**3GPP TSG-RAN WG2 Meeting #131 R2-250xxxx**

**Bengaluru, India, 25th – 29th Aug. 2025**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.321** | **CR** | **2098** | **rev** | **1** | **Current version:** | **18.6.0** |  |
|  | | | | | | | | |
| *For* [***HELP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | Introduction of NR mobility enhancements Phase 4 in MAC | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | vivo (Rapporteur) | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_Mob\_Ph4-Core | | | | |  | ***Date:*** | | | 2025-09-01 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-19 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | This CR is to introduce the support of NR mobility enhancements Phase 4 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | In order to support the features of NR mobility enhancements Phase 4, following procedures and changes are introduced in the MAC specification:   1. Introduction of inter-CU LTM. 2. Introduction of L1 event triggered measurement reporting. 3. Introduction of conditional LTM (C-LTM). | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | NR mobility enhancements Phase 4 is not supported in Rel-19. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.1, 3.2, 5.1.1, 5.1.1b, 5.1.2, 5.2, 5.2x, 5.4.2.1, 5.4.3.1.3, 5.4.4, 5.8.2, 5.12, 5.18.1, 5.18.35, 5.18.x, 5.x, 5.y, 6.2.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS 38.331 CR 5443  TS 38.331 CR 5403  TS 38.306 CR 1321  TS 38.300 CR 1011  TS 37.340 CR 0419 | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

Start of change

## 3.1 Definitions

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

**A2X communication**: A communication to support A2X services leveraging PC5 reference points, as defined in TS 23.256 [31]. A2X services are realized by various types of A2X applications, e.g., BRID or DAA.

**Air to Ground network:** An NG-RAN consisting of ground-based gNBs, which provide cell towers that send signals up to an aircraft's antenna(s) of onboard ATG terminal, with typical vertical altitude of around 10,000 m and take-off/landing altitudes down to 3000 m.

**BWP for SRS for positioning Tx frequency hopping**:For SRS for positioning Tx frequency hopping, separate BWP configuration outside BWP configuration for data transmission.

**CLTM candidate cell**: A candidate cell configured for conditional LTM as defined in TS 38.331 [5].

**Dedicated SL-PRS resource pool**:A sidelink resource pool which can be used for the transmission of SL-PRS and cannot be used for the transmission of PSSCH.

**Dormant BWP**:The dormant BWP is one of downlink BWPs configured by the network via dedicated RRC signaling. In the dormant BWP, the UE stop monitoring PDCCH on/for the SCell, but continues performing CSI measurements, Automatic Gain Control (AGC) and beam management, if configured.

**DRX group**: A group of Serving Cells that is configured by RRC and that have the same DRX Active Time.

**eRedCap UE**: A UE with enhanced reduced capabilities as specified in clause 4.2.22.1 of TS 38.306 [25].

**HARQ information**: HARQ information for DL-SCH, for UL-SCH, or for SL-SCH transmissions consists of New Data Indicator (NDI), Transport Block Size (TBS), Redundancy Version (RV), and HARQ process ID.

**IAB-donor**: gNB that provides network access to UEs via a network of backhaul and access links.

**IAB-node**: RAN node that supports NR access links to UEs and NR backhaul links to parent nodes and child nodes.

**Listen Before Talk**: A procedure according to which transmissions are not performed if the channel is identified as being occupied, see TS 37.213 [18].

**LTM candidate cell**: A candidate cell configured for LTM as defined in TS 38.331 [5].

**Msg3**: Message transmitted on UL-SCH containing a C-RNTI MAC CE or CCCH SDU, submitted from upper layer and associated with the UE Contention Resolution Identity, as part of a Random Access procedure.

**Multi-path**: Mode of operation of a UE in RRC\_CONNECTED configured with one direct path on which the UE connects to gNB using NR Uu, and one indirect path on which the UE connects to the same gNB via another UE using PC5 unicast link or non-3GPP connection (N3C).

**Multi-PUSCH configured grant**: A configured grant configuration configured with *nrOfSlotsInCG-Period* (see TS 38.331 [5]). It includes multiple consecutive configured uplink grants within a single periodicity.

**N3C indirect path:** In Multi-path, the indirect path using Non-3GPP Connection between remote UE and relay UE.

**NCR-Fwd**: NCR-node function, which performs amplifying-and-forwarding of UL/DL RF signals between gNB and UE. The behavior of the NCR-Fwd is controlled according to the side control information received by the NCR-MT from a gNB.

**NCR-MT**: NCR-node entity which communicates with a gNB via a control link to receive side control information. The control link is based on NR Uu interface.

**NCR-node**: RAN node comprising NCR-MT and NCR-Fwd.

**Non-terrestrial network**: An NG-RAN consisting of gNBs, which provide non-terrestrial NR access to UEs by means of an NTN payload embarked on an airborne or space-borne NTN vehicle and an NTN Gateway.

**NR backhaul link**: NR link used for backhauling between an IAB-node and an IAB-donor, and between IAB-nodes in case of a multi-hop backhauling.

**NR sidelink communication**: AS functionality enabling at least V2X Communication as defined in TS 23.287 [19] and ProSe communication (including ProSe non-Relay, UE-to-Network Relay and UE-to-UE Relay communication (including ProSe UE-to-UE Relay communication with integrated discovery)) as defined in TS 23.304 [26], between two or more nearby UEs, using NR technology but not traversing any network node.

**NR sidelink discovery**: AS functionality enabling ProSe non-Relay discovery, ProSe UE-to-Network Relay discovery and ProSe UE-to-UE Relay discovery for Proximity based Services as defined in TS 23.304 [26], between two or more nearby UEs, using NR technology but not traversing any network node.

**NR sidelink transmission**: Any NR Sidelink-based transmission, including transmission for NR sidelink discovery, transmission for NR sidelink communication, transmission for Ranging/Sidelink Positioning, and transmission for A2X communication.

**PDCCH occasion**: A time duration (i.e. one or a consecutive number of symbols) during which the MAC entity is configured to monitor the PDCCH.

**Positioning SRS Bandwidth Aggregation**: Transmission of positioning SRS on multiple carriers in RRC\_CONNECTED and RRC\_INACTIVE where the positioning SRS resources are linked in RRC configuration as defined in TS 38.331 [5].

**PRS Processing Window**: A time window during which UE may perform PRS measurement inside the active DL BWP with the same numerology as the active DL BWP without measurement gap.

**Ranging/Sidelink Positioning**:AS functionality enabling ranging-based services and sidelink positioning as specified in TS 23.586 [30].

**RB set**: A RB set refers to a contiguous set of resource blocks (RBs) on which a channel access procedure is performed in shared spectrum as defined in TS 37.213 [18].

**RedCap UE**: A UE with reduced capabilities as specified in clause 4.2.21.1 in TS 38.306 [25].

**Serving Cell**: A PCell, a PSCell, or an SCell in TS 38.331 [5].

**Shared SL-PRS resource pool**:A sidelink resource pool which can be used for the transmission of both SL-PRS and PSSCH.

**Sidelink transmission information**: Sidelink transmission information included in an SCI for an SL-SCH transmission or SL-PRS transmission with or without SL-SCH transmission on Shared SL-PRS resource pool as specified in clause 8.3 and 8.4 of TS 38.212 [9] consists of Sidelink HARQ information including NDI, RV, Sidelink process ID, HARQ feedback enabled/disabled indicator, Sidelink identification information including cast type indicator, Source Layer-1 ID and Destination Layer-1 ID, and Sidelink other information including CSI request, SL-PRS request, SL-PRS resource ID, a priority, a communication range requirement and Zone ID and COT sharing information.

**SL-PRS delay budget**: Delay budget before which the SL-PRS is expected to be transmitted by the Tx UE.

**SL-PRS transmission information on Dedicated SL-PRS resource pool**:SL-PRS transmission information on Dedicated SL-PRS resource pool is included in an SCI for an SL-PRS transmission on Dedicated SL-PRS resource pool, as specified in TS 38.212 [9], consisting of

- SL-PRS identification information, including cast type indicator, source ID and destination ID;

- SL-PRS transmission other information, including SL-PRS priority, SL-PRS request, SL-PRS resource ID and resource reservation period.

**SRS positioning validity area**:An area consisting of a list of cells within which the corresponding positioning SRS configuration is considered as valid.

**Special Cell**: For Dual Connectivity operation the term Special Cell refers to the PCell of the MCG or the PSCell of the SCG depending on if the MAC entity is associated to the MCG or the SCG, respectively. Otherwise the term Special Cell refers to the PCell. A Special Cell supports PUCCH transmission and contention-based Random Access, and is always activated.

**Timing Advance Group**: A group of Serving Cells that is configured by RRC and that, for the cells with a UL configured, using the same timing reference cell and the same Timing Advance value. A Timing Advance Group containing the SpCell of a MAC entity is referred to as Primary Timing Advance Group (PTAG), whereas the term Secondary Timing Advance Group (STAG) refers to other TAGs.

**UE-gNB RTT**: For non-terrestrial networks, the sum of the UE's Timing Advance value (see TS 38.211 [8] clause 4.3.1) and *kmac*.

**V2X sidelink communication**: AS functionality enabling V2X Communication as defined in TS 23.285 [20], between nearby UEs, using E-UTRA technology but not traversing any network node.

NOTE 1: A timer is running once it is started, until it is stopped or until it expires; otherwise it is not running. A timer can be started if it is not running or restarted if it is running. A Timer is always started or restarted from its initial value. The duration of a timer is not updated until it is stopped or expires (e.g. due to BWP switching). When the MAC entity applies zero value for a timer, the timer shall be started and immediately expire unless explicitly stated otherwise.

NOTE 2: In this version of the specification, the SRS in the procedural description includes Positioning SRS except for the Positioning SRS for transmission in RRC\_INACTIVE as in clause 5.26. Positioning SRS except for the Positioning SRS for transmission in RRC\_INACTIVE is treated the same as SRS by the UE unless explicitly stated otherwise.

Next change

## 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].

A2X Aircraft-to-Everything

AP Aperiodic

BFR Beam Failure Recovery

BRID Broadcast Remote Identification

BSR Buffer Status Report

BWP Bandwidth Part

CE Control Element

CG Cell Group

CG-SDT Configured Grant-based SDT

CI-RNTI Cancellation Indication RNTI

CLTM Conditional L1/L2 Triggered Mobility

CSI Channel State Information

CSI-IM CSI Interference Measurement

CSI-RS CSI Reference Signal

CS-RNTI Configured Scheduling RNTI

DAA Detect And Avoid

DAPS Dual Active Protocol Stack

DCP DCI with CRC scrambled by PS-RNTI

DL-PRS DownLink-Positioning Reference Signal

DSR Delay Status Report

DTX Discontinuous Transmission

G-CS-RNTI Group Configured Scheduling RNTI

G-RNTI Group RNTI

IAB Integrated Access and Backhaul

INT-RNTI Interruption RNTI

LBT Listen Before Talk

LCG Logical Channel Group

LCP Logical Channel Prioritization

LTM L1/L2 Triggered Mobility

MBS Multicast/Broadcast Services

MCCH MBS Control Channel

MCCH-RNTI MBS Control Channel RNTI

MCG Master Cell Group

MO-SDT Mobile Originated SDT

MPE Maximum Permissible Exposure

MTCH MBS Traffic Channel

MT-SDT Mobile Terminated SDT

N3C Non-3GPP Connection

NCC Next Hop Chaining Counter

NCD-SSB Non Cell Defining SSB

NCR Network-Controlled Repeater

NSAG Network Slice AS Group

NUL Normal Uplink

NZP CSI-RS Non-Zero Power CSI-RS

PDB Packet Delay Budget

PEI-RNTI Paging Early Indication RNTI

PHR Power Headroom Report

PQI PC5 QoS Identifier

PS-RNTI Power Saving RNTI

PSI PDU Set Importance

PTAG Primary Timing Advance Group

PTM Point to Multipoint

PTP Point to Point

QCL Quasi-colocation

PPW PRS Processing Window

PRS Positioning Reference Signal

RA-SDT Random Access-based SDT

RRH Remote Radio Head

RS Reference Signal

SCG Secondary Cell Group

SDT Small Data Transmission

SFI-RNTI Slot Format Indication RNTI

SI System Information

SL-PRS-CS-RNTI SL-PRS-Configured Scheduling-RNTI

SL-PRS-RNTI SL-PRS-RNTI

SL-CS-RNTI Sidelink-Configured Scheduling-RNTI

SL-PRS Sidelink-PRS

SL-RNTI Sidelink-RNTI

SpCell Special Cell

SP Semi-Persistent

SP-CSI-RNTI Semi-Persistent CSI RNTI

SPS Semi-Persistent Scheduling

SR Scheduling Request

SRI SRS Resource Indicator

SS Synchronization Signals

SSB Synchronization Signal Block

STAG Secondary Timing Advance Group

STx2P Simultaneous Transmission with 2 Panels

SUL Supplementary Uplink

TAG Timing Advance Group

TCI Transmission Configuration Indicator

TPC-SRS-RNTI Transmit Power Control-Sounding Reference Signal-RNTI

TRIV Time Resource Indicator Value

TRP Transmit/Receive Point

TRS CSI-RS for tracking

TTT Time to Trigger

U2N UE-to-Network

U2U UE-to-UE

UCI Uplink Control Information

UTO-UCI Unused Transmission Occasion - UCI

V2X Vehicle-to-Everything

ZP CSI-RS Zero Power CSI-RS

Next change

# 5 MAC procedures

## 5.1 Random Access procedure

### 5.1.1 Random Access procedure initialization

The Random Access procedure described in this clause is initiated by a PDCCH order, by the MAC entity itself, or by RRC for the events in accordance with TS 38.300 [2]. There is only one Random Access procedure ongoing at any point in time in a MAC entity. The Random Access procedure on an SCell or an LTM candidate cell shall only be initiated by a PDCCH order with *ra-PreambleIndex* different from 0b000000.

NOTE 1: If a new Random Access procedure is triggered while another is already ongoing in the MAC entity, it is up to UE implementation whether to continue with the ongoing procedure or start with the new procedure (e.g. for SI request).

NOTE 2: If there was an ongoing Random Access procedure that is triggered by a PDCCH order while the UE receives another PDCCH order indicating the same Random Access Preamble, PRACH mask index and uplink carrier, the Random Access procedure is considered as the same Random Access procedure as the ongoing one and not initialized again.

When a Random Access procedure is initiated, UE selects a set of Random Access resources as specified in clause 5.1.1b and initialises the following parameters for the Random Access procedure according to the values configured by RRC for the selected set of Random Access resources:

- *prach-ConfigurationIndex*: the available set of PRACH occasions for the transmission of the Random Access Preamble for Msg1. These are also applicable to the MSGA PRACH if the PRACH occasions are shared between 2-step and 4-step RA types;

- *prach-ConfigurationPeriodScaling-IAB*: the scaling factor defined in TS 38.211 [8] and applicable to IAB-MTs, extending the periodicity of the PRACH occasions baseline configuration indicated by *prach-ConfigurationIndex*;

- *prach-ConfigurationFrameOffset-IAB*: the frame offset defined in TS 38.211 [8] and applicable to IAB-MTs, altering the ROs frame defined in the baseline configuration indicated by *prach-ConfigurationIndex*;

- *prach-ConfigurationSOffset-IAB*: the subframe/slot offset defined in TS 38.211 [8] and applicable to IAB-MTs, altering the ROs subframe or slot defined in the baseline configuration indicated by *prach-ConfigurationIndex*;

- *msgA-PRACH-ConfigurationIndex*: the available set of PRACH occasions for the transmission of the Random Access Preamble for MSGA in 2-step RA type;

- *preambleReceivedTargetPower*: initial Random Access Preamble power for 4-step RA type;

- *msgA-PreambleReceivedTargetPower*: initial Random Access Preamble power for 2-step RA type;

- *rsrp-ThresholdSSB*: an RSRP threshold for the selection of the SSB for 4-step RA type. If the Random Access procedure is initiated for beam failure recovery, *rsrp-ThresholdSSB* used for the selection of the SSB within *candidateBeamRSList* refers to *rsrp-ThresholdSSB* in *BeamFailureRecoveryConfig* IE;

- *rsrp-ThresholdCSI-RS*: an RSRP threshold for the selection of CSI-RS for 4-step RA type. If the Random Access procedure is initiated for beam failure recovery, *rsrp-ThresholdCSI-RS* is equal to *rsrp-ThresholdSSB* in *BeamFailureRecoveryConfig* IE;

- *msgA-RSRP-ThresholdSSB*: an RSRP threshold for the selection of the SSB for 2-step RA type;

- *rsrp-ThresholdSSB-SUL*: an RSRP threshold for the selection between the NUL carrier and the SUL carrier;

*- msgA-RSRP-Threshold*: an RSRP threshold for selection between 2-step RA type and 4-step RA type when both 2-step and 4-step RA type Random Access Resources are configured in the UL BWP;

*- rsrp-ThresholdMsg1-RepetitionNum2*: an RSRP threshold for Msg1 repetition with repetition number 2 (see clause 5.1.1b);

*- rsrp-ThresholdMsg1-RepetitionNum4*: an RSRP threshold for Msg1 repetition with repetition number 4 (see clause 5.1.1b);

*- rsrp-ThresholdMsg1-RepetitionNum8*: an RSRP threshold for Msg1 repetition with repetition number 8 (see clause 5.1.1b);

*- rsrp-ThresholdMsg3*: an RSRP threshold for Msg3 repetition (see clause 5.1.1b);

*- FeatureCombination*: feature or a combination of features associated with a set of Random Access resources;

*- featurePriorities*: priorities for features, such as (e)RedCap, Slicing, etc. (see clause 5.1.1d);

- *msgA-TransMax*: The maximum number of MSGA transmissions when both 4-step and 2-step RA type Random Access Resources are configured;

- *candidateBeamRSList*: a list of reference signals (CSI-RS and/or SSB) identifying the candidate beams for recovery and the associated Random Access parameters;

- *recoverySearchSpaceId*: the search space identity for monitoring the response of the beam failure recovery request;

- *powerRampingStep*: the power-ramping factor;

- *msgA-PreamblePowerRampingStep*: the power ramping factor for MSGA preamble;

- *powerRampingStepHighPriority*: the power-ramping factor in case of prioritized Random Access procedure;

- *scalingFactorBI*: a scaling factor for prioritized Random Access procedure;

- *ra-PreambleIndex*: Random Access Preamble;

- *ra-ssb-OccasionMaskIndex*: defines PRACH occasion(s) associated with an SSB in which the MAC entity may transmit a Random Access Preamble (see clause 7.4);

- *msgA-SSB-SharedRO-MaskIndex*: Indicates the subset of 4-step RA type PRACH occasions shared with 2-step RA type PRACH occasions for each SSB. If 2-step RA type PRACH occasions are shared with 4-step RA type PRACH occasions and *msgA-SSB-SharedRO-MaskIndex* is not configured, then all 4-step RA type PRACH occasions are available for 2-step RA type (see clause 7.4);

- *ssb-SharedRO-MaskIndex*: defines PRACH occasions, on which preambles are allocated for a feature or a combination of features, associated with an SSB in which the MAC entity may transmit a Random Access Preamble (see clause 7.4);

- *ra-OccasionList*: defines PRACH occasion(s) associated with a CSI-RS in which the MAC entity may transmit a Random Access Preamble;

- *ra-PreambleStartIndex*: the starting index of Random Access Preamble(s) for on-demand SI request;

- *startPreambleForThisPartition*: the first preamble associated with the set of Random Access Resources applicable to the Random Access procedure;

- *preambleTransMax*: the maximum number of Random Access Preamble transmission;

- *preambleTransMax-Msg1-Repetition*: the maximum number of Random Access Preamble transmissions with a given Msg1 repetition number before switching to Msg1 repetition with the next available higher Msg1 repetition number;

- *ssb-perRACH-OccasionAndCB-PreamblesPerSSB*: defines the number of SSBs mapped to each PRACH occasion for 4-step RA type and the number of contention-based Random Access Preambles mapped to each SSB;

- *msgA-CB-PreamblesPerSSB-PerSharedRO*: defines the number of contention-based Random Access Preambles for 2-step RA type mapped to each SSB when the PRACH occasions are shared between 2-step and 4-step RA types;

- *msgA-SSB-PerRACH-OccasionAndCB-PreamblesPerSSB*: defines the number of SSBs mapped to each PRACH occasion for 2-step RA type and the number of contention-based Random Access Preambles mapped to each SSB;

- *numberOfPreamblesPerSSB-ForThisPartition*: defines the number ofconsecutive preambles for a feature or a combination of features mapped to each SSB;

- *msgA-PUSCH-ResourceGroupA*: defines MSGA PUSCH resources that the UE shall use when performing MSGA transmission using Random Access Preambles group A;

- *msgA-PUSCH-ResourceGroupB*: defines MSGA PUSCH resources that the UE shall use when performing MSGA transmission using Random Access Preambles group B;

- *msgA-PUSCH-Resource-Index*: identifies the index of the PUSCH resource used for MSGA in case of contention-free Random Access with 2-step RA type;

- if *groupBconfigured* is configured, then Random Access Preambles group B is configured for 4-step RA type.

- Amongst the contention-based Random Access Preambles associated with an SSB (as defined in TS 38.213 [6]), the first *numberOfRA-PreamblesGroupA* included in *groupBconfigured* Random Access Preambles belong to Random Access Preambles group A. The remaining Random Access Preambles associated with the SSB belong to Random Access Preambles group B (if configured).

- if *groupB-ConfiguredTwoStepRA* is configured, then Random Access Preambles group B is configured for 2-step RA type.

- Amongst the contention-based Random Access Preambles for 2-step RA type associated with an SSB (as defined in TS 38.213 [6]), the first *numberOfRA-PreamblesGroupA* included in *GroupB-ConfiguredTwoStepRA* Random Access Preambles belong to Random Access Preambles group A. The remaining Random Access Preambles associated with the SSB belong to Random Access Preambles group B (if configured).

