH	15.5.0
	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 Clarfication 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 uption 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
	RP-87	RP-200343	1487	1	B	Introduction of NR eURLLC	16.0.0
	RP-87	RP-200354	1488	2	B	CR for introducing MDT and SON	16.0.0
	RP-87	RP-200357	1489	-	**C**	CR to 38.331 on DRX coordination	16.0.0
	RP-87	RP-200346	1493	1	**B**	Introduction of 5G V2X with NR sidelink	16.0.0
	RP-87	RP-200340	1494	2	**B**	Introduction of CLI handling and RIM in TS38.331	16.0.0
	RP-87	RP-200352	1498	1	**B**	Introduction of NR IIoT	16.0.0
	RP-87	RP-200342	1499	1	**B**	Introduction of 2-step RA	16.0.0
	RP-87	RP-200339	1500	2	**B**	Introduction of MIMO enhancements	16.0.0
	RP-87	RP-200359	1502	-	**B**	Recommended Bit Rate/Query for FLUS and MTSI	16.0.0
	RP-87	RP-200345	1504	2	**B**	Introduction of NR positioning	16.0.0
	RP-87	RP-200358	1505	-	**B**	Support of inter-RAT handover from NR to EN-DC in TS 38.331	16.0.0
07/2020	RP-88	RP-201191	1290	4	**C**	Missing reportAddNeighMeas in periodic measurement reporting	16.1.0
	RP-88	RP-201166	1453	6	**B**	Introduction of NeedForGap capability for NR measurement	16.1.0
	RP-88	RP-201185	1464	5	**B**	Introduction of signalling for high-speed train scenarios	16.1.0
	RP-88	RP-201191	1506	2	**F**	Corrections to PRACH prioritization procedure for MPS and MCS	16.1.0
	RP-88	RP-201182	1513	2	**F**	Finalization of the support of Non-Public Networks	16.1.0
	RP-88	RP-201172	1528	4	**F**	Miscellaneous corrections for NR-U	16.1.0
	RP-88	RP-201174	1540	2	**C**	CR for 38.331 for Power Savings	16.1.0
	RP-88	RP-201180	1553	3	**F**	Correction to transfer of UE capabilities at HO for RACS and minor ASN.1 correction (38.331)	16.1.0
	RP-88	RP-201161	1556	2	**A**	Clarification on avoiding keystream repeat due to COUNT reuse	16.1.0
	RP-88	RP-201178	1557	2	**F**	CR for 38.331 on CA/DC Enhancements	16.1.0
	RP-88	RP-201160	1560	2	**A**	SRS Capability report for SRS only Scell	16.1.0
	RP-88	RP-201160	1562	1	**A**	Correction to RequestedCapabilityCommon	16.1.0
	RP-88	RP-201187	1563	2	**A**	R on introduction of BCS to asymmetric channel bandwidths (38.331)	16.1.0
	RP-88	RP-201159	1568	2	**A**	Correction on PUCCH configuration	16.1.0
	RP-88	RP-201176	1569	3	**F**	Miscellaneous corrections to 38.331 for V2X	16.1.0
	RP-88	RP-201160	1572	2	**A**	Correction on the need for reconfiguration with sync in (NG)EN-DC, NR-DC and NE-DC	16.1.0
	RP-88	RP-201160	1579	1	**A**	38331 CR(R16) on inter-RAT SFTD measurements	16.1.0
	RP-88	RP-201160	1587	1	**A**	Clarification on pdcp-Duplication at RRC Reconfiguration	16.1.0
	RP-88	RP-201188	1588	3	**F**	Correction to RRC spec for eURLLC	16.1.0
	RP-88	RP-201179	1590	4	**B**	Corrections to 38.331 for supporting IAB in NPN	16.1.0
	RP-88	RP-201177	1591	2	**F**	Corrections on NR mobility enhancements	16.1.0
	RP-88	RP-201175	1592	2	**B**	Introduction of RRC Positioning	16.1.0
	RP-88	RP-201166	1596	1	**F**	Band combination list for NE-DC (Cat-F)	16.1.0
	RP-88	RP-201159	1599	-	**A**	Avoiding security risk for RLC AM bearers during termination point change	16.1.0
	RP-88	RP-201161	1602	1	**A**	CR on SRS-CarrierSwitching	16.1.0
	RP-88	RP-201164	1603	1	**A**	CR on introduction of extended capabilities for NR-DC only BCs	16.1.0
	RP-88	RP-201165	1614	1	**A**	Clarification on the presence of ssb-perRACH-Occasion for the CSI-RS based CFRA	16.1.0
	RP-88	RP-201163	1624	1	**A**	Clarification on the maxPUSCH-Duration for LCP Restriction	16.1.0
	RP-88	RP-201159	1631	-	**A**	Clarification for SIB6, SIB7 and SIB8 acquisition during a measurement gap	16.1.0
	RP-88	RP-201198	1632	2	**C**	Introduction of secondary DRX group CR 38.331	16.1.0
	RP-88	RP-201164	1634	1	**A**	Correction to CORESET and PDCCH TCI state release	16.1.0
	RP-88	RP-201181	1641	-	**F**	Correction of NR IIoT	16.1.0
	RP-88	RP-201162	1644	1	**A**	Clarification on release and addition of the uplink for SCell	16.1.0
	RP-88	RP-201189	1645	-	**F**	CR on 38.331 for SRVCC from 5G to 3G	16.1.0
	RP-88	RP-201159	1649	-	**A**	Ambiguity in fr1-fr2-Add-UE-NR-Capabilities parameter	16.1.0
	RP-88	RP-201162	1656	1	**A**	Correction to measurement coordination in MR-DC	16.1.0
	RP-88	RP-201176	1657	1	**F**	Introduction of on-demand SIB(s) procedure in CONNECTED	16.1.0
	RP-88	RP-201164	1662	1	**A**	T310 handling during MobilityFromNR	16.1.0
	RP-88	RP-201173	1664	2	**F**	Corrections for 2-step Random Access Type	16.1.0
	RP-88	RP-201216	1665	2	**B**	Release-16 UE capabilities based on RAN1, RAN4 feature lists and RAN2	16.1.0
	RP-88	RP-201191	1666	1	**F**	Miscellaneous ASN.1 review corrections	16.1.0
	RP-88	RP-201166	1668	2	**F**	Miscellaneous non-controversial corrections Set V	16.1.0
	RP-88	RP-201184	1669	3	**F**	Corrections on MDT and SON in NR	16.1.0
	RP-88	RP-201190	1670	-	**C**	Introduction of eCall over IMS for NR	16.1.0