NOTE 3: If Random Access Preambles group B is supported by the cell Random Access Preambles group B is included for each SSB.

- if Random Access Preambles group B is configured for 4-step RA type:

- *ra-Msg3SizeGroupA*: the threshold to determine the groups of Random Access Preambles for 4-step RA type;

- *msg3-DeltaPreamble*: ∆*PREAMBLE\_Msg3* in TS 38.213 [6];

- *messagePowerOffsetGroupB*: the power offset for preamble selection included in *groupBconfigured*;

- *numberOfRA-PreamblesGroupA*: defines the number of Random Access Preambles in Random Access Preamble group A for each SSB included in *groupBconfigured*.

- if Random Access Preambles group B is configured for 2-step RA type:

- *msgA-DeltaPreamble*: ∆*MsgA\_PUSCH* in TS 38.213 [6];

- *messagePowerOffsetGroupB*: the power offset for preamble selection included in *GroupB-ConfiguredTwoStepRA*;

- *numberOfRA-PreamblesGroupA*: defines the number of Random Access Preambles in Random Access Preamble group A for each SSB included in *GroupB-ConfiguredTwoStepRA*;

- *ra-MsgA-SizeGroupA*: the threshold to determine the groups of Random Access Preambles for 2-step RA type.

- the set of Random Access Preambles and/or PRACH occasions for SI request, if any;

- the set of Random Access Preambles and/or PRACH occasions for beam failure recovery request, if any;

- the set of Random Access Preambles and/or PRACH occasions for reconfiguration with sync, if any;

- *ra-ResponseWindow*: the time window to monitor RA response(s) (SpCell only);

- *ra-ContentionResolutionTimer*: the Contention Resolution Timer (SpCell only);

- *msgB-ResponseWindow*: the time window to monitor RA response(s) for 2-step RA type (SpCell only).

In addition, the following information for related Serving Cell is assumed to be available for UEs:

- if Random Access Preambles group B is configured:

- if the Serving Cell for the Random Access procedure is configured with supplementary uplink as specified in TS 38.331 [5], and SUL carrier is selected for performing Random Access Procedure:

- PCMAX,f,c of the SUL carrier as specified in TS 38.101-1 [14], TS 38.101-2 [15], and TS 38.101-3 [16].

- else:

- PCMAX,f,c of the NUL carrier as specified in TS 38.101-1 [14], TS 38.101-2 [15], and TS 38.101-3 [16].

The following UE variables are used for the Random Access procedure:

- *PREAMBLE\_INDEX*;

- *PREAMBLE\_TRANSMISSION\_COUNTER*;

- *PREAMBLE\_POWER\_RAMPING\_COUNTER*;

- *PREAMBLE\_POWER\_RAMPING\_STEP*;

- *PREAMBLE\_RECEIVED\_TARGET\_POWER*;

- *PREAMBLE\_BACKOFF*;

- *PCMAX*;

- *SCALING\_FACTOR\_BI*;

- *TEMPORARY\_C-RNTI*;

- *RA\_TYPE*;

- *POWER\_OFFSET\_2STEP\_RA*;

- *MSGA\_PREAMBLE\_POWER\_RAMPING\_STEP*.

When the Random Access procedure is initiated on a Serving Cell or for an LTM candidate cell, the MAC entity shall:

1> flush the Msg3 buffer;

1> flush the MSGA buffer;

1> set the *PREAMBLE\_TRANSMISSION\_COUNTER* to 1;

1> if the Random Access procedure is initiated on a Serving Cell; or

1> if the Random Access procedure is initiated by the PDCCH order for an LTM candidate cell and the PDCCH order indicates preamble initial transmission; or

1> if the Random Access procedure is initiated by the PDCCH order for an LTM candidate cell, which is different from the cell to which the UE performed the last Random Access Preamble transmission, and the PDCCH order indicates preamble re-transmission:

2> set the *PREAMBLE\_POWER\_RAMPING\_COUNTER* to 1;

1> set the *PREAMBLE\_BACKOFF* to 0 ms;

1> set *POWER\_OFFSET\_2STEP\_RA* to 0 dB;

1> if the carrier to use for the Random Access procedure is explicitly signalled:

2> select the signalled carrier for performing Random Access procedure;

2> set the *PCMAX* to PCMAX,f,c of the signalled carrier.

1> else if the carrier to use for the Random Access procedure is not explicitly signalled; and

1> if the Serving Cell for the Random Access procedure is configured with supplementary uplink as specified in TS 38.331 [5]; and

1> if the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdSSB-SUL*:

2> select the SUL carrier for performing Random Access procedure;

2> set the *PCMAX* to PCMAX,f,c of the SUL carrier.

1> else:

2> select the NUL carrier for performing Random Access procedure;

2> set the *PCMAX* to PCMAX,f,c of the NUL carrier.

NOTE 4: Void.

1> perform the BWP operation as specified in clause 5.15, except when the Random Access procedure is initiated by the PDCCH order for an LTM candidate cell;

1> select the set of Random Access resources applicable to the current Random Access procedure according to clause 5.1.1b;

1> if the Random Access procedure is initiated by PDCCH order and if the *ra-PreambleIndex* explicitly provided by PDCCH is not 0b000000; or

1> if the Random Access procedure was initiated for SI request (as specified in TS 38.331 [5]) and the Random Access Resources for SI request have been explicitly provided by RRC; or

1> if the Random Access procedure was initiated for SpCell beam failure recovery (as specified in clause 5.17) and if the contention-free Random Access Resources for beam failure recovery request for 4-step RA type have been explicitly provided by RRC for the BWP selected for Random Access procedure; or

1> if the Random Access procedure was initiated for reconfiguration with sync not initiated for recovery using an LTM candidate configuration as specified in TS 38.331 [5] clause 5.3.7.3 and if the contention-free Random Access Resources for 4-step RA type have been explicitly provided in *rach-ConfigDedicated* for the BWP selected for Random Access procedure; or

1> if the contention-free Random Access Resources have been explicitly provided in the (Enhanced) LTM Cell Switch Command MAC CE:

2> set the *RA\_TYPE* to *4-stepRA*.

1> else if the BWP selected for Random Access procedure is configured with both 2-step and 4-step RA type Random Access Resources within the selected set of Random Access resources (as specified in clause 5.1.1b) and the RSRP of the downlink pathloss reference is above *msgA-RSRP-Threshold*; or

1> if the BWP selected for Random Access procedure is only configured with 2-step RA type Random Access resources within the selected set of Random Access resources according to clause 5.1.1b; or

1> if the Random Access procedure was initiated for reconfiguration with sync not initiated for recovery using an LTM candidate configuration as specified in TS 38.331 [5] clause 5.3.7.3 and if the contention-free Random Access Resources for 2-step RA type have been explicitly provided in *rach-ConfigDedicated* for the BWP selected for Random Access procedure:

2> set the *RA\_TYPE* to *2-stepRA*.

1> else:

2> set the *RA\_TYPE* to *4-stepRA*.

1> perform initialization of variables specific to Random Access type as specified in clause 5.1.1a;

1> if *RA\_TYPE* is set to *2-stepRA*:

2> perform the Random Access Resource selection procedure for 2-step RA type (see clause 5.1.2a).

1> else:

2> perform the Random Access Resource selection procedure (see clause 5.1.2).

Next change

### 5.1.1b Selection of the set of Random Access resources for the Random Access procedure

The MAC entity shall:

1> if the BWP selected for Random Access procedure is configured with both set(s) of Random Access resources with *msg3-Repetitions* set to *true* and set(s) of Random Access resources without *msg3-Repetitions* set to *true* and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg3*; or

1> if the BWP selected for Random Access procedure is only configured with the set(s) of Random Access resources with *msg3-Repetitions* set to *true*:

2> assume Msg3 repetition is applicable for the current Random Access procedure.

1> else:

2> assume Msg3 repetition is not applicable for the current Random Access procedure.

1> if contention-free Random Access Resources have been provided for this Random Access procedure in the (Enhanced) LTM Cell Switch Command MAC CE and a non-zero Msg1 repetition number is indicated in the (Enhanced) LTM Cell Switch Command MAC CE:

2> assume that Msg1 repetition is applicable and that the Msg1 repetition number applicable for the current Random Access procedure is the Msg1 repetition number indicated in the (Enhanced) LTM Cell Switch Command MAC CE.

1> else if contention-free Random Access Resources have been provided for this Random Access procedure and a Msg1 repetition number is indicated in *rach-ConfigDedicated*:

2> assume Msg1 repetition is applicable and Msg1 repetition number applicable for the current Random Access procedure is the Msg1 repetition number indicated in *rach-ConfigDedicated*.

1> else if contention free Random Access Resources have not been provided for this Random Access procedure and the BWP selected for the Random Access procedure is configured with set(s) of Random Access resources with *msg1-Repetitions* set to *true* and set(s) of Random Access resources without *msg1-Repetitions* set to *true*:

2> if the BWP selected for the Random Access procedure is configured with set(s) of Random Access resources associated with Msg1 repetition number 8 and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg1-RepetitionNum8*:

3> assume Msg1 repetition is applicable and Msg1 repetition number applicable for the current Random Access procedure includes 8.

2> if the BWP selected for the Random Access procedure is configured with set(s) of Random Access resources associated with Msg1 repetition number 4 and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg1-RepetitionNum4*:

3> assume Msg1 repetition is applicable and Msg1 repetition number applicable for the current Random Access procedure includes 4.

2> if the BWP selected for the Random Access procedure is configured with set(s) of Random Access resources associated with Msg1 repetition number 2 and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg1-RepetitionNum2*:

3> assume Msg1 repetition is applicable and Msg1 repetition number applicable for the current Random Access procedure includes 2.

2> else if the RSRP of the downlink pathloss reference is not less than any configured *rsrp-ThresholdMsg1-RepetitionNumX*:

3> assume Msg1 repetition is not applicable for the current Random Access procedure.

1> else ifthe BWP selected for Random Access procedure is configured only with the set(s) of Random Access resources with *msg1-Repetitions* set to *true*:

2> assume Msg1 repetition is applicable for the current Random Access procedure;

2> if at least one of *rsrp-ThresholdMsg1-RepetitionNumX* is configured:

3> if *rsrp-ThresholdMsg1-RepetitionNum8* is configured and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg1-RepetitionNum8*;

4> assume Msg1 repetition number applicable for the current Random Access procedure includes 8.

3> if *rsrp-ThresholdMsg1-RepetitionNum4* is configured and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg1-RepetitionNum4*:

4> assume Msg1 repetition number applicable for the current Random Access procedure includes 4.

3> if *rsrp-ThresholdMsg1-RepetitionNum2* is configured and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg1-RepetitionNum2*:

4> assume Msg1 repetition number applicable for the current Random Access procedure includes 2.

3> else if the RSRP of the downlink pathloss reference is not less than any configured *rsrp-ThresholdMsg1-RepetitionNumX*:

4> assume Msg1 repetition number applicable for the current Random Access procedure is the lowest Msg1 repetition number configured for this BWP.

2> else (none of *rsrp-ThresholdMsg1-RepetitionNumX* is configured):

3> assume Msg1 repetition number applicable for the current Random Access procedure is the Msg1 repetition number that configured for this BWP.

NOTE 1: Void.

1> if neither contention-free Random Access Resources nor Random Access Resources for SI request have been provided for this Random Access procedure and one or more of the features including (e)RedCap and/or Slicing and/or SDT and/or MSG3 repetition and/or MSG1 repetition is applicable for this Random Access procedure:

NOTE 2: The applicability of SDT is determined by MAC entity according to clause 5.27. The applicability of *NSAG-ID* is determined by upper layers when the Random Access procedure is initiated. The applicability of (e)RedCap is also determined by upper layers when Random Access procedure is initiated and it is applicable to the Random Access procedures initiated by PDCCH orders and any Random Access procedure initiated by the MAC entity.

NOTE 3: SDT is not applicable for the Random Access procedure initiated by upper layers for MT-SDT.

2> if none of the sets of Random Access resources are available for any feature applicable to the current Random Access procedure (as specified in clause 5.1.1c):

3> select the set(s) of Random Access resources that are not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.

2> else if there is one set of Random Access resources available which can be used for indicating all features triggering this Random Access procedure:

3> select this set of Random Access resources for this Random Access procedure.

2> else if there are more than one set of Random Access resources available which can be used for indicating all features triggering this Random Access procedure and Msg1 repetition is applicable for this Random Access procedure:

3> select the set of Random Access resources that associated with highest repetition number among the sets of Random Access resources.

2> else (i.e. there are one or more sets of Random Access resources available that are configured with indication(s) for a subset of all features triggering this Random Access procedure):

3> select a set of Random Access resources from the available set(s) of Random Access resources based on the priority order indicated by upper layers as specified in clause 5.1.1d for this Random Access Procedure.

1> else if this Random Access procedure is initiated by PDCCH order with the *PRACH association indicator* field in DCI set to 1 and *SSB-MTC-AdditionalPCI* is configured by upper layers, as specified in clause 7.3.1.2.1 of TS 38.212 [9]:

2> select the set of Random Access resources corresponding to the *additionalPCI* associated with active TCI states.

1> else if this Random Access procedure is initiated by PDCCH order for an LTM candidate cell:

2> select the set of Random Access resources configured in *EarlyUL-SyncConfig* corresponding to the carrier and the cell indicated by the field *UL/SUL indicator* and the field *Cell indicator* in the PDCCH order respectively, as specified in TS 38.212 [9].

1> else if contention-free Random Access Resources have been provided for this Random Access procedure by PDCCH order:

2> if RedCap is applicable for the current Random Access procedure:

3> if there is one set of Random Access resources available that is only configured with RedCap indication:

4> select this set of Random Access resources for this Random Access procedure.

3> else:

4> select the set of Random Access resources that is not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.

2> else if eRedCap is applicable for the current Random Access procedure:

3> if there is one set of Random Access resources available that is only configured with eRedCap indication:

4> select this set of Random Access resources for this Random Access procedure.

3> else if there is one set of Random Access resources available that is only configured with RedCap indication:

4> select this set of Random Access resources for this Random Access procedure.

3> else:

4> select the set of Random Access resources that is not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.

2> else:

3> select the set of Random Access resources that is not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.

1> else if contention-free Random Access Resources have been provided for this Random Access procedure in the (Enhanced) LTM Cell Switch Command MAC CE:

2> if RedCap is applicable for this Random Access procedure:

3> if a non-zero Msg1 repetition number is indicated in the (Enhanced) LTM Cell Switch Command MAC CE:

4> select the set of Random Access resources that is only configured with RedCap indication and Msg1 repetition indication and associated with the indicated Msg1 repetition number for this Random Access procedure.

3> else:

4> if there is one set of Random Access resources available that is only configured with RedCap indication:

5> select this set of Random Access resources for this Random Access procedure.

4> else:

5> select the set of Random Access resources that is not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.

2> else if eRedCap is applicable for this Random Access procedure:

3> if a non-zero Msg1 repetition number is indicated in the (Enhanced) LTM Cell Switch Command MAC CE:

4> select the set of Random Access resources that is only configured with eRedCap indication and Msg1 repetition indication and associated with the indicated Msg1 repetition number for this Random Access procedure.

3> else:

4> if there is one set of Random Access resources available that is only configured with eRedCap indication:

5> select this set of Random Access resources for this Random Access procedure.

4> else if there is one set of Random Access resources available that is only configured with RedCap indication:

5> select this set of Random Access resources for this Random Access procedure.

4> else:

5> select the set of Random Access resources that is not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.

2> else:

3> if a non-zero Msg1 repetition number is indicated in the (Enhanced) LTM Cell Switch Command MAC CE:

4> select the set of Random Access resources that is only configured with Msg1 repetition indication and associated with the indicated Msg1 repetition number for this Random Access procedure.

3> else:

4> select the set of Random Access resources that is not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.

1> else if contention-free Random Access Resources have been provided for this Random Access procedure in *rach-ConfigDedicated*:

2> if RedCap is applicable for this Random Access procedure:

3> if Msg1 repetition number is indicated in *rach-ConfigDedicated*:

4> select the set of Random Access resources that is only configured with RedCap indication and Msg1 repetition indication and associated with the indicated Msg1 repetition number for this Random Access procedure.

3> else:

4> if there is one set of Random Access resources available that is only configured with RedCap indication:

5> select this set of Random Access resources for this Random Access procedure.

4> else:

5> select the set of Random Access resources that is not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.

2> else if eRedCap is applicable for this Random Access procedure:

3> if Msg1 repetition number is indicated in *rach-ConfigDedicated*:

4> select the set of Random Access resources that is only configured with eRedCap indication and Msg1 repetition indication and associated with the indicated Msg1 repetition number for this Random Access procedure.

3> else:

4> if there is one set of Random Access resources available that is only configured with eRedCap indication:

5> select this set of Random Access resources for this Random Access procedure.

4> else if there is one set of Random Access resources available that is only configured with RedCap indication:

5> select this set of Random Access resources for this Random Access procedure.

4> else:

5> select the set of Random Access resources that not is associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.

2> else:

3> if Msg1 repetition number is indicated in *rach-ConfigDedicated*:

4> select the set of Random Access resources that is only configured with Msg1 repetition indication and associated with the indicated Msg1 repetition number for this Random Access procedure.

3> else:

4> select the set of Random Access resources that is not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.

1> else if contention-free Random Access Resources have been provided for this Random Access procedure in the *BeamFailureRecoveryConfig*:

2> if RedCap is applicable for this Random Access procedure:

3> if there is one set of Random Access resources available that is only configured with RedCap indication:

4> select this set of Random Access resources for this Random Access procedure.

3> else:

4> select the set of Random Access resources that is not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.

2> else if eRedCap is applicable for this Random Access procedure:

3> if there is one set of Random Access resources available that is only configured with eRedCap indication:

4> select this set of Random Access resources for this Random Access procedure.

3> else if there is one set of Random Access resources available that is only configured with RedCap indication:

4> select this set of Random Access resources for this Random Access procedure.

3> else:

4> select the set of Random Access resources that is not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.

2> else:

3> select the set of Random Access resources that is not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.

1> else if Random Access resources for SI request have been provided for this Random Access procedure:

2> if Random Access Resources associated with Msg1 repetition for SI request and Msg1 repetition number have been provided for this Random Access procedure:

3> ifthe BWP selected for Random Access procedure is indicated by *initialUplinkBWP-RedCap*:

4> if RedCap is applicable for the current Random Access procedure:

5> select the set of Random Access Resources that is only configured with RedCap indication and Msg1 repetition indication and associated with the indicated Msg1 repetition number for this Random Access procedure.

4> else if eRedCap is applicable for the current Random Access procedure:

5> if there is one set of Random Access resources available that is only configured with RedCap indication and Msg1 repetition indication and associated with the indicated Msg1 repetition number:

6> select this set of Random Access resources for this Random Access procedure.

5> else:

6> select the set of Random Access Resources that is only configured with eRedCap indication and Msg1 repetition indication and associated with the indicated Msg1 repetition number for this Random Access procedure.

3> else:

4> select the set of Random Access resources that is only configured with Msg1 repetition indication and associated with the indicated Msg1 repetition number for this Random Access procedure.

2> else:

3> select the set of Random Access resources that is not associated with any feature indication (as specified in clause 5.1.1c) for the current Random Access procedure.

1> else:

2> select the set of Random Access resources that is not associated with any feature indication (as specified in clause 5.1.1c) for the current Random Access procedure.

Next change

### 5.1.2 Random Access Resource selection

If the selected *RA\_TYPE* is set to *4-stepRA*, the MAC entity shall:

1> if the Random Access procedure was initiated for SpCell beam failure recovery (as specified in clause 5.17); and

1> if the *beamFailureRecoveryTimer* (in clause 5.17) is either running or not configured; and

1> if the contention-free Random Access Resources for beam failure recovery request associated with any of the SSBs and/or CSI-RSs have been explicitly provided by RRC; and

1> if at least one of the SSBs with SS-RSRP above *rsrp-ThresholdSSB* amongst the SSBs in *candidateBeamRSList* or the CSI-RSs with CSI-RSRP above *rsrp-ThresholdCSI-RS* amongst the CSI-RSs in *candidateBeamRSList* is available:

2> select an SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the SSBs in *candidateBeamRSList* or a CSI-RS with CSI-RSRP above *rsrp-ThresholdCSI-RS* amongst the CSI-RSs in *candidateBeamRSList*;

2> if CSI-RS is selected, and there is no *ra-PreambleIndex* associated with the selected CSI-RS:

3> set the *PREAMBLE\_INDEX* to a *ra-PreambleIndex* corresponding to the SSB in *candidateBeamRSList* which is quasi-colocated with the selected CSI-RS as specified in TS 38.214 [7].

2> else:

3> set the *PREAMBLE\_INDEX* to a *ra-PreambleIndex* corresponding to the selected SSB or CSI-RS from the set of Random Access Preambles for beam failure recovery request.

1> else if the *ra-PreambleIndex* has been explicitly provided by PDCCH; and

1> if the *ra-PreambleIndex* is not 0b000000:

2> set the *PREAMBLE\_INDEX* to the signalled *ra-PreambleIndex*;

2> select the SSB signalled by PDCCH.

1> else if contention-free Random Access Resources have been explicitly provided by an (Enhanced) LTM Cell Switch Command MAC CE and the SS-RSRP of the SSB signalled by the (Enhanced) LTM Cell Switch Command MAC CE is above *rsrp-ThresholdSSB*:

2> set the *PREAMBLE\_INDEX* to the Random Access Preamble index signalled by the (Enhanced) LTM Cell Switch Command MAC CE;

2> select the SSB signalled by the (Enhanced) LTM Cell Switch Command MAC CE.

1> else if contention-free Random Access Resources have not been explicitly provided by an (Enhanced) LTM Cell Switch Command MAC CE, the Random Access procedure was not initiated for recovery using an LTM candidate configuration as specified in TS 38.331 [5] clause 5.3.7.3, contention-free Random Access Resources associated with SSBs have been explicitly provided in *rach-ConfigDedicated* and at least one SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs is available:

2> select an SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs;

2> set the *PREAMBLE\_INDEX* to a *ra-PreambleIndex* corresponding to the selected SSB.

1> else if contention-free Random Access Resources have not been explicitly provided by an (Enhanced) LTM Cell Switch Command MAC CE, the Random Access procedure was not initiated for recovery using an LTM candidate configuration as specified in TS 38.331 [5] clause 5.3.7.3, contention-free Random Access Resources associated with CSI-RSs have been explicitly provided in *rach-ConfigDedicated* and at least one CSI-RS with CSI-RSRP above *rsrp-ThresholdCSI-RS* amongst the associated CSI-RSs is available:

2> select a CSI-RS with CSI-RSRP above *rsrp-ThresholdCSI-RS* amongst the associated CSI-RSs;

2> set the *PREAMBLE\_INDEX* to a *ra-PreambleIndex* corresponding to the selected CSI-RS.

1> else if the Random Access procedure was initiated for SI request (as specified in TS 38.331 [5]); and

1> if the Random Access Resources for SI request have been explicitly provided by RRC:

2> if at least one of the SSBs with SS-RSRP above *rsrp-ThresholdSSB* is available:

3> select an SSB with SS-RSRP above *rsrp-ThresholdSSB*.

2> else:

3> select any SSB.

2> select a Random Access Preamble corresponding to the selected SSB, from the Random Access Preamble(s) determined according to *ra-PreambleStartIndex* as specified in TS 38.331 [5];

2> set the *PREAMBLE\_INDEX* to selected Random Access Preamble.

1> else (i.e. for the contention-based Random Access preamble selection):

2> if at least one of the SSBs with SS-RSRP above *rsrp-ThresholdSSB* is available:

3> select an SSB with SS-RSRP above *rsrp-ThresholdSSB*.

2> else:

3> select any SSB.

2> if the *RA\_TYPE* is switched from *2-stepRA* to *4-stepRA*:

3> if a Random Access Preambles group was selected during the current Random Access procedure:

4> select the same group of Random Access Preambles as was selected for the 2-step RA type.

3> else:

4> if Random Access Preambles group B is configured; and

4> if the transport block size of the MSGA payload configured in the *rach-ConfigDedicated* corresponds to the transport block size of the MSGA payload associated with Random Access Preambles group B:

5> select the Random Access Preambles group B.

4> else:

5> select the Random Access Preambles group A.

2> else if Msg3 buffer is empty:

3> if Random Access Preambles group B is configured:

4> if the potential Msg3 size (UL data available for transmission plus MAC subheader(s) and, where required, MAC CEs) is greater than *ra-Msg3SizeGroupA* and the pathloss is less than *PCMAX* (of the Serving Cell performing the Random Access Procedure) – *preambleReceivedTargetPower* – *msg3-DeltaPreamble* – *messagePowerOffsetGroupB*; or

4> if the Random Access procedure was initiated for the CCCH logical channel and the CCCH SDU size plus MAC subheader is greater than *ra-Msg3SizeGroupA*:

5> select the Random Access Preambles group B.

4> else:

5> select the Random Access Preambles group A.

3> else:

4> select the Random Access Preambles group A.

2> else (i.e. Msg3 is being retransmitted):

3> select the same group of Random Access Preambles as was used for the Random Access Preamble transmission attempt corresponding to the first transmission of Msg3.

2> select a Random Access Preamble randomly with equal probability from the Random Access Preambles associated with the selected SSB and the selected Random Access Preambles group;

2> set the *PREAMBLE\_INDEX* to the selected Random Access Preamble.

1> if the Random Access procedure was initiated for SI request (as specified in TS 38.331 [5]); and

1> if *ra-AssociationPeriodIndex* and *si-RequestPeriod* are configured:

2> determine the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB in the association period given by *ra-AssociationPeriodIndex* in the *si-RequestPeriod* permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured (the MAC entity shall select a PRACH occasion randomly with equal probability amongst the consecutive PRACH occasions according to clause 8.1 of TS 38.213 [6] corresponding to the selected SSB).

1> else if an SSB is selected above:

2> if the set of Random Access resources associated with Msg1 repetition is selected for this Random Access procedure:

3> determine the next available set of PRACH occasions (as specified in TS 38.213 [6]) for the Msg1 repetition number applicable for this Random Access procedure corresponding to the selected SSB (the MAC entity shall select a set of PRACH occasions randomly with equal probability amongst sets of PRACH occasions according to clause 8.1 of TS 38.213 [6] regardless the FR2 UL gap, corresponding to the selected SSB and selected Msg1 repetition number for this Random Access procedure; the MAC entity may take into account the possible occurrence of measurement gaps and MUSIM gaps when determining the next available set of PRACH occasions corresponding to the selected SSB).

2> else:

3> determine the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, or *ssb-SharedRO-MaskIndex* if configured, or indicated by PDCCH, or indicated by the (Enhanced) LTM Cell Switch Command MAC CE (the MAC entity shall select a PRACH occasion randomly with equal probability amongst the consecutive PRACH occasions according to clause 8.1 of TS 38.213 [6] regardless the FR2 UL gap, corresponding to the selected SSB; the MAC entity may take into account the possible occurrence of measurement gaps and MUSIM gaps when determining the next available PRACH occasion corresponding to the selected SSB).

1> else if a CSI-RS is selected above:

2> if there is no contention-free Random Access Resource associated with the selected CSI-RS:

3> determine the next available PRACH occasion from the PRACH occasions, permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, corresponding to the SSB in *candidateBeamRSList* which is quasi-colocated with the selected CSI-RS as specified in TS 38.214 [7] (the MAC entity shall select a PRACH occasion randomly with equal probability amongst the consecutive PRACH occasions according to clause 8.1 of TS 38.213 [6] regardless the FR2 UL gap, corresponding to the SSB which is quasi-colocated with the selected CSI-RS; the MAC entity may take into account the possible occurrence of measurement gaps and MUSIM gaps when determining the next available PRACH occasion corresponding to the SSB which is quasi-colocated with the selected CSI-RS).

2> else:

3> determine the next available PRACH occasion from the PRACH occasions in *ra-OccasionList* corresponding to the selected CSI-RS (the MAC entity shall select a PRACH occasion randomly with equal probability amongst the PRACH occasions occurring simultaneously but on different subcarriers regardless the FR2 UL gap, corresponding to the selected CSI-RS; the MAC entity may take into account the possible occurrence of measurement gaps and MUSIM gaps when determining the next available PRACH occasion corresponding to the selected CSI-RS).

1> perform the Random Access Preamble transmission procedure (see clause 5.1.3).

NOTE 1: When the UE determines if there is an SSB with SS-RSRP above *rsrp-ThresholdSSB* or a CSI-RS with CSI-RSRP above *rsrp-ThresholdCSI-RS*, the UE uses the latest unfiltered L1-RSRP measurement.

NOTE 2: Void.

NOTE 3: If an (e)RedCap UE in RRC\_IDLE or RRC\_INACTIVE mode is configured with a BWP indicated by *initialDownlinkBWP-RedCap* which is not associated with any SSB, SS-RSRP measurement is performed based on the SSB associated with the BWP indicated by *initialDownlinkBWP*. If an (e)RedCap UE in RRC\_INACTIVE mode is configured with SDT and with a BWP indicated by *initialDownlinkBWP-RedCap* which is associated with NCD-SSB, SS-RSRP measurement can also be performed based on this NCD-SSB during SDT.

NOTE 4: If an (e)RedCap UE in RRC\_IDLE or RRC\_INACTIVE mode is configured with a BWP indicated by *initialDownlinkBWP-RedCap* which is not associated with any SSB for RACH, it is up to the UE implementation to perform a new RSRP measurements before Msg1/MsgA retransmission.

Next change

## 5.2 Maintenance of Uplink Time Alignment

RRC configures the following parameters for the maintenance of UL time alignment:

- *timeAlignmentTimer* (per TAG) which controls how long the MAC entity considers the Serving Cells to the associated TAG to be uplink time aligned for the TAG;

- *inactivePosSRS-TimeAlignmentTimer* which controls how long the MAC entity considers the Positioning SRS transmission in RRC\_INACTIVE in clause 5.26 to be uplink time aligned;

- *cg-SDT-TimeAlignmentTimer* which controls how long the MAC entity considers the uplink transmission for CG-SDT to be uplink time aligned;

- *inactivePosSRS-ValidityAreaTAT* which controls how long the MAC entity considers Positioning SRS transmission in RRC\_INACTIVE in clause 5.26 to be uplink time aligned when SRS positioning validity area is configured;

- *ltm-TimeAlignmentTimer* which controls how long the MAC entity considers the CLTM candidate cell associated with this timer to be uplink time aligned. Each *ltm-Candidate-TimeAlignmentTimer* is associated with one CLTM candidate cell;

- *ltm-TimeAlignmentTimerTAG2* which controls how long the MAC entity considers the CLTM candidate cell associated with this timer to be uplink time aligned for TAG with ID *tag2-Id*. This timer is configured if two TAGs are configured for the CLTM candidate cell.

The MAC entity shall:

1> when a Timing Advance Command MAC CE is received, and if an NTA (as defined in TS 38.211 [8]) has been maintained with the indicated TAG:

2> apply the Timing Advance Command for the indicated TAG;

2> if there is ongoing Positioning SRS Transmission in RRC\_INACTIVE as in clause 5.26:

3> if SRS positioning validity area is configured:

4> start or restart the *inactivePosSRS-ValidityAreaTAT* associated with the indicated TAG.

3> else:

4> start or restart the *inactivePosSRS-TimeAlignmentTimer* associated with the indicated TAG.

2> if CG-SDT procedure triggered as in clause 5.27 is ongoing:

3> start or restart the *cg-SDT-TimeAlignmentTimer* associated with the indicated TAG.

2> else:

3> start or restart the *timeAlignmentTimer* associated with the indicated TAG.

1> when a Timing Advance Command is received in a Random Access Response message for a Serving Cell configured with two TAGs or in a MSGB for an SpCell configured with two TAGs:

2> if the Random Access Preamble was not selected by the MAC entity among the contention-based Random Access Preamble:

3> apply the Timing Advance Command for the TAG indicated in the received Random Access Response message or MSGB;

3> start or restart the *timeAlignmentTimer* associated with TAG indicated in the received Random Access Response message or MSGB.

2> else if the *timeAlignmentTimer* associated with the TAG indicated in the received Random Access Response message or MSGB is not running:

3> apply the Timing Advance Command for this TAG;

3> start the *timeAlignmentTimer* associated with this TAG;

3> when the Contention Resolution is considered not successful as described in clause 5.1.5:

4> stop the *timeAlignmentTimer* associated with this TAG.

2> else:

3> ignore the received Timing Advance Command.

1> when a Timing Advance Command is received in a Random Access Response message for a Serving Cell not configured with two TAGs or in a MSGB for an SpCell not configured with two TAGs:

2> if the Random Access Preamble was not selected by the MAC entity among the contention-based Random Access Preamble:

3> apply the Timing Advance Command for this TAG;

3> start or restart the *timeAlignmentTimer* associated with this TAG.

2> else if the *timeAlignmentTimer* associated with this TAG is not running:

3> apply the Timing Advance Command for this TAG;

3> start the *timeAlignmentTimer* associated with this TAG;

3> when the Contention Resolution is considered not successful as described in clause 5.1.5; or

3> when the Contention Resolution is considered successful for SI request as described in clause 5.1.5, after transmitting HARQ feedback for MAC PDU including UE Contention Resolution Identity MAC CE:

4> stop *timeAlignmentTimer* associated with this TAG.

3> when the Contention Resolution is considered not successful as described in clause 5.1.5:

4> if CG-SDT procedure triggered as in clause 5.27 is ongoing; or

4> if SRS transmission in RRC\_INACTIVE as in clause 5.26 is ongoing:

5> set the NTA value to the value before applying the received Timing Advance Command as in TS 38.211 [8].

3> when the Contention Resolution is considered successful for Random Access procedure while the CG-SDT procedure is ongoing:

4> stop *timeAlignmentTimer* associated with this TAG;

4> start or restart the *cg-SDT-TimeAlignmentTimer* associated with this TAG.

3> when the Contention Resolution is considered successful for Random Access procedure while Positioning SRS transmission in RRC\_INACTIVE is ongoing as in clause 5.26:

4> if SRS positioning validity area is configured:

5> start or restart the *inactivePosSRS-ValidityAreaTAT* associated with the indicated TAG.

4> else:

5> start or restart the *inactivePosSRS-TimeAlignmentTimer* associated with this TAG.

2> else:

3> ignore the received Timing Advance Command.

1> when an Absolute Timing Advance Command is received in response to a MSGA transmission including C-RNTI MAC CE, as specified in clause 5.1.4a, for an SpCell configured with two TAGs:

2> apply the Timing Advance Command for the PTAG indicated in the Absolute Timing Advance Command MAC CE;

2> start or restart the *timeAlignmentTimer* associated with this PTAG.

1> when an Absolute Timing Advance Command is received in response to a MSGA transmission including C-RNTI MAC CE, as specified in clause 5.1.4a, for an SpCell not configured with two TAGs:

2> apply the Timing Advance Command for PTAG;

2> if there is ongoing Positioning SRS Transmission in RRC\_INACTIVE as in clause 5.26:

3> if SRS positioning validity area is configured:

4> start or restart the *inactivePosSRS-ValidityAreaTAT* associated with the indicated TAG.

3> else:

4> start or restart the *inactivePosSRS-TimeAlignmentTimer* associated with the indicated TAG.

2> if CG-SDT procedure is ongoing:

3> start or restart the *cg-SDT-TimeAlignmentTimer* associated with PTAG.

2> else:

3> start or restart the *timeAlignmentTimer* associated with PTAG.

1> when the MAC entity is configured with *rach-LessHO*:

2> set the NTA value (as defined in TS 38.211 [8]) to the value indicated by *targetNTA* in *rach-LessHO* for PTAG;

2> start the *timeAlignmentTimer* associated with PTAG.

1> when the indication is received from upper layer for stopping the *inactivePosSRS-TimeAlignmentTimer*:

2> stop the *inactivePosSRS-TimeAlignmentTimer*.

1> when the indication is received from upper layer for starting the *inactivePosSRS-TimeAlignmentTimer*:

2> start or restart the *inactivePosSRS-TimeAlignmentTimer*.

1> when instruction from the upper layer has been received for starting the *cg-SDT-TimeAlignmentTimer*:

2> start the *cg-SDT-TimeAlignmentTimer*.

1> when instruction from the upper layer has been received for stopping the *cg-SDT-TimeAlignmentTimer*:

2> consider the *cg-SDT-TimeAlignmentTimer* as expired.

1> when the indication is received from upper layer for starting the *inactivePosSRS-ValidityAreaTAT*:

2> start or restart the *inactivePosSRS-ValidityAreaTAT*.

1> when the indication is received from upper layer for stopping the *inactivePosSRS-ValidityAreaTAT*:

2> stop the *inactivePosSRS-ValidityAreaTAT*.

1> when instruction from the upper layer has been received for starting the *TimeAlignmentTimer* associated with PTAG:

2> start the *TimeAlignmentTimer* associated with the indicated PTAG.

1> when an (Enhanced) LTM Cell Switch Command MAC CE is received and the Timing Advance Command is not set as FFF:

2> apply the Timing Advance Command for the PTAG as specified in clause 6.1.3.75 and clause 6.1.3.75a;

2> start or restart the *timeAlignmentTimer* associated with the PTAG as specified in clause 6.1.3.75 and clause 6.1.3.75a.

1> when an (Enhanced) LTM Cell Switch Command MAC CE is received, and the Timing Advance Command is set as FFF, and the UE has successfully measured the Timing Advance as in clause 5.18.35:

2> apply the measured Timing Advance for the PTAG;

2> start or restart the *timeAlignmentTimer* associated with the PTAG.

1> when a conditional LTM cell switch procedure is triggered for a CLTM candidate cell or indicated by upper layer as specified in clause 5.y.3:

2> if the CLTM candidate cell is not configured with two TAGs and the *ltm-Candidate-TimeAlignmentTimer* associated with the CLTM candidate cell is running as specified in clause 5.2x:

3> apply the stored TA value associated with the CLTM candidate cell for the PTAG as specified in clause 6.1.3.4x;

3> start or restart the *timeAlignmentTimer* associated with the PTAG with the length of the remaining time of the *ltm-Candidate-TimeAlignmentTimer*.

2> if the CLTM candidate cell is configured with two TAGs and the *ltm-Candidate-TimeAlignmentTimer* or *ltm-Candidate-TimeAlignmentTimerTAG2* associated with the CLTM candidate cell for the TAG associated with the selected SSB or selected CSI-RS for CLTM is running as specified in clause 5.2x:

3> apply the stored TA value associated with the CLTM candidate cell for the PTAG as specified in clause 6.1.3.4x;

3> start or restart the *timeAlignmentTimer* associated with the PTAG with the length of the remaining time of the *ltm-Candidate-TimeAlignmentTimer* or *ltm-Candidate-TimeAlignmentTimerTAG2*.

2> else if the UE has successfully measured the Timing Advance as in clause 5.18.35:

3> apply the measured Timing Advance for the PTAG;

3> start or restart the *timeAlignmentTimer* associated with the PTAG.

1> when a *timeAlignmentTimer* expires:

2> if the *timeAlignmentTimer* is associated with a PTAG and the SpCell is not configured with two PTAGs; or

2> if the *timeAlignmentTimer* is associated with a PTAG, the SpCell is configured with two PTAGs, and the *timeAlignmentTimer* associated with the other PTAG is not running:

3> flush all HARQ buffers for all Serving Cells;

3> notify RRC to release PUCCH for all Serving Cells, if configured;

3> notify RRC to release SRS for all Serving Cells, if configured;

3> clear any configured downlink assignments and configured uplink grants;

3> clear any PUSCH resource for semi-persistent CSI reporting;

3> consider all running *timeAlignmentTimer*s as expired;

3> maintain NTA (defined in TS 38.211 [8]) of all TAGs.

2> else:

3> if the *timeAlignmentTimer* is associated with a TAG for an SCell configured with only this TAG; or

3> if the *timeAlignmentTimer* is associated with a TAG for an SCell, and if the SCell is configured with two TAGs and *the timeAlignmentTimer* associated with the other TAG is not running:

4> flush all HARQ buffers for all such SCells;

4> notify RRC to release PUCCH, if configured for all such SCells;

4> notify RRC to release SRS, if configured for all such SCells;

4> clear any configured downlink assignments and configured uplink grants for all such SCells;

4> clear any PUSCH resource for semi-persistent CSI reporting for all such SCells;

4> maintain NTA (defined in TS 38.211 [8]) of this TAG.

3> else if the *timeAlignmentTimer* is associated with a TAG for a Serving Cell configured with two TAGs, and if the *timeAlignmentTimer* associated with the other TAG is running, for all such Serving Cells:

4> clear any configured downlink assignment, if the activated TCI state(s) for all PUCCH resources configured for the configured downlink assignment is associated with the TAG of the expired *timeAlignmentTimer*;

4> clear any configured uplink grant, if the activated TCI state(s) for the configured uplink grant is associated with the TAG of the expired *timeAlignmentTimer*;

4> clear any PUSCH resource for semi-persistent CSI reporting, if the activated TCI state(s) for the PUSCH resource is associated with the TAG of the expired *timeAlignmentTimer*;

4> maintain NTA (defined in TS 38.211 [8]) of this TAG.

1> when the *inactivePosSRS-TimeAlignmentTimer* expires:

2> notify RRC to release Positioning SRS for RRC\_INACTIVE configuration(s).

1> when the *cg-SDT-TimeAlignmentTimer* expires:

2> clear any configured uplink grants;

2> if a PDCCH addressed to the MAC entity's C-RNTI after initial transmission for the CG-SDT with CCCH message has not been received:

3> consider ongoing CG-SDT procedure as terminated;

3> indicate the expiry of *cg-SDT-TimeAlignmentTimer* to the upper layer.

2> flush all HARQ buffers;

2> maintain NTA (defined in TS 38.211 [8]) of this TAG.

When the MAC entity stops uplink transmissions for an SCell not configured with two TAGs due to the fact that the maximum uplink transmission timing difference between TAGs of the MAC entity or the maximum uplink transmission timing difference between TAGs of any MAC entity of the UE is exceeded, the MAC entity considers the *timeAlignmentTimer* associated with the SCell as expired.

When the MAC entity stops uplink transmissions associated to a STAG for an SCell configured with two TAGs due to the fact that the maximum uplink transmission timing difference between TAGs of the MAC entity or the maximum uplink transmission timing difference between TAGs of any MAC entity of the UE is exceeded, the MAC entity considers the *timeAlignmentTimer* associated with the STAG as expired.

The MAC entity shall not perform any uplink transmission on a Serving Cell except the Random Access Preamble and MSGA transmission when the *timeAlignmentTimer*(s) associated with all TAG(s) to which this Serving Cell belongs is not running, CG-SDT procedure is not ongoing and Positioning SRS transmission in RRC\_INACTIVE as in clause 5.26 is not ongoing. Furthermore, when the *timeAlignmentTimer*(s) associated with all PTAG(s) is not running, CG-SDT procedure is not ongoing and Positioning SRS transmission in RRC\_INACTIVE as in clause 5.26 is not ongoing, the MAC entity shall not perform any uplink transmission on any Serving Cell except the Random Access Preamble and MSGA transmission on the SpCell. The MAC entity shall not perform any uplink transmission except the Random Access Preamble and MSGA transmission when the *cg-SDT-TimeAlignmentTimer* is not running during the ongoing CG-SDT procedure as triggered in clause 5.27 and the *inactivePosSRS-TimeAlignmentTimer* or *inactivePosSRS-ValidityAreaTAT* is not running. The MAC entity shall not perform any uplink transmission except the Random Access Preamble and MSGA transmission on a Serving Cell using TCI state(s) associated with a TAG for which the *timeAlignmentTimer* is not running.