	RP-88	RP-201191	1671	1	**F**	38.331 CR for overheating in (NG)EN-DC and NR-DC	16.1.0
	RP-88	RP-201186	1673	1	**B**	Introduction of inter-frequency measurement without gap	16.1.0
	RP-88	RP-201164	1682	2	**A**	Correction on SRS antenna capability for carrier switching	16.1.0
	RP-88	RP-201161	1683	1	**A**	UE Capability Enhancement for FR1(TDD/FDD) / FR2 CA and DC	16.1.0
	RP-88	RP-201164	1687	1	**A**	Correction to re-sending UEAssistanceInformation upon reconfiguration w/ sync	16.1.0
	RP-88	RP-201170	1696	4	**F**	eMIMO corrections	16.1.0
	RP-88	RP-201166	1697	-	**F**	Corrections to SIB1 Processing	16.1.0
	RP-88	RP-201171	1700	-	**F**	Corrections for CLI	16.1.0
	RP-88	RP-201191	1703	1	**F**	Correction on MN-SN measurements coordination in INM	16.1.0
	RP-88	RP-201163	1707	-	**A**	SMTC Configuration for PSCell Addition for NR-DC (Option 2)	16.1.0
	RP-88	RP-201165	1711	1	**A**	Introduction of CGI reporting capabilities	16.1.0
	RP-88	RP-201191	1716	-	**B**	Aperiodic CSI-RS triggering with beam switching timing of 224 and 336	16.1.0
	RP-88	RP-201166	1717	1	**B**	Implementing confirmation of code block group based transmission	16.1.0
	RP-88	RP-201179	1718	1	**F**	Correction to TS 38.331 for IAB WI	16.1.0
	RP-88	RP-201183	1719	-	**B**	RRC configuration of supporting UL Tx switching	16.1.0
	RP-88	RP-201183	1720	-	**B**	UE capability of supporting UL Tx switching	16.1.0

History

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