Next change

## 5.2x Maintenance of UL Synchronization for CLTM candidate cell

The MAC entity shall for each CLTM candidate cell:

1> when an LTM Candidate Timing Advance Command MAC CE described in clause 6.1.3.4x is received:

2> if two TAGs are configured for the CLTM candidate cell:

3> store the TA value in the LTM Candidate Timing Advance Command MAC CE for the indicated CLTM candidate cell for the indicated TAG as specified in clause 6.1.3.4x;

3> start or restart the *ltm-Candidate-TimeAlignmentTimer* or *ltm-Candidate-TimeAlignmentTimerTAG2* associated with the indicated LTM candidate cell for the indicated TAG as specified in clause 6.1.3.4x;

2> else:

3> store the TA value in the LTM Candidate Timing Advance Command MAC CE for the indicated CLTM candidate cell as specified in clause 6.1.3.4x;

3> start or restart the *ltm-Candidate-TimeAlignmentTimer* associated with the indicated LTM candidate cell as specified in clause 6.1.3.4x.

1> when the CLTM candidate configuration(s) is released as specified in TS 38.331 [5]:

2> stop the running *ltm-Candidate-TimeAlignmentTimer* associated with the corresponding CLTM candidate cell(s), if any;

2> release the stored TA value for the corresponding CLTM candidate cell(s), if any.

Next change

#### 5.4.2.1 HARQ Entity

The MAC entity includes a HARQ entity for each Serving Cell with configured uplink (including the case when it is configured with *supplementaryUplink*), which maintains a number of parallel HARQ processes.

The number of parallel UL HARQ processes per HARQ entity is specified in TS 38.214 [7].

Each HARQ process supports one TB.

For uplink spatial multiplexing, two associated HARQ processes are associated with one HARQ process identifier. Otherwise, each HARQ process is associated with a HARQ process identifier. For UL transmission with UL grant in RA Response or for UL transmission for MSGA payload, HARQ process identifier 0 is used.

NOTE: When a single DCI is used to schedule multiple PUSCH, the UE is allowed to map generated TB(s) internally to different HARQ processes in case of LBT failure(s), i.e. UE may transmit a new TB on any HARQ process in the grants that have the same TBS, the same RV and the NDIs indicate new transmission.

The maximum number of transmissions of a TB within a bundle of the dynamic grant or configured grant or the uplink grant received in a MAC RAR is given by *REPETITION\_NUMBER* as follows:

- For a dynamic grant, *REPETITION\_NUMBER* is set to a value provided by lower layers, as specified in clause 6.1.2.1 of TS 38.214 [7];

- For a configured grant, *REPETITION\_NUMBER* is set to a value provided by lower layers, as specified in clause 6.1.2.3 of TS 38.214 [7];

- For an uplink grant received in a MAC RAR, REPETITION\_NUMBER is set to a value provided by lower layers, as specified in clause 6.1.2.1 of TS 38.214 [7].

If *REPETITION\_NUMBER* > 1, after the first transmission within a bundle, at most *REPETITION\_NUMBER* – 1 HARQ retransmissions follow within the bundle. For both dynamic grant and configured uplink grant, and uplink grant received in a MAC RAR bundling operation relies on the HARQ entity for invoking the same HARQ process for each transmission that is part of the same bundle. Within a bundle, HARQ retransmissions are triggered without waiting for feedback from previous transmission according to *REPETITION\_NUMBER* for a dynamic grant or configured uplink grant or uplink grant received in a MAC RAR unless they are terminated as specified in clause 6.1 of TS 38.214 [7]. Each transmission within a bundle is a separate uplink grant delivered to the HARQ entity.

For each transmission within a bundle of the dynamic grant or uplink grant received in a MAC RAR, the sequence of redundancy versions is determined according to clause 6.1.2.1 of TS 38.214 [7]. For each transmission within a bundle of the configured uplink grant, the sequence of redundancy versions is determined according to clause 6.1.2.3 of TS 38.214 [7].

For each uplink grant, the HARQ entity shall:

1> identify the HARQ process associated with this grant, and for each identified HARQ process:

2> if the received grant was not addressed to a Temporary C-RNTI on PDCCH, and the NDI provided in the associated HARQ information has been toggled compared to the value in the previous transmission of this TB of this HARQ process; or

2> if the uplink grant was received on PDCCH for the C-RNTI and the HARQ buffer of the identified process is empty; or

2> if the uplink grant was received in a Random Access Response (i.e. in a MAC RAR or a fallback RAR); or

2> if the uplink grant was determined as specified in clause 5.1.2a for the transmission of the MSGA payload; or

2> if the uplink grant was received on PDCCH for the C-RNTI in *ra-ResponseWindow* and this PDCCH successfully completed the Random Access procedure initiated for beam failure recovery; or

2> if the uplink grant is part of a bundle of the configured uplink grant, and may be used for initial transmission according to clause 6.1.2.3 of TS 38.214 [7], and if no MAC PDU has been obtained for this bundle:

3> if there is a MAC PDU in the MSGA buffer and the uplink grant determined as specified in clause 5.1.2a for the transmission of the MSGA payload was selected; or

3> if there is a MAC PDU in the MSGA buffer and the uplink grant was received in a fallbackRAR and this fallbackRAR successfully completed the Random Access procedure:

4> obtain the MAC PDU to transmit from the MSGA buffer.

3> else if there is a MAC PDU in the Msg3 buffer and the uplink grant was received in a fallbackRAR:

4> obtain the MAC PDU to transmit from the Msg3 buffer.

3> else if there is a MAC PDU in the Msg3 buffer and the uplink grant was received in a MAC RAR; or

3> if there is a MAC PDU in the Msg3 buffer and the uplink grant was received on PDCCH for the C-RNTI in *ra-ResponseWindow* and this PDCCH successfully completed the Random Access procedure initiated for beam failure recovery:

4> obtain the MAC PDU to transmit from the Msg3 buffer.

4> if the uplink grant size does not match with size of the obtained MAC PDU; and

4> if the Random Access procedure was successfully completed upon receiving the uplink grant:

5> indicate to the Multiplexing and assembly entity to include MAC subPDU(s) carrying MAC SDU from the obtained MAC PDU in the subsequent uplink transmission;

5> obtain the MAC PDU to transmit from the Multiplexing and assembly entity.

3> else if this uplink grant is a configured grant configured with *autonomousTx*; and

3> if the previous configured uplink grant, in the BWP, for this HARQ process was not prioritized; and

3> if a MAC PDU had already been obtained for this HARQ process; and

3> if the uplink grant size matches with size of the obtained MAC PDU; and

3> if none of PUSCH transmission(s) of the obtained MAC PDU has been completely performed:

4> consider the MAC PDU has been obtained.

3> else if the MAC entity is not configured with *lch-basedPrioritization*; or

3> if this uplink grant is a prioritized uplink grant:

4> obtain the MAC PDU to transmit from the Multiplexing and assembly entity, if any;

3> if a MAC PDU to transmit has been obtained:

4> if the uplink grant is not a configured grant configured with *autonomousTx*; or

4> if the uplink grant is a prioritized uplink grant:

5> deliver the MAC PDU and the uplink grant and the HARQ information of the TB to the identified HARQ process;

5> instruct the identified HARQ process to trigger a new transmission;

5> if the uplink grant is a configured uplink grant:

6> start or restart the *configuredGrantTimer*, if configured, for the corresponding HARQ process when the transmission is performed if LBT failure indication is not received from lower layers;

6> start or restart the *cg-RetransmissionTimer*, if configured, for the corresponding HARQ process when the transmission is performed if LBT failure indication is not received from lower layers.

6> if the configured uplink grant is for the initial transmission for CG-SDT with CCCH message:

7> start or restart the *cg-SDT-RetransmissionTimer*, if configured, for the corresponding HARQ process when the transmission is performed.

6> if the configured uplink grant is for the first PUSCH transmission at RACH-less LTM cell switch; or

6> if the configured uplink grant is for the first PUSCH transmission of RACH-less handover:

7> start or restart the *cg-RRC-RetransmissionTimer*, if configured, for the corresponding HARQ process when the transmission is performed.

5> if the uplink grant is addressed to C-RNTI, and the identified HARQ process is configured for a configured uplink grant:

6> start or restart the *configuredGrantTimer*, if configured, for the corresponding HARQ process when the transmission is performed if LBT failure indication is not received from lower layers.

5> if *cg-RetransmissionTimer* is configured for the identified HARQ process; and

5> if the transmission is performed and LBT failure indication is received from lower layers:

6> consider the identified HARQ process as pending.

3> else:

4> flush the HARQ buffer of the identified HARQ process.

2> else (i.e. retransmission):

3> if the uplink grant received on PDCCH was addressed to CS-RNTI and if the HARQ buffer of the identified process is empty; or

3> if the uplink grant is part of a bundle and if no MAC PDU has been obtained for this bundle; or

3> if the uplink grant is part of a bundle of the configured uplink grant, and the PUSCH duration of the uplink grant overlaps with an uplink grant received in a Random Access Response (i.e. MAC RAR or fallbackRAR) or an uplink grant determined as specified in clause 5.1.2a for MSGA payload for this Serving Cell; or

3> if the MAC entity is not configured with *lch-basedPrioritization* and the BWP is not configured with *sTx-2Panel*, and if this uplink grant is part of a bundle of the configured uplink grant and the PUSCH duration of the uplink grant overlaps with a PUSCH duration of another uplink grant received on the PDCCH; or

3> if the MAC entity is not configured with *lch-basedPrioritization* and the BWP is configured with *sTx-2Panel*, and if this uplink grant is part of a bundle of the configured uplink grant associated with an *srs-ResourceSetId* corresponding to a *coresetPoolIndex*, and the PUSCH duration of the uplink grant overlaps with a PUSCH duration of another uplink grant received on the PDCCH associated with the same *coresetPoolIndex*; or

3> if the MAC entity is configured with *lch-basedPrioritization* and this uplink grant is not a prioritized uplink grant:

4> ignore the uplink grant.

3> else:

4> deliver the uplink grant and the HARQ information (redundancy version) of the TB to the identified HARQ process;

4> instruct the identified HARQ process to trigger a retransmission;

4> if the uplink grant is addressed to CS-RNTI; or

4> if the uplink grant is addressed to C-RNTI, and the identified HARQ process is configured for a configured uplink grant:

5> start or restart the *configuredGrantTimer*, if configured, for the corresponding HARQ process when the transmission is performed if LBT failure indication is not received from lower layers.

4> if the uplink grant is a configured uplink grant:

5> if the identified HARQ process is pending:

6> start or restart the *configuredGrantTimer*, if configured, for the corresponding HARQ process when the transmission is performed if LBT failure indication is not received from lower layers;

5> start or restart the *cg-RetransmissionTimer*, if configured, for the corresponding HARQ process when the transmission is performed if LBT failure indication is not received from lower layers.

5> if the configured uplink grant is for the retransmission of the initial transmission of the CG-SDT with CCCH message:

6> start or restart the *cg-SDT-RetransmissionTimer* for the corresponding HARQ process when transmission is performed.

5> if the configured uplink grant is for the retransmission of the first PUSCH transmission of RACH-less handover or RACH-less LTM cell switch:

6> start or restart the *cg-RRC-RetransmissionTimer* for the corresponding HARQ process when transmission is performed.

4> if the identified HARQ process is pending and the transmission is performed and LBT failure indication is not received from lower layers:

5> consider the identified HARQ process as not pending.

When determining if NDI has been toggled compared to the value in the previous transmission the MAC entity shall ignore NDI received in all uplink grants on PDCCH for its Temporary C-RNTI.

When *configuredGrantTimer* or *cg-RetransmissionTimer* or *cg-SDT-RetransmissionTimer* or *cg-RRC-RetransmissionTimer* is started or restarted by a PUSCH transmission, it shall be started at the beginning of the first symbol of the PUSCH transmission.

NOTE X: If the random access procedure is initiated due to expiry of *TimeAlignmentTimer* associated with PTAG after the initial uplink transmission during the RACH-less CLTM cell switch according to clause 5.y.3, it is up to UE implementation to include MAC subPDU(s) carrying MAC SDU from the MAC PDU of the initial uplink transmission in the UL grant in Random Access Response or determined as specified in clause 5.1.2a for the transmission of the MSGA payload.

Next change

##### 5.4.3.1.3 Allocation of resources

Before the successful completion of the Random Access procedure initiated for DAPS handover, the target MAC entity shall not select the logical channel(s) corresponding to non-DAPS DRB(s) for the uplink grant received in a Random Access Response or the uplink grant for the transmission of the MSGA payload. The source MAC entity shall select only the logical channel(s) corresponding to DAPS DRB(s) during DAPS handover.

The MAC entity shall, when a new transmission is performed:

1> allocate resources to the logical channels as follows:

2> logical channels selected in clause 5.4.3.1.2 for the UL grant with *Bj* > 0 are allocated resources in a decreasing priority order. If the PBR of a logical channel is set to *infinity*, the MAC entity shall allocate resources for all the data that is available for transmission on the logical channel before meeting the PBR of the lower priority logical channel(s);

2> decrement *Bj* by the total size of MAC SDUs served to logical channel *j* above;

2> if any resources remain, all the logical channels selected in clause 5.4.3.1.2 are served in a strict decreasing priority order (regardless of the value of *Bj*) until either the data for that logical channel or the UL grant is exhausted, whichever comes first. Logical channels configured with equal priority should be served equally.

NOTE 1: The value of *Bj* can be negative.

If the MAC entity is requested to simultaneously transmit multiple MAC PDUs, or if the MAC entity receives the multiple UL grants within one or more coinciding PDCCH occasions (i.e. on different Serving Cells), it is up to UE implementation in which order the grants are processed.

The UE shall also follow the rules below during the scheduling procedures above:

- the UE should not segment an RLC SDU (or partially transmitted SDU or retransmitted RLC PDU) if the whole SDU (or partially transmitted SDU or retransmitted RLC PDU) fits into the remaining resources of the associated MAC entity;

- if the UE segments an RLC SDU from the logical channel, it shall maximize the size of the segment to fill the grant of the associated MAC entity as much as possible;

- the UE should maximise the transmission of data;

- if the MAC entity is given a UL grant size that is equal to or larger than 8 bytes (when eLCID is not used) or 10 bytes (when eLCID is used) while having data available and allowed (according to clause 5.4.3.1) for transmission, the MAC entity shall not transmit only padding BSR and/or padding.

The MAC entity shall:

1> if the MAC entity is configured with *enhancedSkipUplinkTxDynamic* with value *true* and the grant indicated to the HARQ entity was addressed to a C-RNTI, or if the MAC entity is configured with *enhancedSkipUplinkTxConfigured* with value *true* and the grant indicated to the HARQ entity is a configured uplink grant:

2> if there is no UCI to be multiplexed on this PUSCH transmission as specified in TS 38.213 [6]; and

2> if there is no aperiodic CSI requested for this PUSCH transmission as specified in TS 38.212 [9]; and

2> if the MAC PDU includes zero MAC SDUs; and

2> if the MAC PDU includes only the periodic BSR and there is no data available for any LCG, or the MAC PDU includes only the padding BSR:

3> not generate a MAC PDU for the HARQ entity.

1> else if the MAC entity is configured with *skipUplinkTxDynamic* with value *true* and the grant indicated to the HARQ entity was addressed to a C-RNTI, or the grant indicated to the HARQ entity is a configured uplink grant:

2> if there is no aperiodic CSI requested for this PUSCH transmission as specified in TS 38.212 [9]; and

2> if the MAC PDU includes zero MAC SDUs; and

2> if the MAC PDU includes only the periodic BSR and there is no data available for any LCG, or the MAC PDU includes only the padding BSR:

3> not generate a MAC PDU for the HARQ entity.

NOTE 1a: For uplink spatial multiplexing as specified in clause 5.4.1, if at least one MAC PDU is to be generated or to be retransmitted for a PDCCH that schedules two TBs, the MAC entity generates MAC PDU(s) corresponding to all UL grants indicated by the PDCCH.

Logical channels shall be prioritised in accordance with the following order (highest priority listed first):

- MAC CE for C-RNTI, or data from UL-CCCH;

- MAC CE for (Enhanced) BFR, or MAC CE for Configured Grant Confirmation, or MAC CE for Multiple Entry Configured Grant Confirmation, or MAC CE for Event Triggered L1 Measurement Report;

- MAC CE for Sidelink Configured Grant Confirmation;

- MAC CE for LBT failure;

- MAC CE for SL LBT failure according to clause 5.31.2;

- MAC CE for Timing Advance Report;

- MAC CE for Delay Status Report;

- MAC CE for SL-BSR prioritized according to clause 5.22.1.6;

- MAC CE for (Extended) BSR, with exception of BSR included for padding;

- MAC CE for (Enhanced) Single Entry PHR, or MAC CE for (Enhanced) Multiple Entry PHR or MAC CE for Single Entry PHR with assumed PUSCH, or MAC CE for Multiple Entry PHR with assumed PUSCH, or MAC CE for Enhanced Single Entry PHR for multiple TRP or MAC CE for Enhanced Multiple Entry PHR for multiple TRP, or MAC CE for Enhanced Single Entry PHR for multiple TRP STx2P or MAC CE for Enhanced Multiple Entry PHR for multiple TRP STx2P;

- MAC CE for Positioning Measurement Gap Activation/Deactivation Request;

- MAC CE for the number of Desired Guard Symbols;

- MAC CE for Case-6 Timing Request;

- MAC CE for (Extended) Pre-emptive BSR;

- MAC CE for SL-BSR, with exception of SL-BSR prioritized according to clause 5.22.1.6 and SL-BSR included for padding;

- MAC CE for SL-PRS Resource Request;

- MAC CE for IAB-MT Recommended Beam Indication, or MAC CE for Desired IAB-MT PSD range, or MAC CE for Desired DL Tx Power Adjustment;

- data from any Logical Channel, except data from UL-CCCH;

- MAC CE for Recommended bit rate query;

- MAC CE for BSR included for padding;

- MAC CE for SL-BSR included for padding.

NOTE 2: Prioritization among MAC CEs of same priority is up to UE implementation.

The MAC entity shall prioritize any MAC CE listed in a higher order than 'data from any Logical Channel, except data from UL-CCCH' over NR sidelink transmission.

Next change

### 5.4.4 Scheduling Request

The Scheduling Request (SR) is used for requesting UL-SCH resources for new transmission.

The MAC entity may be configured with zero, one, or more SR configurations. An SR configuration consists of a set of PUCCH resources for SR across different BWPs and cells. For a logical channel or for SCell beam failure recovery (see clause 5.17) and for consistent LBT failure recovery (see clause 5.21), at most one PUCCH resource for SR is configured per BWP. For a logical channel serving a radio bearer configured with SDT, PUCCH resource for SR is not configured for SDT. For beam failure recovery of BFD-RS set(s) of Serving Cell, up to two PUCCH resources for SR are configured per BWP. For positioning measurement gap activation/deactivation request, a dedicated SR configuration is configured. For event triggered L1 measurement report, a dedicated SR configuration may be configured.

Each SR configuration corresponds to one or more logical channels and/or to SCell beam failure recovery and/or to consistent LBT failure recovery and/or to beam failure recovery of a BFD-RS set and/or to positioning measurement gap activation/deactivation request and/or to event triggered L1 measurement report. Each logical channel, SCell beam failure recovery, beam failure recovery of a BFD-RS set and consistent LBT failure recovery, and event triggered L1 measurement report, may be mapped to zero or one SR configuration, which is configured by RRC. The SR configuration of the logical channel that triggered a BSR (clause 5.4.5) or a DSR (clause 5.4.9) or the SCell beam failure recovery or the beam failure recovery of a BFD-RS set or the consistent LBT failure recovery (clause 5.21) (if such a configuration exists) or positioning measurement gap activation/deactivation request (clause 5.25) or event triggered L1 measurement report (clause 5.x) is considered as corresponding SR configuration for the triggered SR. Any SR configuration may be used for an SR triggered by Pre-emptive BSR (clause 5.4.7) or Timing Advance reporting (clause 5.4.8).

RRC configures the following parameters for the scheduling request procedure:

- *sr-ProhibitTimer* (per SR configuration);

- *sr-TransMax* (per SR configuration).

The following UE variables are used for the scheduling request procedure:

- *SR\_COUNTER* (per SR configuration).

If an SR is triggered and there are no other SRs pending corresponding to the same SR configuration, the MAC entity shall set the *SR\_COUNTER* of the corresponding SR configuration to 0.

When an SR is triggered, it shall be considered as pending until it is cancelled.

All pending SR(s) for BSR triggered according to the BSR procedure (clause 5.4.5) prior to the MAC PDU assembly shall be cancelled and each respective *sr-ProhibitTimer* shall be stopped when the MAC PDU is transmitted and this PDU includes a Long, Refined Long or Short BSR MAC CE which contains buffer status up to (and including) the last event that triggered a BSR (see clause 5.4.5) prior to the MAC PDU assembly. All pending SR(s) for BSR triggered according to the BSR procedure (clause 5.4.5) shall be cancelled and each respective *sr-ProhibitTimer* shall be stopped when the UL grant(s) can accommodate all pending data available for transmission.

The MAC entity shall for each pending SR not triggered according to the BSR procedure (clause 5.4.5) for a Serving Cell:

1> if this SR was triggered by Pre-emptive BSR procedure (see clause 5.4.7) prior to the MAC PDU assembly and a MAC PDU containing the relevant Pre-emptive BSR MAC CE is transmitted; or

1> if this SR was triggered by beam failure recovery (see clause 5.17) of an SCell and a MAC PDU is transmitted and this PDU includes a MAC CE for BFR which contains beam failure recovery information for this SCell; or

1> if this SR was triggered by beam failure recovery (see clause 5.17) for a BFD-RS set of a Serving Cell and a MAC PDU is transmitted and this PDU includes an Enhanced BFR MAC CE or a Truncated Enhanced BFR MAC CE which contains beam failure recovery information for this BFD-RS set of the Serving Cell; or

1> if this SR was triggered by beam failure recovery (see clause 5.17) of an SCell and this SCell is deactivated (see clause 5.9); or

1> if this SR was triggered by beam failure recovery (see clause 5.17) for a BFD-RS set of an SCell and this SCell is deactivated (see clause 5.9); or

1> if the SR is triggered by positioning measurement gap activation/deactivation request (see clause 5.25) and the Positioning Measurement Gap Activation/Deactivation Request MAC CE that triggers the SR has already been cancelled; or

1> if this SR was triggered by consistent LBT failure recovery (see clause 5.21) of an SCell and a MAC PDU is transmitted and the MAC PDU includes an LBT failure MAC CE that indicates consistent LBT failure for this SCell; or

1> if this SR was triggered by consistent LBT failure recovery (see clause 5.21) of an SCell and all the triggered consistent LBT failure(s) for this SCell are cancelled; or

1> if this SR was triggered by Timing Advance reporting (see clause 5.4.8) and all the triggered Timing Advance reports are cancelled; or

1> if this SR was triggered by DSR procedure (see clause 5.4.9) and the DSR that triggered the SR has been cancelled; or

1> if this SR was triggered by event triggered L1 measurement report procedure (see clause 5.x) and the event triggered L1 measurement report that triggered the SR has been cancelled:

2> cancel the pending SR and stop the corresponding *sr-ProhibitTimer*, if running.

Only PUCCH resources on a BWP which is active at the time of SR transmission occasion are considered valid.

As long as at least one SR is pending, the MAC entity shall for each pending SR:

1> if the MAC entity has no valid PUCCH resource configured for the pending SR; and

1> if there is no ongoing RACH-less LTM cell switch; and

1> if *rach-LessHO* is not configured:

2> initiate a Random Access procedure (see clause 5.1) on the SpCell and cancel the pending SR.

1> else, for the SR configuration corresponding to the pending SR:

2> when the MAC entity has an SR transmission occasion on the valid PUCCH resource for SR configured; and

2> if *sr-ProhibitTimer* is not running at the time of the SR transmission occasion; and

2> if the PUCCH resource for the SR transmission occasion does not overlap with a measurement gap:

3> if the PUCCH resource for the SR transmission occasion does not overlap with any of a UL-SCH resource whose simultaneous transmission with the SR is not allowed by configuration of *simultaneousPUCCH-PUSCH* or *simultaneousPUCCH-PUSCH-SecondaryPUCCHgroup* or *simultaneousSR-PUSCH-diffPUCCH-Groups* or *simultaneousPUCCH-PUSCH-SamePriority* or *simultaneousPUCCH-PUSCH-SamePriority-SecondaryPUCCHgroup*, an SL-SCH resource, or an SL-PRS resource; or

3> if the MAC entity is able to perform this SR transmission simultaneously with the transmission of the SL-SCH resource; or

3> if the MAC entity is configured with *lch-basedPrioritization*, and the PUCCH resource for the SR transmission occasion does not overlap with the PUSCH duration of an uplink grant received in a Random Access Response or with the PUSCH duration of an uplink grant addressed to Temporary C-RNTI or with the PUSCH duration of a MSGA payload, and the PUCCH resource for the SR transmission occasion for the pending SR triggered as specified in clause 5.4.5 overlaps with any other UL-SCH resource(s), and the physical layer can signal the SR on one valid PUCCH resource for SR, and the priority of the logical channel that triggered SR is higher than the priority of the uplink grant(s) for any UL-SCH resource(s) where the uplink grant was not already de-prioritized and its simultaneous transmission with the SR is not allowed by configuration of *simultaneousPUCCH-PUSCH* or *simultaneousPUCCH-PUSCH-SecondaryPUCCHgroup* or *simultaneousSR-PUSCH-diffPUCCHgroups* or *simultaneousPUCCH-PUSCH-SamePriority* or *simultaneousPUCCH-PUSCH-SamePriority-SecondaryPUCCHgroup*, and the priority of the uplink grant is determined as specified in clause 5.4.1; or

3> if both *sl-PrioritizationThres* and *ul-PrioritizationThres* are configured and the PUCCH resource for the SR transmission occasion for the pending SR triggered as specified in clause 5.22.1.5 overlaps with any UL-SCH resource(s) carrying a MAC PDU, and the value of the priority of the triggered SR determined as specified in clause 5.22.1.5 is lower than *sl-PrioritizationThres* and the value of the highest priority of the logical channel(s) in the MAC PDU is higher than or equal to *ul-PrioritizationThres* and any MAC CE prioritized as described in clause 5.4.3.1.3 is not included in the MAC PDU and the MAC PDU is not prioritized by upper layer according to TS 23.287 [19]; or

3> if an SL-SCH resource overlaps with the PUCCH resource for the SR transmission occasion for the pending SR triggered as specified in clause 5.4.5, and the MAC entity is not able to perform this SR transmission simultaneously with the transmission of the SL-SCH resource, and either transmission on the SL-SCH resource is not prioritized as described in clause 5.22.1.3.1a or the priority value of the logical channel that triggered SR is lower than *ul-PrioritizationThres*, if configured; or

3> if an SL-SCH resource overlaps with the PUCCH resource for the SR transmission occasion for the pending SR triggered as specified in clause 5.22.1.5, and the MAC entity is not able to perform this SR transmission simultaneously with the transmission of the SL-SCH resource, and the priority of the triggered SR determined as specified in clause 5.22.1.5 is higher than the priority of the MAC PDU determined as specified in clause 5.22.1.3.1a for the SL-SCH resource; or

3> if an SL-PRS resource overlaps with the PUCCH resource for the SR transmission occasion for the pending SR triggered as specified in clause 5.4.5, and the MAC entity is not able to perform this SR transmission simultaneously with the transmission of the SL-PRS resource, and either transmission on the SL-PRS resource is not prioritized as described in clause 5.22.1.3.1a or in the clause 5.22.1.3.5, or the priority value of the logical channel that triggered SR is lower than *ul-PrioritizationThres*, if configured; or

3> if an SL-PRS resource overlaps with the PUCCH resource for the SR transmission occasion for the pending SR triggered as specified in clause 5.22.1.5, and the MAC entity is not able to perform this SR transmission simultaneously with the transmission of the SL-PRS resource, and the priority of the triggered SR determined as specified in clause 5.22.1.5 is higher than the priority of the MAC PDU and SL-PRS, if available, determined as specified in clause 5.22.1.3.1a or the SL-PRS resource in clause 5.22.1.3.5:

4> consider the SR transmission as a prioritized SR transmission.

4> consider the other overlapping uplink grant(s), if any, as a de-prioritized uplink grant(s), except for the overlapping uplink grant(s) whose simultaneous transmission is allowed by configuration of *simultaneousPUCCH-PUSCH* or *simultaneousPUCCH-PUSCH-SecondaryPUCCHgroup* or *simultaneousSR-PUSCH-diffPUCCH-Groups* or *simultaneousPUCCH-PUSCH-SamePriority* or *simultaneousPUCCH-PUSCH-SamePriority-SecondaryPUCCHgroup*;

4> if the de-prioritized uplink grant(s) is a configured uplink grant configured with *autonomousTx* whose PUSCH has already started:

5> stop the *configuredGrantTimer* for the corresponding HARQ process of the de-prioritized uplink grant(s);

5> stop the *cg-RetransmissionTimer* for the corresponding HARQ process of the de-prioritized uplink grant(s).

4> if *SR\_COUNTER* < *sr-TransMax*:

5> instruct the physical layer to signal the SR on one valid PUCCH resource for SR;

5> if LBT failure indication is not received from lower layers:

6> increment *SR\_COUNTER* by 1;

6> start the *sr-ProhibitTimer*.

5> else if *lbt-FailureRecoveryConfig* is not configured:

6> increment *SR\_COUNTER* by 1.

4> else:

5> notify RRC to release PUCCH for all Serving Cells;

5> notify RRC to release SRS for all Serving Cells;

5> clear any configured downlink assignments and uplink grants;

5> clear any PUSCH resources for semi-persistent CSI reporting;

5> if *rach-LessHO* is not configured and if there is no ongoing RACH-less LTM cell switch:

6> initiate a Random Access procedure (see clause 5.1) on the SpCell and cancel all pending SRs.

3> else:

4> consider the SR transmission as a de-prioritized SR transmission.

NOTE 1: Except for the cases specified in NOTE 3 below, the selection of which valid PUCCH resource for SR to signal SR on when the MAC entity has more than one overlapping valid PUCCH resource for the SR transmission occasion is left to UE implementation.

NOTE 2: If more than one individual SR triggers an instruction from the MAC entity to the PHY layer to signal the SR on the same valid PUCCH resource, the *SR\_COUNTER* for the relevant SR configuration is incremented only once.

NOTE 3: When the MAC entity has pending SR for SCell beam failure recovery and the MAC entity has one or more PUCCH resources (other than PUCCH resources of pending SR for beam failure recovery of a BFD-RS set) overlapping with PUCCH resource for SCell beam failure recovery for the SR transmission occasion, the MAC entity considers only the PUCCH resource for SCell beam failure recovery as valid. When the MAC entity has pending SR for beam failure recovery of a BFD-RS set of Serving Cell and the MAC entity has one or more PUCCH resources (other than PUCCH resources of pending SR for beam failure recovery) overlapping with PUCCH resource for beam failure recovery of that BFD-RS set for the SR transmission occasion, the MAC entity considers only the PUCCH resource for beam failure recovery of that BFD-RS set as valid.

NOTE 4: For a UE operating in a semi-static channel access mode as described in TS 37.213 [18], PUCCH resources overlapping with the set of consecutive symbols where the UE does not transmit before the start of a next channel occupancy time are not considered valid.

NOTE 5: If the MAC entity is configured with *lch-basedPrioritization*, the MAC entity does not take UCI multiplexing according to the procedure specified in TS 38.213 [6] into account when determining whether the valid PUCCH resource for the SR transmission can be signalled by the physical layer and the SR transmission occasion overlaps with the PUSCH duration of an uplink grant of a MSGA payload.

NOTE 6: When the MAC entity has PUCCH resource for pending SR for SCell beam failure recovery overlapping with PUCCH resource for pending SR for beam failure recovery of a BFD-RS set for the SR transmission occasion, it is up to UE implementation to select PUCCH resource for SCell beam failure recovery or PUCCH resource for beam failure recovery of a BFD-RS set.

NOTE 7: If an SL-SCH resource overlaps with the PUCCH resource for the SR transmission occasion for the pending SR triggered by Uu MAC CEs except BSR/SL-BSR MAC CE, and the MAC entity is not able to perform this SR transmission simultaneously with the transmission of the SL-SCH resource, it is left to UE implementation to determine whether this SR transmission is prioritized over the SL transmission.

The MAC entity may stop, if any, ongoing Random Access procedure due to a pending SR for BSR, which was initiated by the MAC entity prior to the MAC PDU assembly and which has no valid PUCCH resources configured, if:

- a MAC PDU is transmitted using a UL grant other than a UL grant provided by Random Access Response or a UL grant determined as specified in clause 5.1.2a for the transmission of the MSGA payload, and this PDU includes a BSR MAC CE which contains buffer status up to (and including) the last event that triggered a BSR (see clause 5.4.5) prior to the MAC PDU assembly; or

- the UL grant(s) can accommodate all pending data available for transmission.

The MAC entity may stop, if any, ongoing Random Access procedure due to a pending SR for SL-BSR, which has no valid PUCCH resources configured, if:

- a MAC PDU is transmitted using a UL grant other than a UL grant provided by Random Access Response or a UL grant determined as specified in clause 5.1.2a for the transmission of the MSGA payload, and the ongoing Random Access procedure was initiated by the MAC entity prior to the MAC PDU assembly, and this PDU includes an SL-BSR MAC CE which contains buffer status up to (and including) the last event that triggered an SL-BSR (see clause 5.22.1.6) prior to the MAC PDU assembly; or

- the SL grant(s) can accommodate all pending data available for transmission, and the ongoing Random Access procedure was initiated by the MAC entity prior to the sidelink MAC PDU assembly.

The MAC entity may stop, if any, ongoing Random Access procedure due to a pending SR for SL-CSI reporting, which has no valid PUCCH resources configured, if:

- the SL grant can accommodate SL-CSI reporting MAC CE for transmission.

The MAC entity may stop, if any, ongoing Random Access procedure due to a pending SR for SL-DRX command indication, which has no valid PUCCH resources configured, if:

- the SL grant can accommodate SL-DRX command indication for transmission.

The MAC entity may stop, if any, ongoing Random Access procedure due to a pending SR for BFR of an SCell, which has no valid PUCCH resources configured, if:

- a MAC PDU is transmitted using a UL grant other than a UL grant provided by Random Access Response or a UL grant determined as specified in clause 5.1.2a for the transmission of the MSGA payload, and this PDU contains a MAC CE for BFR which includes beam failure recovery information of that SCell; or

- the SCell is deactivated (as specified in clause 5.9) and all triggered BFRs for SCells are cancelled.

The MAC entity may stop, if any, ongoing Random Access procedure due to a pending SR for BFR of a BFD-RS set of a Serving Cell, which has no valid PUCCH resources configured, if:

- a MAC PDU is transmitted using a UL grant other than a UL grant provided by Random Access Response or a UL grant determined as specified in clause 5.1.2a for the transmission of the MSGA payload, and this PDU contains an Enhanced BFR MAC CE or a Truncated Enhanced BFR MAC CE which includes beam failure recovery information of that BFD-RS set of the Serving Cell.

The MAC entity may stop, if any, ongoing Random Access procedure due to a pending SR for consistent LBT failure recovery, which has no valid PUCCH resources configured, if:

- a MAC PDU is transmitted using a UL grant other than a UL grant provided by Random Access Response or a UL grant determined as specified in clause 5.1.2a for the transmission of the MSGA payload, and this PDU includes an LBT failure MAC CE that indicates consistent LBT failure for all the SCells that triggered consistent LBT failure; or

- all the SCells that triggered consistent LBT failure recovery are deactivated (see clause 5.9).

The MAC entity may stop, if any, ongoing Random Access procedure due to a pending SR for Sidelink consistent LBT failure recovery, which has no valid PUCCH resources configured, if one of the following conditions is met:

- a MAC PDU is transmitted using a UL grant other than a UL grant provided by Random Access Response or a UL grant determined as specified in clause 5.1.2a for the transmission of the MSGA payload, and this PDU includes an SL LBT failure MAC CE that indicates Sidelink consistent LBT failure; or

- all the triggered Sidelink consistent LBT failure recovery are cancelled (see clause 5.31.2).

The MAC entity may stop, if any, ongoing Random Access procedure due to a pending SR for positioning measurement gap activation/deactivation request, which has no valid PUCCH resources configured, if:

- the Positioning Measurement Gap Activation/Deactivation Request MAC CE that triggers the SR corresponding to the Random Access procedure has already been cancelled.

The MAC entity may stop, if any, ongoing Random Access procedure due to a pending SR for Timing Advance report, which has no valid PUCCH resources configured, if:

- a MAC PDU is transmitted using a UL grant other than a UL grant provided by Random Access Response or a UL grant determined as specified in clause 5.1.2a for the transmission of the MSGA payload, and this PDU includes a Timing Advance Report MAC CE (see clause 5.4.8).

The MAC entity may stop, if any, ongoing Random Access procedure due to a pending SR for DSR, which has no valid PUCCH resources configured, if:

- a MAC PDU is transmitted using a UL grant other than a UL grant provided by Random Access Response or a UL grant determined as specified in clause 5.1.2a for the transmission of the MSGA payload, and this PDU includes either a DSR MAC CE or all the PDCP SDUs associated with the DSR (see clause 5.4.9); or

- all the PDCP SDUs associated with the DSR have been discarded (see clause 5.4.9).

The MAC entity may stop, if any, ongoing Random Access procedure due to a pending SR for SL-PRS Resource Request, which has no valid PUCCH resources configured, if:

- a MAC PDU is transmitted using a UL grant other than a UL grant provided by Random Access Response or a UL grant determined as specified in clause 5.1.2a for the transmission of the MSGA payload, and this PDU includes a SL-PRS Resource Request MAC CE (see clause 5.22.1.12).

The MAC entity may stop, if any, ongoing Random Access procedure due to a pending SR for Event Triggered L1 Measurement Report, which has no valid PUCCH resources configured, if:

- a MAC PDU is transmitted using an UL grant other than an UL grant provided by Random Access Response or a UL grant determined as specified in clause 5.1.2a for the transmission of the MSGA payload, and this PDU includes a (Truncated) Event Triggered L1 Measurement Report MAC CE (see clause 5.x).

Next change

### 5.4.5 Buffer Status Reporting

Next change

### 5.8.2 Uplink

There are two types of transmission without dynamic grant:

- configured grant Type 1 where an uplink grant is provided by RRC, and stored as configured uplink grant;

- configured grant Type 2 where an uplink grant is provided by PDCCH, and stored or cleared as configured uplink grant based on L1 signalling indicating configured uplink grant activation or deactivation.

Type 1 and Type 2 are configured by RRC for a Serving Cell per BWP. Multiple configurations can be active simultaneously in the same BWP. For Type 2, activation and deactivation are independent among the Serving Cells. For the same BWP, the MAC entity can be configured with both Type 1 and Type 2.

A multi-PUSCH configured grant has multiple consecutive configured uplink grants within a *periodicity*. Both Type 1 and Type 2 can be configured for a multi-PUSCH configured grant by RRC.

Only configured grant Type 1 can be configured for CG-SDT or for RACH-less LTM cell switch or for RACH-less handover. CG-SDT can only be configured on initial BWP.

RRC configures the following parameters when the configured grant Type 1 is configured:

- *cs-RNTI*: CS-RNTI for retransmission;

- *cg-SDT-CS-RNTI*: CS-RNTI for CG-SDT retransmission;

- *cg-SDT-RSRP-ThresholdSSB*: an RSRP threshold configured for SSB selection for CG-SDT;

- *cg-RRC-RSRP-ThresholdSSB*: an RSRP threshold configured for SSB selection for RACH-less handover;

- *periodicity*: periodicity of the configured grant Type 1;

- *timeDomainOffset*: Offset of a resource with respect to SFN = *timeReferenceSFN* in time domain;

- *timeDomainAllocation*: Allocation of configured uplink grant in time domain which contains *startSymbolAndLength* (i.e. *SLIV* in TS 38.214 [7]) or *startSymbol* (i.e. *S* in TS 38.214 [7]);

- *nrofHARQ-Processes*: the number of HARQ processes for configured grant;

- *harq-ProcID-Offset*: offset of HARQ process for configured grant configured with *cg-RetransmissionTimer* for operation with shared spectrum channel access;

- *harq-ProcID-Offset2*: offset of HARQ process for configured grant not configured with *cg-RetransmissionTimer*;

- *timeReferenceSFN*: 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;

- *timeReferenceHyperSFN*: H-SFN used for determination of the offset of a resource in time domain. The UE uses the closest H-SFN with the indicated number preceding the reception of the configured grant configuration.

RRC configures the following parameters when the configured grant Type 2 is configured:

- *cs-RNTI*: CS-RNTI for activation, deactivation, and retransmission;

- *periodicity*: periodicity of the configured grant Type 2;

- *nrofHARQ-Processes*: the number of HARQ processes for configured grant;

- *harq-ProcID-Offset*: offset of HARQ process for configured grant configured with *cg-RetransmissionTimer* for operation with shared spectrum channel access;

- *harq-ProcID-Offset2*: offset of HARQ process for configured grant not configured with *cg-RetransmissionTimer*.

RRC configures the following parameter when retransmissions on configured uplink grant is configured:

- *cg-RetransmissionTimer*: the duration after a configured grant (re)transmission of a HARQ process when the UE shall not autonomously retransmit that HARQ process;

- *cg-SDT-RetransmissionTimer*: the duration after a configured grant (re)transmission of a HARQ process of the initial CG-SDT transmission with CCCH message when the UE shall not autonomously retransmit the HARQ process;

- *cg-RRC-RetransmissionTimer*: the duration after a configured grant (re)transmission of a HARQ process of the first PUSCH transmission of RACH-less handover and RACH-less LTM cell switch when the UE shall not autonomously retransmit the HARQ process.

RRC configures the following parameter when a multi-PUSCH configured grant is configured:

*- nrofSlotsInCG-Period*: the number of configured uplink grants in a *periodicity* of a multi-PUSCH configured grant.

RRC configures the following parameter when UTO-UCI (as specified in clause 9.3 in TS 38.213 [6]) is configured for a configured grant:

*- nrofBitsInUTO-UCI*: number of bits in a UTO-UCI bitmap.

For a configured uplink grant, the MAC entity shall:

1> if its associated configured grant is configured with UTO-UCI and it has not been indicated to the lower layers as unused for PUSCH transmission; or

1> if its associated configured grant is not configured with UTO-UCI:

2> if it is associated with a multi-PUSCH configured grant and meets the validity conditions specified in the clause 6.1 in TS 38.214 [7]; or

2> if it is not associated with a multi-PUSCH configured grant:

3> consider it available for use.

The MAC entity shall not include the UL-SCH resource of a configured uplink grant not available for use in its procedures (e.g. in clauses 5.4.1 and 5.4.4).

For a configured grant configured with UTO-UCI, the MAC entity determines if a configured uplink grant which is within the subsequent *nrofBitsInUTO-UCI* valid occasions of its associated configured grant configuration is going to be used for PUSCH transmission by considering at least the amount of buffered data that can be transmitted on the available occasions of the associated configured grant and other available UL-SCH resources. Upon this determination, the MAC entity sends an indication to lower layers, for use in the procedure for reporting UTO-UCI.

Upon configuration of a configured grant Type 1 for a BWP of a Serving Cell by upper layers, the MAC entity shall:

1> store the uplink grant provided by upper layers as a configured uplink grant for the indicated BWP of the Serving Cell;

1> if *cg-SDT-PeriodicityExt* is configured:

2> initialise or re-initialise the configured uplink grant to start in the symbol according to *timeDomainOffset*, *timeReferenceHyperSFN, timeReferenceSFN*, and *S* (derived from *SLIV* or provided by *startSymbol* as specified in TS 38.214 [7]), and to reoccur with *cg-SDT-PeriodicityExt*.

1> else:

2> initialise or re-initialise the configured uplink grant to start in the symbol according to *timeDomainOffset*, *timeReferenceSFN*, and *S* (derived from *SLIV* or provided by *startSymbol* as specified in TS 38.214 [7]), and to reoccur with *periodicity*.

If *cg-SDT-PeriodicityExt* (as defined in TS 38.331 [5]) is not configured, after an uplink grant is configured for a configured grant Type 1, the MAC entity shall consider sequentially that the configured uplink grant, or the first configured uplink grant in a multi-PUSCH configured grant, in the Nth (N ≥ 0) *periodicity* occurs in the symbol for which:

[(SFN × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*)  
 + (slot number in the frame × *numberOfSymbolsPerSlot*) + symbol number in the slot] =  
 (*timeReferenceSFN* × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*  
 + *timeDomainOffset* × *numberOfSymbolsPerSlot* + S + N × *periodicity*)  
 modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*)

If *cg-SDT-PeriodicityExt* (as defined in TS 38.331 [5]) is configured, after an uplink grant is configured for a configured grant Type 1, the MAC entity shall consider sequentially that the configured uplink grant in the Nth (N ≥ 0) *periodicity* occurs in the symbol for which:

[(H-SFN × *numberOfSFNperH-SFN* + SFN) × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*  
 + (slot number in the frame × *numberOfSymbolsPerSlot*) + symbol number in the slot] =  
 ((*timeReferenceHyperSFN* × *numberOfSFNperH-SFN + timeReferenceSFN*)  
 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*  
 + *timeDomainOffset* × *numberOfSymbolsPerSlot* + S + N × *cg-SDT-PeriodicityExt*)  
 modulo (1024 × 1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*)

For a multi-PUSCH configured grant Type 1, the Mth (1 < M ≤ *nrofSlotsInCG-Period*) configured uplink grant within a *periodicity* occurs (M-1) × *numberOfSymbolsPerSlot* symbols after the symbol in which the first configured uplink grant in that *periodicity* occurs.

For an uplink grant configured for configured grant Type 1 for CG-SDT on the selected uplink carrier as in clause 5.27, when CG-SDT is triggered and not terminated, for each configured uplink grant valid according to TS 38.214 [7] for which the above formula is satisfied, the MAC entity shall:

1> if, after initial transmission for CG-SDT with CCCH message has been performed according to clause 5.4.1, PDCCH addressed to the MAC entity's C-RNTI has not been received:

2> if the SSB corresponding to the configured UL grant has the same SSB index as the SSB selected for initial transmission for CG-SDT with CCCH message (i.e., retransmission of initial transmission of CG-SDT):

3> select this SSB;

3> indicate the SSB index corresponding to the configured uplink grant to the lower layer;

3> consider this configured uplink grant as valid.

1> else if at least one SSB corresponding to the configured uplink grant with SS-RSRP above the *cg-SDT-RSRP-ThresholdSSB* is available:

2> if this is the initial transmission of CG-SDT with CCCH message after the CG-SDT procedure is initiated as in clause 5.27 (i.e., initial transmission for CG-SDT):

3> select an SSB with SS-RSRP above *cg-SDT-RSRP-ThresholdSSB* amongst the SSB(s) associated with the configured uplink grant.

2> else if PDCCH addressed to C-RNTI has been received after the initial transmission of CG-SDT with CCCH message (i.e., subsequent new transmission for CG-SDT):

3> if SS-RSRP of the SSB selected for the previous transmission for CG-SDT is above *cg-SDT-RSRP-ThresholdSSB* and this SSB is associated with this configured uplink grant:

4> select this SSB.

3> else if SS-RSRP of the SSB selected for the previous transmission for CG-SDT is not above *cg-SDT-RSRP-ThresholdSSB*:

4> select an SSB with SS-RSRP above *cg-SDT-RSRP-ThresholdSSB* amongst the SSB(s) associated with the configured uplink grant.

2> if SSB is selected above:

3> indicate the SSB index to the lower layer;

3> consider this configured uplink grant as valid.

The MAC entity shall:

1> if no SSB configured for CG-SDT with SS-RSRP above *cg-SDT-RSRP-ThresholdSSB* is available:

2> if PDCCH addressed to C-RNTI after the initial transmission of the CG-SDT with CCCH message has been received:

3> if there is data available for transmission for at least one RB configured for SDT:

4> initiate Random Access procedure in clause 5.1.

NOTE 1: Void.

For an uplink grant configured for configured grant Type 1 for RACH-less LTM cell switch, when there is an ongoing RACH-less LTM cell switch procedure, for each configured uplink grant valid according to TS 38.214 [7] for which the above formula is satisfied, the MAC entity shall:

1> if an SSB corresponding to the configured UL grant has the same SSB index as the SSB associated with the TCI state indicated by the UL TCI state ID field, if present, or by the TCI state ID field otherwise, in the (Enhanced) LTM Cell Switch Command MAC CE, as specified in clause 21.1 in TS 38.213 [6]:

2> select the SSB associated with the TCI state indicated by (Enhanced) LTM Cell Switch Command MAC CE.

2> indicate the SSB index to the lower layer;

2> consider this configured uplink grant as valid.

1> if an SSB corresponding to the configured UL grant has the same SSB index as the selected SSB or the SSB associated with the selected CSI-RS according to 5.y.3, as specified in clause 21.1 in TS 38.213 [6]:

2> indicate the SSB index to the lower layer;

2> consider this configured uplink grant as valid.

1> else:

2> consider this configured uplink grant as not valid.

NOTE 1a: When there is an ongoing RACH-less LTM cell switch, the configured grant Type 1 which is not specifically configured for LTM (see *cg-LTM-Configuration* in TS 38.331 [5]) is not used.

NOTE 1b: After completion of LTM cell switch, the UE stops using the grant configured for RACH-less LTM cell switch (see *cg-LTM-Configuration* in TS 38.331 [5]).

For the uplink grant configured for configured grant Type 1 for RACH-less handover, if the configured uplink grant is valid according to TS 38.214 [7] for which the above formula is satisfied and RACH-less handover is not successfully completed, the MAC entity shall:

1> if the first PUSCH transmission of RACH-less handover has been performed according to clause 5.4.1 and 5.33:

2> if the SSB corresponding to the configured UL grant has the same SSB index as the SSB selected for the first PUSCH transmission of RACH-less handover (i.e., retransmission of the first PUSCH transmission of RACH-less handover):

3> select this SSB;

3> indicate the SSB index corresponding to the configured uplink grant to the lower layer;

3> consider this configured uplink grant as valid.

1> else if at least one SSB corresponding to the configured uplink grant with SS-RSRP above *cg-RRC-RSRP-ThresholdSSB* is available:

2> select an SSB with SS-RSRP above *cg-RRC-RSRP-ThresholdSSB* amongst the SSB(s) associated with the configured uplink grant;

2> indicate the selected SSB index to the lower layer;

2> consider this configured uplink grant as valid.

The MAC entity shall:

1> if no SSB configured for RACH-less handover with SS-RSRP above *cg-RRC-RSRP-ThresholdSSB* is available:

2> initiate Random Access procedure in clause 5.1.

NOTE 1A: When the UE determines if there is an SSB with SS-RSRP above *cg-RRC-RSRP-ThresholdSSB* or *cg-SDT-RSRP-ThresholdSSB*, the UE uses the latest unfiltered L1-RSRP measurement.

After an uplink grant is configured for a configured grant Type 2, the MAC entity shall consider sequentially that the configured uplink grant, or the first configured uplink grant in a multi-PUSCH configured grant, in the Nth (N ≥ 0) *periodicity* occurs in the symbol for which:

[(SFN × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*)  
 + (slot number in the frame × *numberOfSymbolsPerSlot*) + symbol number in the slot] =  
 [(SFNstart time × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*  
 + slotstart time × *numberOfSymbolsPerSlot* + symbolstart time) + N × *periodicity*]  
 modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*)

where SFNstart time, slotstart time, and symbolstart time are the SFN, slot, and symbol, respectively, of the first transmission opportunity of PUSCH where the configured uplink grant was (re-)initialised.

For a multi-PUSCH configured grant Type 2, the Mth (1 < M ≤ *nrofSlotsInCG-Period*) configured uplink grant within the same *periodicity* occurs (M-1) × *numberOfSymbolsPerSlot* symbols after the symbol in which the first configured uplink grant in that *periodicity* occurs.

If *cg-nrofPUSCH-InSlot* or *cg-nrofSlots* is configured for a configured grant Type 1 or Type 2, the MAC entity shall consider the uplink grants occur in those additional PUSCH allocations as specified in clause 6.1.2.3 of TS 38.214 [7].

NOTE 2: In case of unaligned SFN across carriers in a cell group, the SFN of the concerned Serving Cell is used to calculate the occurrences of configured uplink grants.

When the configured uplink grant is released by upper layers, all the corresponding configurations shall be released and all corresponding uplink grants shall be cleared.

The MAC entity shall:

1> if at least one configured uplink grant confirmation has been triggered and not cancelled; and

1> if the MAC entity has UL resources allocated for new transmission:

2> if, in this MAC entity, at least one configured uplink grant is configured by *configuredGrantConfigToAddModList*:

3> instruct the Multiplexing and Assembly procedure to generate a Multiple Entry Configured Grant Confirmation MAC CE as defined in clause 6.1.3.31.

2> else:

3> instruct the Multiplexing and Assembly procedure to generate a Configured Grant Confirmation MAC CE as defined in clause 6.1.3.7.

2> cancel all triggered configured uplink grant confirmation(s).

For a configured grant Type 2, the MAC entity shall clear the configured uplink grant(s) immediately after first transmission of Configured Grant Confirmation MAC CE or Multiple Entry Configured Grant Confirmation MAC CE which confirms the configured uplink grant deactivation.

Retransmissions use:

- repetition of configured uplink grants; or

- received uplink grants addressed to CS-RNTI; or

- configured uplink grants with *cg-RetransmissionTimer*, *cg-RRC-RetransmissionTimer* or *cg-SDT-RetransmissionTimer* configured.

Next change

## 5.12 MAC Reset

If a reset of the MAC entity is requested by upper layers upon receiving *RRCResume* or *RRCSetup*, the MAC entity shall:

1> stop the MBS multicast DRX timers;

1> flush the soft buffers for all DL HARQ processes used for MBS multicast;

1> for each DL HARQ process used for MBS multicast, consider the next received transmission for a TB as the very first transmission.

Otherwise, if a reset of the MAC entity is requested by upper layers or the reset of the MAC entity is triggered due to SCG deactivation as defined in clause 5.29, the MAC entity shall:

1> if the MAC reset is not due to SCG deactivation:

2> initialize *Bj* for each logical channel to zero;

1> initialize *SBj* for each logical channel to zero if Sidelink resource allocation mode 1 is configured by RRC;

1> if upper layers indicate SCG deactivation and *bfd-and-RLM* with value *true* is configured for the deactivated SCG:

2> stop (if running) all timers except *beamFailureDetectionTimer* associated with PSCell and *timeAlignmentTimer*s.

1> else if upper layers indicate the reset is triggered by conditional LTM, or triggered by LTM while there is CLTM candidate configuration(s), or triggered by handover while there is CLTM candidate configuration(s):

2> stop (if running) all timers, except MBS broadcast DRX timers, *ltm-Candidate-TimeAlignmentTimers*, and *tm-Candidate-TimeAlignmentTimerTAG2*, if configured;

2> consider all *timeAlignmentTimer*s as expired and perform the corresponding actions in clause 5.2;

1> else:

2> stop (if running) all timers, except MBS broadcast DRX timers;

2> consider all *timeAlignmentTimer*s, *inactivePosSRS-TimeAlignmentTimer*, and *cg-SDT-TimeAlignmentTimer*, if configured, as expired and perform the corresponding actions in clause 5.2;

1> set the NDIs for all uplink HARQ processes to the value 0;

1> sets the NDIs for all HARQ process IDs to the value 0 for monitoring PDCCH in Sidelink resource allocation mode 1;

1> stop, if any, ongoing Random Access procedure;

1> discard explicitly signalled contention-free Random Access Resources for 4-step RA type and 2-step RA type, if any, except the contention-free Random Access Resources signalled in the LTM Cell Switch Command;

1> flush Msg3 buffer;

1> flush MSGA buffer;

1> cancel, if any, triggered Scheduling Request procedure;

1> cancel, if any, triggered Buffer Status Reporting procedure;

1> cancel, if any, triggered Delay Status Reporting procedure;

1> cancel, if any, triggered Power Headroom Reporting procedure;

1> cancel, if any, triggered consistent LBT failure;

1> cancel, if any, triggered Sidelink consistent LBT failure;

1> cancel, if any, triggered BFR;

1> cancel, if any, triggered Sidelink Buffer Status Reporting procedure;

1> cancel, if any, triggered Pre-emptive Buffer Status Reporting procedure;

1> cancel, if any, triggered Timing Advance Reporting procedure;

1> cancel, if any, triggered Recommended bit rate query procedure;

1> cancel, if any, triggered Configured uplink grant confirmation;

1> cancel, if any, triggered configured sidelink grant confirmation;

1> clear, if any, configured sidelink grants;

1> cancel, if any, triggered Desired Guard Symbol query;

1> cancel, if any, triggered Positioning Measurement Gap Activation/Deactivation Request procedure;

1> cancel, if any, triggered SDT procedure;

1> cancel, if any, triggered IAB-MT Recommended Beam Indication query;

1> cancel, if any, triggered Desired DL TX Power Adjustment query;

1> cancel, if any, triggered Desired IAB-MT PSD range query;

1> cancel, if any, triggered Case-6 Timing Request query;

1> cancel, if any, triggered SL-PRS resource request;

1> cancel, if any, triggered Event Triggered L1 Measurement Report;

1> flush the soft buffers for all DL HARQ processes, except for the DL HARQ process being used for MBS broadcast;

1> for each DL HARQ process, except for the DL HARQ process being used for MBS broadcast, consider the next received transmission for a TB as the very first transmission;

1> release, if any, Temporary C-RNTI;

1> clear, if any, Differential Koffset;

1> if upper layers indicate SCG deactivation and *bfd-and-RLM* with value *true* is not configured; or

1> if the MAC reset is not due to SCG deactivation:

2> reset all *BFI\_COUNTER*s;

1> reset all *LBT\_COUNTERs*;

1> reset TTT for event triggered L1 measurement report triggering condition evaluation;

1> reset all *MR\_SENT\_COUNTER*;

1> clear all *BEAM\_ENTERING\_LIST*;

1> clear all *BEAM\_LEAVING\_LIST*;

1> clear all *BEAM\_REPORTED\_LIST*;

1> clear all *MR\_LIST*.

If a Sidelink specific reset of the MAC entity is requested for a PC5-RRC connection by upper layers, the MAC entity shall:

1> flush the soft buffers for all Sidelink processes for all TB(s) associated to the PC5-RRC connection;

1> consider all Sidelink processes for all TB(s) associated to the PC5-RRC connection as unoccupied;

1> cancel, if any, triggered Scheduling Request procedure only associated to the PC5-RRC connection;

1> cancel, if any, triggered Sidelink Buffer Status Reporting procedure only associated to the PC5-RRC connection;

1> cancel, if any, triggered Sidelink CSI Reporting procedure associated to the PC5-RRC connection;

1> cancel, if any, triggered Sidelink DRX Command Indication procedure associated to the PC5-RRC connection;

1> cancel, if any, triggered Sidelink IUC-Request transmission procedure associated to the PC5-RRC connection;

1> cancel, if any, triggered Sidelink IUC-Information Reporting procedure associated to the PC5-RRC connection;

1> stop (if running) all timers associated to the PC5-RRC connection;

1> reset the *numConsecutiveDTX* associated to the PC5-RRC connection;

1> initialize *SBj* for each logical channel associated to the PC5-RRC connection to zero.

Next change

## 5.17 Beam Failure Detection and Recovery procedure

The MAC entity may be configured by RRC per Serving Cell or per BFD-RS set with a beam failure recovery procedure which is used for indicating to the serving gNB of a new SSB or CSI-RS when beam failure is detected on the serving SSB(s)/CSI-RS(s). Beam failure is detected by counting beam failure instance indication from the lower layers to the MAC entity. If *beamFailureRecoveryConfig* is reconfigured by upper layers during an ongoing Random Access procedure for beam failure recovery for SpCell, the MAC entity shall stop the ongoing Random Access procedure and initiate a Random Access procedure using the new configuration. The Serving Cell is configured with two BFD-RS sets if and only if *failureDetectionSet1* and *failureDetectionSet2* are configured for the active DL BWP of the Serving Cell. When the SCG is deactivated, the UE performs beam failure detection on the PSCell if *bfd-and-RLM* is set to *true*.

RRC configures the following parameters in the *beamFailureRecoveryConfig*, *beamFailureRecoverySpCellConfig*, *beamFailureRecoverySCellConfig* and the *radioLinkMonitoringConfig* for the Beam Failure Detection and Recovery procedure:

- *beamFailureInstanceMaxCount* for the beam failure detection (per Serving Cell or per BFD-RS set of Serving Cell configured with two BFD-RS sets);

- *beamFailureDetectionTimer* for the beam failure detection (per Serving Cell or per BFD-RS set of Serving Cell configured with two BFD-RS sets);

- *beamFailureRecoveryTimer* for the beam failure recovery procedure for SpCell;

- *rsrp-ThresholdSSB*: an RSRP threshold for the SpCell beam failure recovery;

- *rsrp-ThresholdBFR*: an RSRP threshold for the SCell beam failure recovery or for the beam failure recovery of BFD-RS set of Serving Cell;

- *powerRampingStep*: *powerRampingStep* for the SpCell beam failure recovery;

- *powerRampingStepHighPriority*: *powerRampingStepHighPriority* for the SpCell beam failure recovery;

- *preambleReceivedTargetPower*: *preambleReceivedTargetPower* for the SpCell beam failure recovery;

- *preambleTransMax*: *preambleTransMax* for the SpCell beam failure recovery;

- *scalingFactorBI*: *scalingFactorBI* for the SpCell beam failure recovery;

- *ssb-perRACH-Occasion*: *ssb-perRACH-Occasion* for the SpCell beam failure recovery using contention-free Random Access Resources;

- *ra-ResponseWindow*: the time window to monitor response(s) for the SpCell beam failure recovery using contention-free Random Access Resources;

- *prach-ConfigurationIndex*: *prach-ConfigurationIndex* for the SpCell beam failure recovery using contention-free Random Access Resources;

- *ra-ssb-OccasionMaskIndex*: *ra-ssb-OccasionMaskIndex* for the SpCell beam failure recovery using contention-free Random Access Resources;

- *ra-OccasionList*: *ra-OccasionList* for the SpCell beam failure recovery using contention-free Random Access Resources;

- *candidateBeamRSList*: list of candidate beams for SpCell beam failure recovery;

- *candidateBeamRS-List-r16*: list of candidate beams for SCell beam failure recovery or list of candidate beams for beam failure recovery of a Serving Cell for BFD-RS set one;

- *candidateBeamRS-List2-r17*: list of candidate beams for beam failure recovery of a Serving Cell for BFD-RS set two.

The following UE variables are used for the beam failure detection procedure:

- *BFI\_COUNTER* (per Serving Cell or per BFD-RS set of Serving Cell configured with two BFD-RS sets): counter for beam failure instance indication which is initially set to 0.

The MAC entity shall for each Serving Cell configured for beam failure detection:

1> if the Serving Cell is configured with two BFD-RS sets:

2> if beam failure instance indication for a BFD-RS set has been received from lower layers:

3> start or restart the *beamFailureDetectionTimer* of the BFD-RS set;

3> increment *BFI\_COUNTER* of the BFD-RS set by 1;

3> if *BFI\_COUNTER* of the BFD-RS set >= *beamFailureInstanceMaxCount*:

4> trigger a BFR for this BFD-RS set of the Serving Cell;

2> if BFR is triggered for both BFD-RS sets of the SpCell and the Beam Failure Recovery procedure is not successfully completed for any of the BFD-RS sets:

3> initiate a Random Access procedure (see clause 5.1) on the SpCell;

2> if the Serving Cell is SpCell and the Random Access procedure initiated for beam failure recovery of both BFD-RS sets of SpCell is successfully completed (see clause 5.1):

3> set *BFI\_COUNTER* of each BFD-RS set of SpCell to 0.

3> consider the Beam Failure Recovery procedure successfully completed.

2> if the *beamFailureDetectionTimer* of a BFD-RS set expires; or

2> if *beamFailureDetectionTimer*, *beamFailureInstanceMaxCount*, or any of the reference signals used for beam failure detection is reconfigured by upper layers or by the BFD-RS Indication MAC CE associated with a BFD-RS set of the Serving Cell; or

2> if the reference signal(s) associated with a BFD-RS set of the Serving Cell used for beam failure detection is changed:

3> set *BFI\_COUNTER* of the BFD-RS set to 0.

2> if a PDCCH addressed to C-RNTI indicating uplink grant for a new transmission is received for the HARQ process used for the transmission of the Enhanced BFR MAC CE or Truncated Enhanced BFR MAC CE which contains beam failure recovery information of a BFD-RS set of the Serving Cell:

3> set *BFI\_COUNTER* of the BFD-RS set to 0;

3> consider the Beam Failure Recovery procedure successfully completed for this BFD-RS set and cancel all the triggered BFRs of this BFD-RS set of the Serving Cell.

2> if the Serving Cell is SCell and the SCell is deactivated as specified in clause 5.9:

3> set *BFI\_COUNTER* of each BFD-RS set of SCell to 0;

3> consider the Beam Failure Recovery procedure successfully completed and cancel all the triggered BFRs of all BFD-RS sets of the Serving Cell.

1> else:

2> if beam failure instance indication has been received from lower layers:

3> start or restart the *beamFailureDetectionTimer*;

3> increment *BFI\_COUNTER* by 1;

3> if *BFI\_COUNTER* >= *beamFailureInstanceMaxCount*:

4> if the Serving Cell is SCell:

5> trigger a BFR for this Serving Cell;

4> else if the Serving Cell is PSCell and, the SCG is deactivated:

5> if beam failure of the PSCell has not been indicated to upper layers since the SCG was deactivated or since the deactivated SCG was last reconfigured with BFD-RS:

6> indicate beam failure of the PSCell to upper layers.

NOTE: After beam failure is indicated to upper layers, the UE may stop the *beamFailureDetectionTimer* and lower layer beam failure indication while *BFI\_COUNTER* >= *beamFailureInstanceMaxCount* for the deactivated SCG.

4> else:

5> initiate a Random Access procedure (see clause 5.1) on the SpCell;

5> if beam failure is detected for an NCR-MT:

6> indicate to NCR-Fwd to cease forwarding.

2> if the *beamFailureDetectionTimer* expires; or

2> if *beamFailureDetectionTimer*, *beamFailureInstanceMaxCount*, or any of the reference signals used for beam failure detection is reconfigured by upper layers associated with this Serving Cell; or

2> if the reference signal(s) associated with this Serving Cell used for beam failure detection is changed:

3> set *BFI\_COUNTER* to 0.

2> if the Serving Cell is SpCell and the Random Access procedure initiated for SpCell beam failure recovery is successfully completed (see clause 5.1):

3> set *BFI\_COUNTER* to 0;

3> stop the *beamFailureRecoveryTimer*, if configured;

3> if the Random Access procedure was triggered by beam failure recovery for NCR-MT:

4> indicate to NCR-Fwd to resume forwarding using the last forwarding configuration received by NCR-MT as part of side control information before beam failure detection;

3> consider the Beam Failure Recovery procedure successfully completed.

2> else if the Serving Cell is SCell, and a PDCCH addressed to C-RNTI indicating uplink grant for a new transmission is received for the HARQ process used for the transmission of the MAC CE for BFR which contains beam failure recovery information of this Serving Cell; or

2> if the SCell is deactivated as specified in clause 5.9:

3> set *BFI\_COUNTER* to 0;

3> consider the Beam Failure Recovery procedure successfully completed and cancel all the triggered BFRs for this Serving Cell.

The MAC entity shall:

1> if the Beam Failure Recovery procedure determines that at least one BFR has been triggered and not cancelled for an SCell for which evaluation of the candidate beams according to the requirements as specified in TS 38.133 [11] has been completed and if none of the Serving Cell(s) of this MAC entity are configured with two BFD-RS sets:

2> if UL-SCH resources are available for a new transmission and if the UL-SCH resources can accommodate the BFR MAC CE plus its subheader as a result of LCP:

3> instruct the Multiplexing and Assembly procedure to generate the BFR MAC CE.

2> else if UL-SCH resources are available for a new transmission and if the UL-SCH resources can accommodate the Truncated BFR MAC CE plus its subheader as a result of LCP:

3> instruct the Multiplexing and Assembly procedure to generate the Truncated BFR MAC CE.

2> else:

3> trigger the SR for SCell beam failure recovery for each SCell for which BFR has been triggered, not cancelled, and for which evaluation of the candidate beams according to the requirements as specified in TS 38.133 [11] has been completed.

1> if the Beam Failure Recovery procedure determines that at least one BFR for any BFD-RS set has been triggered and not cancelled for an SCell for which evaluation of the candidate beams according to the requirements as specified in TS 38.133 [11] has been completed; or

1> if the Beam Failure Recovery procedure determines that at least one BFR for only one BFD-RS set has been triggered and not cancelled for an SpCell for which evaluation of the candidate beams according to the requirements as specified in TS 38.133 [11] has been completed; or

1> if the Beam Failure Recovery procedure determines that at least one BFR has been triggered and not cancelled for an SCell for which evaluation of the candidate beams according to the requirements as specified in TS 38.133 [11] has been completed and if at least one Serving Cell of this MAC entity is configured with two BFD-RS sets:

2> if UL-SCH resources are available for a new transmission and if the UL-SCH resources can accommodate the Enhanced BFR MAC CE plus its subheader as a result of LCP:

3> instruct the Multiplexing and Assembly procedure to generate the Enhanced BFR MAC CE.

2> else if UL-SCH resources are available for a new transmission and if the UL-SCH resources can accommodate the Truncated Enhanced BFR MAC CE plus its subheader as a result of LCP:

3> instruct the Multiplexing and Assembly procedure to generate the Truncated Enhanced BFR MAC CE.

2> else:

3> trigger the SR for beam failure recovery of each BFD-RS set for which BFR has been triggered, not cancelled, and for which evaluation of the candidate beams according to the requirements as specified in TS 38.133 [11] has been completed;

3> trigger the SR for SCell beam failure recovery for each SCell for which BFR has been triggered, not cancelled, and for which evaluation of the candidate beams according to the requirements as specified in TS 38.133 [11] has been completed.

All BFRs triggered for an SCell shall be cancelled when a MAC PDU is transmitted and this PDU includes a MAC CE for BFR which contains beam failure information of that SCell. All BFRs triggered for a BFD-RS set of a Serving Cell shall be cancelled when a MAC PDU is transmitted and this PDU includes an Enhanced BFR MAC CE or Truncated Enhanced BFR MAC CE which contains beam failure recovery information of that BFD-RS set of the Serving Cell.

Next change

### 5.18.1 General

This clause specifies the requirements upon reception or transmission of the following MAC CEs:

- SP CSI-RS/CSI-IM Resource Set Activation/Deactivation MAC CE;

- Aperiodic CSI Trigger State Subselection MAC CE;

- TCI States Activation/Deactivation for UE-specific PDSCH MAC CE;

- TCI State Indication for UE-specific PDCCH MAC CE;

- SP CSI reporting on PUCCH Activation/Deactivation MAC CE;

- Enhanced SP CSI reporting on PUCCH Activation/Deactivation MAC CE;

- SP SRS Activation/Deactivation MAC CE;

- PUCCH spatial relation Activation/Deactivation MAC CE;

- Enhanced PUCCH spatial relation Activation/Deactivation MAC CE;

- SP ZP CSI-RS Resource Set Activation/Deactivation MAC CE;

- Recommended Bit Rate MAC CE;

- Enhanced SP/AP SRS Spatial Relation Indication MAC CE;

- SRS Pathloss Reference RS Update MAC CE;

- PUSCH Pathloss Reference RS Update MAC CE;

- Serving Cell set based SRS Spatial Relation Indication MAC CE;

- SP Positioning SRS Activation/Deactivation MAC CE;

- Timing Delta MAC CE;

- Guard Symbols MAC CEs;

- Positioning Measurement Gap Activation/Deactivation Command MAC CE;

- PPW Activation/Deactivation Command MAC CE;

- PUCCH spatial relation Activation/Deactivation for multiple TRP PUCCH repetition MAC CE;

- PUCCH Power Control Set Update for multiple TRP PUCCH repetition MAC CE;

- Unified TCI States Activation/Deactivation MAC CE;

- Differential Koffset MAC CE;

- Case-7 Timing advance offset MAC CE;

- DL TX Power Adjustment MAC CEs;

- Child IAB-DU Restricted Beam Indication MAC CE;

- Timing Case Indication MAC CE;

- PSI-Based SDU Discard Activation/Deactivation MAC CE;

- BFD-RS Indication MAC CE;

- IAB-MT Recommended Beam Indication MAC CE;

- UL PSD range adjustment for IAB MAC CE;

- Case-6 Timing Request MAC CE;

- NCR Backhaul Link Beam Indication MAC CEs;

- NCR Access Link Beam Indication MAC CE;

- Enhanced Unified TCI States Activation/Deactivation MAC CE;

- LTM Cell Switch Command MAC CE;

- Candidate Cell TCI States Activation/Deactivation MAC CE;

- Aggregated SP Positioning SRS Activation/Deactivation MAC CE;

- Enhanced LTM Cell Switch Command MAC CE;

- SP CSI-RS/CSI-IM Resource Set Activation/Deactivation for Candidate Cell MAC CE.

Next change

### 5.18.35 (Enhanced) LTM Cell Switch Command

The network may instruct the UE to perform LTM cell switch procedure by sending the LTM Cell Switch Command MAC CE described in clause 6.1.3.75 or the Enhanced LTM Cell Switch Command MAC CE described in clause 6.1.3.75a. The Enhanced LTM Cell Switch Command MAC CE is used for MAC entity associated with MCG if the value of *ltm-NoSecurityChangeID* contained within the *LTM-Candidate* associated with target configuration ID in *ltm-Config* is not equal to the value of stored *ltm-ServingCellNoSecurityChangeID* as specified in TS 38.331 [5]. Otherwise, the LTM Cell Switch MAC CE is used.

The MAC entity shall:

1> if the MAC entity receives an (Enhanced) LTM Cell Switch Command MAC CE on a Serving Cell:

2> indicate to upper layers that the LTM cell switch procedure is triggered and the Target Configuration ID included in the LTM Cell Switch Command MAC CE; or indicate to upper layers that the LTM cell switch procedure is triggered, the Target Configuration ID and the NCC value included in the Enhanced LTM Cell Switch Command MAC CE;

2> if the MAC reset operation as specified in clause 5.12 is performed, as requested by upper layers:

3> if Timing Advance Command value (hexa-decimal) is not set as FFF:

4> process the received Timing Advance Command (see clause 5.2);

4> consider the RACH-less LTM cell switch to be ongoing;

4> if the MAC entity is associated with the SCG:

5> indicate to upper layers to skip the Random Access procedure for this LTM cell switch.

3> else if the UE is configured with UE-based Timing Advance measurement as specified in TS 38.331 [5] and the UE has successfully measured the Timing Advance for the SpCell of the indicated LTM target configuration:

4> process the measured Timing Advance (see clause 5.2);

4> consider the RACH-less LTM cell switch to be ongoing.

4> if the MAC entity is associated with the SCG:

5> indicate to upper layers to skip the Random Access procedure for this LTM cell switch.

3> indicate to lower layers the information regarding the TCI state information included in the LTM Cell Switch Command MAC CE or the Enhanced LTM Cell Switch Command MAC CE.

Next change

### 5.18.37 Activation/Deactivation of Aggregated Semi-Persistent Positioning SRS

The network may activate and deactivate the configured aggregated resource sets of Semi-Persistent Positioning SRS by sending the Aggregated SP Positioning SRS Activation/Deactivation MAC CE described in clause 6.1.3.83. The configured aggregated SP positioning SRS resource sets are initially deactivated upon (re-)configuration by upper layers and after reconfiguration with sync.

The MAC entity shall:

1> if the MAC entity receives an Aggregated SP Positioning SRS Activation/Deactivation MAC CE:

2> indicate to lower layers the information regarding the Aggregated SP Positioning SRS Activation/Deactivation MAC CE.

### 5.18.x Activation/Deactivation of Semi-persistent CSI-RS/CSI-IM resource set for candidate cell

The network may activate or deactivate the configured Semi-persistent CSI-RS/CSI-IM resource sets for a candidate cell by sending the SP CSI-RS/CSI-IM Resource Set Activation/Deactivation for Candidate Cell MAC CE described in clause 6.1.3.12a. The configured Semi-persistent CSI-RS/CSI-IM resource sets are initially deactivated upon (re-)configuration by upper layers and after reconfiguration with sync that is not triggered by LTM*.* After reconfiguration with sync that is triggered by LTM, the configured Semi-persistent CSI-RS/CSI-IM resource sets for all candidate cell(s), except the target cell, are deactivated. After CSI reporting at the target cell after or during cell switch triggered by LTM, the configured Semi-persistent CSI-RS/CSI-IM resource sets for the target cell is deactivated.

The MAC entity shall:

1> if the MAC entity receives an SP CSI-RS/CSI-IM Resource Set Activation/Deactivation for Candidate Cell MAC CE:

2> indicate to lower layers the information regarding the SP CSI-RS/CSI-IM Resource Set Activation/Deactivation for Candidate Cell MAC CE.

Next change

## 5.x L1 measurement and event triggered report

### 5.x.1 Introduction

The network may configure an RRC\_CONNECTED UE to perform L1 beam level measurements for LTM candidate cell(s) and/or serving cell. The network may configure the UE to report them in accordance with the event triggered L1 measurement configuration. The measurement report is used for indicating to serving gNB of the L1 measurement results from the serving cell and/or candidate cell(s). The measurement configuration is provided by means of RRC dedicated signalling*.*

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

- Measurement results per SS/PBCH block;

- SS/PBCH block(s) resource indicator (SSBRI).

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

- Measurement results per CSI-RS resource;

- CSI-RS resource indicator (CRI).

The RRC configures the following parameters in the *LTM-CSI-ReportConfig* and *LTM-CSI-ResourceConfig* for event triggered L1 measurement and corresponding reporting procedure:

- *LTM-CSI-ReportConfig* for the event-triggered measurement report;

- *eventTriggered* for the event-triggered measurement report;

- *eventLTM2*, *eventLTM3*, *eventLTM4*, *eventLTM5*: events for the event-triggered measurement report;

- *timeToTrigger*: time during which an entering/leaving condition needs to be consistently satisfied for reporting event triggered L1 measurement report;

- *ltm-CandidateReportConfigList*: List of report configurations for LTM candidate IDs;

- *ltm-EventTriggeredPeriodicReport*: whether the event triggered L1 measurement report is sent periodically if an LTM event is triggered;

- *reportOnLeave*: whether the event triggered L1 measurement report shall be triggered when leaving condition for a event is satisfied;

- *ltm-EventTriggeredReportReportContent*: the content of the event triggered L1 measurement report.

### 5.x.2 Performing measurement

An RRC\_CONNECTED UE obtains L1 beam level measurement results by measuring one or multiple RSs as configured by the network as specified in [RAN1 REF] for the LTM candidate cell(s) with the candidate ID configured in *ltm-CandidateReportConfigList* for evaluation of reporting criteria. For each L1 beam level measurement result in RRC\_CONNECTED, the UE applies the layer 1 filtering by implementation, before using the measured results for evaluation of reporting criteria and measurement reporting. When the serving cell is configured with multiple TRP, the best beam of the current beams of serving cell for LTM event evaluation, where the current beams are the beams corresponds to the RS(s) configured in the indicated TCI State or the RS QCLed with the RS configured in the indicated TCI State indicated by TCI State for multiple TRP in the serving cell as defined in clause 5.1.5 in TS 38.214. It is up to the UE implementation how to choose the best beam. The MAC entity performs the evaluation of reporting criteria as specified in 5.x.3 based on the L1 measurement results from lower layer. For the LTM candidate cell(s) with the candidate ID not configured in *ltm-CandidateReportConfigList*, the UE is not required to perform and event evaluation in 5.x.3 on the RSs belonging to the candidate ID for the corresponding event.

For L1 beam level event triggered measurements report, the network can configure SS/PBCH block(s) or CSI-RS as event evaluation RS type, and L1-RSRP as trigger quantity. Reporting quantity is the same as the trigger quantity.

### 5.x.3 Measurement report triggering

#### 5.x.3.1 General

The UE maintains the following UE variables for event triggered L1 measurement and report procedure:

- *MR\_LIST*: includes the list of event triggered L1 measurement report information, including RS resource index of LTM candidate cell(s), L1 measurement result, and type of reporting RS(s) as defined in 6.1.3.x, for which the L1 measurement report triggering conditions have been met for TTT. Each entry in the list is associated with a *ltm-CSI-ReportConfigId*;

- *MR\_SENT\_COUNTER*: represents the number of event triggered L1 measurement report performed by UE if the triggering condition for the corresponding event is met for TTT for each *ltm-CSI-ReportConfigId*;

- *BEAM\_ENTERING\_LIST*: includes the reference signaling resource index of LTM candidate cell(s) for each *ltm-CSI-ReportConfigId*, for which the L1 measurement report entering conditions have been met for TTT for the triggered L1 measurement report;

- *BEAM\_LEAVING\_LIST*: includes the reference signaling resource index of LTM candidate cell(s) for each *ltm-CSI-ReportConfigId*, for which has been reported in the (Truncated) L1 measurement report MAC CE, and the L1 measurement report leaving conditions have been met for TTT for the triggered L1 measurement report;

- *BEAM\_REPORTED\_LIST*: includes the reference signaling resource index of LTM candidate cell(s) for each *ltm-CSI-ReportConfigId*, for which has been reported in the (Truncated) L1 measurement report MAC CE, and the L1 measurement report leaving conditions have not been met for TTT.

Unless explicitly specified otherwise, it is up to UE implementation how to store these variables.

The MAC entity shall for LTM event evaluation procedure:

1> for each *ltm-CSI-ReportConfigId* included in the *LTM-CSI-ReportConfig*:

2> if the corresponding *ltm-ReportConfigType* is set to *eventTriggered* and there is *ltm-EventTriggeredReportContent* configuration:

3> if the *eventLTM2* is configured in the corresponding *ltm-CSI-ReportConfigId*:

4> consider only the current beam of serving cell, i.e. the beam corresponds to the RS configured in the indicated TCI State or the RS QCLed with the RS configured in the indicated TCI State indicated by TCI State in the serving cell as defined in clause 5.1.5 in TS 38.214, with the same RS type as the beam of LTM candidate cell, i.e. the RSs configured in *LTM-CSI-ResourceConfig* which associated with this *ltm-CSI-ReportConfigId*, to be applicable;

3> if the *eventLTM3*, *eventLTM4,* or *eventLTM5* is configured in the corresponding *ltm-CSI-ReportConfigId*:

4> consider any beam of LTM candidate cell (except the serving cell) configured in *ltm-CandidateReportConfigList*, i.e. the RSs configured in *LTM-CSI-ResourceConfig* which associated with this *ltm-CSI-ReportConfigId*, to be applicable;

2> if the entry condition for the event associated with *ltm-CSI-ReportConfigId* is fulfilled for one or more applicable beams, i.e. reference signalling associated with *SSB-Index* or *NZP-CSI-RS-ResourceID* in the *LTM-CSI-ResourceConfig* associated with the *LTM-CSI-ReportConfig*, which is not in the *BEAM\_ENTERING\_LIST* and not in the *BEAM\_REPORTED\_LIST*,for the measurement from lower layer during *timeToTrigger* defined for this event:

3> if the *MR\_LIST* does not include a measurement reporting entry for this *ltm-CSI-ReportConfigId* (a first RS triggers the event):

4> include a measurement reporting entry in the *MR\_LIST* for this *ltm-CSI-ReportConfigId*;

3> include the SSBRI or CRI of the concerned beam(s) in the *BEAM\_ENTERING\_LIST* for this *ltm-CSI-ReportConfigId*;

3> if the beam is in *BEAM\_LEAVING\_LIST*

4> remove the concerned beam(s) in the *BEAM\_LEAVING\_LIST* for this ltm-CSI-ReportConfigId;

4> include the SSBRI or CRI of the concerned beam(s) in the *BEAM\_REPORTING\_LIST* for this ltm-CSI-ReportConfigId;

3> initiate the measurement reporting procedure, as specified in 5.x.4.

2> else if the leaving condition for the event associated with *ltm-CSI-ReportConfigId* is fulfilled for one or more applicable beams included in the *BEAM\_ENTERING\_LIST* or *BEAM\_REPORTED\_LIST* for the measurement from lower layer during *timeToTrigger* defined for this event:

3> if the *MR\_LIST* does not include a measurement reporting entry for this *ltm-CSI-ReportConfigId* (a first RS triggers the event):

4> include a measurement reporting entry in the *MR\_LIST* for this *ltm-CSI-ReportConfigId*;

3> if the beam is in *BEAM\_ENTERING\_LIST*

4> remove the concerned beam(s) in the *BEAM\_ENTERING\_LIST* for this ltm-CSI-ReportConfigId;

3> if the beam is in *BEAM\_REPORTED\_LIST*

4> remove the concerned beam(s) in the *BEAM\_REPORTED\_LIST* for this ltm-CSI-ReportConfigId;

4> include the SSBRI or CRI of the concerned beam(s) in the *BEAM\_LEAVING\_LIST* for this ltm-CSI-ReportConfigId;

3> if *reportOnLeave* is set to *true* for this *ltm-CSI-ReportConfigId*:

4> initiate the measurement reporting procedure, as specified in 5.x.4;

2> upon expiry of the periodical reporting timer for this *ltm-CSI-ReportConfigId*:

3> initiate the measurement reporting procedure, as specified in 5.x.4.

NOTE x: *timeToTrigger* is not restarted if the current beam of serving cell changes and the entry condition is still met with the new current beam.

NOTE y: To evaluate the L1 measurement reporting triggering event, the UE uses the latest *L1-RSRP* measurement from lower layer.

#### 5.x.3.2 Event LTM2 (Beam of serving cell becomes worse than threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition LTM2-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition LTM2-2, as specified below, is fulfilled;

Inequality LTM2-1 (Entering condition)

*Ms + Hys < Thresh*

Inequality LTM2-2 (Leaving condition)

*Ms – Hys > Thresh*

The variables in the formula are defined as follows:

***Ms*** is the beam measurement quantity of the serving cell based on SS/PBCH block or CSI-RS, not taking into account any offsets. The beam associated with this event is the current beam, i.e. corresponding to the RS configured in the indicated TCI state or the RS QCLed with the RS configured in the indicated TCI state in the serving cell as defined in clause 5.1.5 in TS 38.214], with the same RS type as the beam of LTM candidate cell, i.e. the RSs configured in *LTM-CSI-ResourceConfig*.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *LTM-CSI-ReportConfig* for this event).

***Thresh*** is the threshold parameter for this event (i.e. *ltm2-Threshold* as defined within *LTM-CSI-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.x.3.3 Event LTM3 (Beam of candidate cell becomes offset better than beam of serving cell)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition LTM3-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition LTM3-2, as specified below, is fulfilled;

Inequality LTM3-1 (Entering condition)

*Mn + Obn* *– Hys > Ms + Obs + Off*

Inequality LTM3-2 (Leaving condition)

*Mn + Obn + Hys < Ms + Obs + Off*

The variables in the formula are defined as follows:

***Mn*** is the beam measurement quantity of the LTM candidate cell based on SS/PBCH block or CSI-RS, not taking into account any offsets.

***Obn*** is the offset of the LTM candidate cell (i.e. *candidateSpecificOffset* as defined in *LTM-CSI-ReportConfig* for this event). One offset is applied to all beam(s) associated with the LTM candidate cell.

***Ms*** is the beam measurement quantity of the serving cell based on SS/PBCH block or CSI-RS, not taking into account any offsets. The beam associated with this event is the current beam, i.e corresponding to the RS configured in the indicated TCI state or the RS QCLed with the RS configured in the indicated TCI State in the serving cell [as defined in clause 5.1.5 in TS 38.214] in the serving cell.

***Obs*** is the offset of the beam of the serving cell (i.e. *candidateSpecificOffsetS* as defined in *LTM-CSI-ReportConfig* for this event).

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *LTM-CSI-ReportConfig* for this event).

***Off*** is the offset parameter for this event (i.e. *ltm3-Offset* as defined within *LTM-CSI-ReportConfig* for this event).

***Mn, Ms*** are expressed in dBm in case of RSRP.

***Obn***, ***Obs***, ***Hys***, ***Off*** are expressed in dB.

#### 5.x.3.4 Event LTM4 (Beam of candidate cell becomes better than absolute threshold)

The UE shall:

1> consider the entering condition for this event to be satisfied when condition LTM4-1, as specified below, is fulfilled;

1> consider the leaving condition for this event to be satisfied when condition LTM4-2, as specified below, is fulfilled.

Inequality LTM4-1 (Entering condition)

*Mn + Obn* *– Hys > Thresh*

Inequality LTM4-2 (Leaving condition)

*Mn + Obn* *+ Hys < Thresh*

The variables in the formula are defined as follows:

***Mn*** is the beam measurement quantity of the LTM candidate cell based on SS/PBCH block or CSI-RS, not taking into account any offsets.

***Obn*** is the offset of the beam of the LTM candidate cell (i.e. [*beamIndividualOffsetN*] as defined in *LTM-CSI-ReportConfig* for this event). One offset is applied to all beam(s) associated with the LTM candidate cell.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *LTM-CSI-ReportConfig* for this event).

***Off*** is the offset parameter for this event (i.e. *ltm4-Offset* as defined within *LTM-CSI-ReportConfig* for this event).

***Mn*** is expressed in dBm in case of RSRP.

***Obn, Hys*** are expressed in dB.

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

#### 5.x.3.5 Event LTM5 (Beam of serving cell becomes worse than threshold1 and Beam of candidate cell becomes better than threshold2)

The UE shall:

1> consider the entering condition for this event to be satisfied when both condition LTM5-1 and condition LTM5-2, as specified below, are fulfilled;

1> consider the leaving condition for this event to be satisfied when condition LTM5-3 or condition LTM5-4, i.e. at least one of the two, as specified below, is fulfilled;

Inequality LTM5-1 (Entering condition 1)

*Ms + Hys < Thresh1*

Inequality LTM5-2 (Entering condition 2)

*Mn + Obn* *– Hys > Thresh2*

Inequality LTM5-3 (Leaving condition 1)

*Ms – Hys > Thresh1*

Inequality LTM5-4 (Leaving condition 2)

*Mn + Obn* *+ Hys < Thresh2*

The variables in the formula are defined as follows:

***Ms*** is the beam measurement quantity of the serving cell based on SS/PBCH block or CSI-RS, not taking into account any offsets. The beam associated with this event is the current beam, i.e corresponding to the RS configured in the indicated TCI state or the RS QCLed with the RS configured in the indicated TCI State in the serving cell, as defined in clause 5.1.5 in TS 38.214.

***Mn*** is the beam measurement quantity of the LTM candidate cell based on SS/PBCH block or CSI-RS, not taking into account any offsets.

***Obn*** is the offset of the LTM candidate cell (i.e. [*beamIndividualOffsetN*] as defined in *LTM-CSI-ReportConfig* for this event). One offset is applied to all beam(s) associated with the LTM candidate cell.

***Hys*** is the hysteresis parameter for this event (i.e. *hysteresis* as defined within *LTM-CSI-ReportConfig* for this event).

***Thresh1*** is the threshold parameter for this event (i.e. ltm5*-Threshold1* as defined within *LTM-CSI-ReportConfig* for this event).

***Thresh2*** is the threshold parameter for this event (i.e. ltm5*-Threshold2* as defined within *LTM-CSI-ReportConfig* for this event).

***Mn, Ms*** are expressed in dBm in case of RSRP.

***Obn***, ***Hys*** are expressed in dB.

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

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

### 5.x.4 Measurement report

The purpose of this procedure is to transfer L1 measurement results from the UE to the network.

RRC controls the event triggered L1 beam level measurement reporting by configuring the following parameter:

- *reportInterval*: the periodicity of the event-triggered periodic measurement report;

- *reportAmount*: number of measurement reports needs to be transmitted after the event is triggered;

- *maxNumberOfReportedBeams*: number of beams whose measurements can be reported in the event triggered L1 measurement report by MAC CE regardless whether or not the report includes the current beam;

- *allowReportAnyBeam*: whether the UE can report the measurement results for the beams not satisfying the conditions of the events;

- *reportCurrentBeam*: whether the UE is required to report the measurement result of the current beam;

- *ltm-CandidateReportConfigId*: LTM candidate cell ID for which the UE is required to measure reference signal and perform LTM event evaluation;

- *candidateSpecificOffset*: offset for event condition that is applicable for all the reference signals belonging to the candidate cell with the candidate cell ID *ltm-CandidateReportConfigId*;

- *candidateSpecificOffsetS*: offset for event condition that is applicable for all the reference signals belonging to the serving cell with the candidate cell ID *ltm-CandidateReportConfigId*;

- *reportQuantity*: the report quantity for the CSI report.

For the event triggered L1 measurement reporting, for each *ltm-CSI-ReportConfigId* included in the *LTM-CSI-ReportConfig*, the MAC entity shall:

1> if at least one L1 measurement report has been triggered as specified in 5.x.3 and not cancelled:

2> if UL-SCH resources are available for a new transmission in the serving cell and these UL-SCH resources can accommodate the L1 measurement report MAC CE plus its subheader as a result of logical channel prioritization:

3> instruct the Multiplexing and Assembly procedure to generate the L1 measurement report MAC CE associated with the *ltm-CSI-ReportConfigId* as befined in clause 6.1.3.x according to the measurement report information in the *MR\_LIST*;

3> if *reportAmount* is configured in the *LTM-EventTriggeredPeriodicReport* by RRC:

4> if at least one L1 measurement report associated with the *ltm-CSI-ReportConfigId* has been triggered due to the reason other than the expiry of the periodical reporting timer and the L1 measurement report is not cancelled:

5> set the MR\_SENT\_COUNTER to 0 for this ltm-CSI-ReportConfigId;

4> increment the *MR\_SENT\_COUNTER* associated with the *ltm-CSI-ReportConfigId* by 1;

4> stop the periodical reporting timer, if running;

4> if *reportAmount* is configured in RRC, and the *MR\_SENT\_COUNTER* as defined for this *ltm-CSI-ReportConfigId* is less than *reportAmount*:

5> restart the periodical reporting timer with the value of *reportInterval* for this *ltm-CSI-ReportConfigId* as defined within the corresponding *LTM-CSI-reportConfig*;

3> include the SSBRI or CRI in the *BEAM\_ENTERING\_LIST* for this *ltm-CSI-ReportConfigId*, if any, into the *BEAM\_REPORTED\_LIST* for this *ltm-CSI-ReportConfigId*;

3> clear the *BEAM\_ENTERING\_LIST* for this *ltm-CSI-ReportConfigId*;

3> clear the *BEAM\_LEAVING\_LIST* for this *ltm-CSI-ReportConfigId*;

3> if the *BEAM\_REPORTED\_LIST* for this *ltm-CSI-ReportConfigId* is empty:

4> remove the measurement reporting entry within the *MR\_LIST* for this *ltm-CSI-ReportConfigId*;

4> stop the periodical reporting timer for this *ltm-CSI-ReportConfigId*, if running;

3> cancel the triggered L1 measurement report;

2> else if the UL-SCH resources are available for a new transmission in the serving cell and these UL-SCH resources can accommodate the Truncated L1 measurement report MAC CE plus its subheader as a result of logical channel prioritization:

3> instruct the Multiplexing and Assembly procedure to generate the Truncated L1 measurement report MAC CE associated with the *ltm-CSI-ReportConfigId* as defined in clause 6.1.3.x according to the measurement report information in the *MR\_LIST* be selecting the RS(s) based on a decreasing order of the priority for the type of beam: RS(s) in *BEAM\_ENTERING\_LIST*, RS(s) in *BEAM\_LEAVING\_LIST*, RS(s) in *BEAM\_REPORTED\_LIST*, and other RS(s) not in these three lists;

2> else:

3> if the dedicated SR configuration for L1 measurement report MAC CE transmission is configured:

4> trigger the SR using the dedicated SR configuration for L1 measurement report;

3> else:

4> initiate a Random Access procedure (see clause 5.1) on the SpCell and cancel the pending SR trigger;

3> stop the periodical reporting timer for this *ltm-CSI-ReportConfigId*, if running.

NOTE X: After sending a Truncated L1 measurement report MAC CE, if the subsequent UL grant is still not big enough to fit all the remaining beams, it is up to UE implementation to select the beam(s) which were not included in the previous MAC CE.

NOTE Y: If more than one triggering events for L1 measurement report are pending and the UL grant is not sufficient for all regular L1 measurement report MAC CEs, it is up to UE implementation how to handle/include the L1 measurement report MAC CEs and/or Truncated L1 measurement report MAC CE.

NOTE Z: When a measurement report is triggered by entry condition for one or more RS(s), and included in the *BEAM\_ENTERING\_LIST*, another measurement report is triggered by exit condition for the same RS(s), all the corresponding measurement reports are cancelled. When a measurement report is triggered by exit condition for one or more RS(s), and included in the *BEAM\_LEAVING\_LIST*, another measurement report is triggered by entry condition for the same RS(s), all the corresponding measurement reports are cancelled.

Next change

## 5.y Conditional LTM

### 5.y.1 Introduction

The UE may perform conditional LTM by using the L1 or L3 measurement for LTM cell switch conditions evaluation in accordance with the reconfiguration for conditional LTM. The RRC configures the following parameters for L1 trigger condition for CLTM procedure:

- *ltm-ExecutionCondition* and *ltm-ServingCellExecutionCondition* for conditional LTM cell switch execution condition.

### 5.y.2 L1 measurement based Conditional LTM triggering condition evaluation

Upon indication from upper layers to initiate the LTM cell switch conditions evaluation based on L1 measurements according to the indicated field *ltm-ServingCellExecutionCondition*, the MAC entity shall for the PCell configured for conditional LTM procedure:

1> for each entry within the *LTM-ExecutionCondition*:

2> if the *LTM3* or *LTM5* is configured in the corresponding *ltm-CSI-ReportConfigId* for *l1-Conditions*:

3> consider all beams of LTM candidate cell indicated by the *ltm-CandidateId* within this *LTM-ExecutionCondition* and associated with *LTM-CSI-ResourceConfigId* which is associated with the *LTM-CSI-ReportConfigId* for *l1-Conditions* within the *LTM-ExecutionCondition* to be applicable;

3> if the entry condition for the event associated with *ltm-CSI-ReportConfigId* is fulfilled for TTT for one or more applicable beams, i.e. reference signalling associated with *SSB-Index* or *NZP-CSI-RS-ResourceID* in the *LTM-CSI-ResourceConfig* associated with the *LTM-CSI-ReportConfig*, for the measurement from lower layer during *timeToTrigger* defined for this event;

4> consider the event associated with *LTM-CSI-ReportConfigId* to be fulfilled for the *ltm-CandidateId* associated with *LTM-CSI-ReportConfigId*;

4> perform the CLTM execution procedure for the LTM candidate configuration associated with *ltm-CandidateId* according to the procedure specified in 5.y.3;

### 5.y.3 Conditional LTM execution

The conditional LTM cell switch procedure is triggered when:

- the MAC entity determines that the event for conditional LTM is satisfied based on L1 measurements as specified in clause 5.y.2; or

- the event for conditional LTM is satisfied based on L3 measurements indicated by upper layers.

The MAC entity shall:

1> if the event for conditional LTM is satisfied based on L1 measurements as specified in clause 5.y.2:

2> select the SSB(s) or CSI-RS(s) corresponding to the *SSB-Index* or *NZP-CSI-RS-ResourceID* in the *LTM-CSI-ResourceConfig* associated with the *LTM-CSI-ReportConfig* in which the satisfied event is included;

2> indicate to upper layers that the event for the LTM cell switch procedure is triggered, and the Target Configuration ID, corresponding to *ltm-CandidateId* minus 1, for which the associated L1 measurement based event is satisfied.

1> if the MAC reset operation as specified in clause 5.12 is performed, as requested by upper layers:

2> acquire the Target Configuration ID from upper layers, if any, for the satisfied L3 measurement based event;

2> if the event for conditional LTM is satisfied based on L1 measurement:

3> if the *cg-LTM-Configuration* is configured for the CLTM target cell (i.e. the SpCell corresponding to the target configuration indicated by Target Configuration ID), if two TAGs are not configured for the CLTM target cell, and if the *ltm-Candidate-TimeAlignmentTimer* associated with the CLTM target cell is running in the first available CG occasion corresponding to one of the selected SSB/CSI-RS for initial uplink transmission according to clause 5.8.2:

4> process the stored Timing Advance Command associated with the running *ltm-Candidate-TimeAlignmentTimer* (see clause 5.2);

4> consider the RACH-less CLTM cell switch to be ongoing;

3> if the *cg-LTM-Configuration* is configured for the CLTM target cell (i.e. the SpCell corresponding to the target configuration indicated by Target Configuration ID), if two TAGs are configured for the CLTM target cell, and if the *ltm-Candidate-TimeAlignmentTimer* or *ltm-Candidate-TimeAlignmentTimerTAG2* associated with the Target Configuration ID for the TAG associated with the TCI state associated with one the selected SSB/CSI-RS is running, in the first available CG occasion corresponding to the same selected SSB/CSI-RS for initial uplink transmission according to clause 5.8.2:

4> process the stored Timing Advance Command associated with the running *ltm-Candidate-TimeAlignmentTimer* or *ltm-Candidate-TimeAlignmentTimerTAG2* (see clause 5.2);

4> consider the RACH-less CLTM cell switch to be ongoing;

3> else if the UE is configured with UE-based Timing Advance measurement as specified in TS 38.331 [5] and the UE has successfully measured the Timing Advance for the CLTM tartget cell (i.e. the SpCell corresponding to the target configuration indicated by Target Configuration ID), and the measured Timing Advance is valid in the first available CG occasion corresponding to one of the selected SSB or CSI-RS for initial uplink transmission according to clause 5.8.2:

4> process the measured Timing Advance (see clause 5.2);

4> consider the RACH-less CLTM cell switch to be ongoing;3> else:

4> initiate a Random Access procedure (see clause 5.1) on the SpCell;

4> consider the RACH-based CLTM cell switch to be ongoing;

NOTE X: For L1 measurement based RACH-less CLTM, when multiple SSBs/CSI-RSs satisfy the event for conditional LTM, it is up to UE implementation to select a SSB/CSI-RS that satisfies the event and perform CLTM.

2> if the event for conditional LTM is satisfied based on L3 measurement:

3> if *cg-LTM-Configuration* is configured for the CLTM target cell (i.e. the SpCell corresponding to the target configuration indicated by Target Configuration ID), if two TAGs are not configured for the CLTM target cell, and if at least one of the SSB(s) of the CLTM target cell with SS-RSRP above *cg-LTM-RSRP-ThresholdSSB* and amongst the SSBs associated with the CG is available:

4> select the SSB(s) with SS-RSRP above the *cg-LTM-RSRP-ThresholdSSB* amongst the SSB(s) associated with the configured uplink grant;

4> if the *ltm-Candidate-TimeAlignmentTimer* associated with the CLTM target cell is running in the first available CG occasion corresponding to one of the seleted SSB for initial uplink transmission according to clause 5.8.2:

5> process the stored Timing Advance Command associated with the running *ltm-Candidate-TimeAlignmentTimer* (see clause 5.2);

5> consider the RACH-less CLTM cell switch to be ongoing;

3> if *cg-LTM-Configuration* is configured for the CLTM target cell (i.e. the SpCell corresponding to the target configuration indicated by Target Configuration ID), if two TAGs are configured for the CLTM target cell, and if at least one of the SSB(s) of the CLTM target cell with SS-RSRP above *cg-LTM-RSRP-ThresholdSSB* and amongst the SSBs associated with the CG is available:

4> select the SSB(s) with SS-RSRP above the *cg-LTM-RSRP-ThresholdSSB* amongst the SSB(s) associated with the configured uplink grant;

4> if the *ltm-Candidate-TimeAlignmentTimer* or *ltm-Candidate-TimeAlignmentTimerTAG2* associated with the CLTM target cell for the TAG associated with the TCI state asscociated with one of the selected SSB is running in the first available CG occasion corresponding to the same seleted SSB for initial uplink transmission according to clause 5.8.2:

5> process the stored Timing Advance Command associated with the running *ltm-Candidate-TimeAlignmentTimer* or *ltm-Candidate-TimeAlignmentTimerTAG2* (see clause 5.2);

5> consider the RACH-less CLTM cell switch to be ongoing;

3> else if the UE is configured with UE-based Timing Advance measurement as specified in TS 38.331 [5] and the UE has successfully measured the Timing Advance for the CLTM target cell (i.e. the SpCell corresponding to the target configuration indicated by Target Configuration ID):

4> select the SSB(s) with SS-RSRP above the *cg-LTM-RSRP-ThresholdSSB* amongst the SSB(s) associated with the configured uplink grant;

4> if the measured Timing Advance is valid in the first available CG occasion corresponding to one of the selected SSB(s) for initial uplink transmission according to clause 5.8.2:

5> process the measured Timing Advance (see clause 5.2);

5> consider the RACH-less CLTM cell switch to be ongoing;3> else:

4> initiate a Random Access procedure (see clause 5.1) on the SpCell;

4> consider the RACH-based CLTM cell switch to be ongoing;

NOTE Y: For L3 measurement based RACH-less CLTM, if there are multiple selected RSs corresponding to the CG with the measurement above the *cg-LTM-RSRP-ThresholdSSB*, it is up to UE implementation to select one of them to perform C-LTM.

2> if the RACH-less CLTM cell switch is considered to be ongoing:

3> attempt to select a configured uplink grant for uplink transmission according to clause 5.8.2;

3> if a valid configured uplink grant is selected:

4> perform uplink transmission in the available CG occasion for RACH-less CLTM cell switch according to clause 5.8.2;

4> monitor the PDCCH as specified in clause 5.7 and TS 38.213 [6];

2> if the *TimeAlignmentTimer* associated with PTAG expires while the RACH-less CLTM cell switch is ongoing:

3> initiate a Random Access procedure (see clause 5.1) on the SpCell;

3> consider the RACH-based CLTM cell switch to be ongoing.

NOTE Z: For RACH-based CLTM, if there are multiple selected RSs, it is up to UE implementation to select one of them to perform C-LTM.

Next change

#### 6.1.3.4x LTM Candidate Timing Advance Command MAC CE

The LTM Candidate Timing Advance Command MAC CE is identified by MAC subheader with eLCID as specified in Table 6.2.1-1b.

It has a fixed size and consists of two octets defined as follows (Figure 6.1.3.4x-1):

- Candidate Config ID: This field indicates the index of the corresponding CLTM candidate configuration, corresponding to *ltm-CandidateID* minus 1 as specified in TS 38.331 [5]. The length of the field is 3 bits;

- TI: If two TAGs are configured for the CLTM candidate cell corresponding to Candidate Config ID, this field indicates one of the two TAGs to which the Timing Advance Command is applied. The field set to 0 indicates the tag2-Id and the field set to 1 indicates the tag-Id of the CLTM candidate cell. If two TAGs are not configured for the CLTM candidate cell indicated by the latest PDCCH order before UE receives this MAC CE, the R bit is present instead;

- Timing Advance Command: This field indicates the index value *TA* used to control the amount of timing adjustment that MAC entity has to apply (as specified in TS 38.213 [6]) when UE switches to the candidate cell during CLTM. The length of the field is 12 bits;

- R: Reserved bit, set to 0.



Figure 6.1.3.4x-1: LTM Candidate Timing Advance Command MAC CE

Next change

#### 6.1.3.12a SP CSI-RS/CSI-IM Resource Set Activation/Deactivation for Candidate Cell MAC CE

The SP CSI-RS/CSI-IM Resource Set Activation/Deactivation for Candidate Cell MAC CE is identified by a MAC subheader with eLCID as specified in Table 6.2.1-1b. It has a variable size and consists of the following fields (Figure 6.1.3.12a-1):

- A/D: This field indicates whether to activate or deactivate indicated SP CSI-RS resource set for the candidate cell(s) associated with the CSI Resource Configuration Index, or SP CSI-RS and CSI-IM resource set for the candidate cell(s) associated with the CSI Resource Configuration ID1 and ID2, respectively. The field is set to 1 to indicate activation, otherwise it indicates deactivation;

- CSI Resource Configuration ID1: This field indicates the index of the LTM CSI resource configuration corresponding to *LTM-CSI-ResourceConfigId* minus 1as specified in TS 38.331 [5] associated with SP CSI-RS resource set for the candidate cell(s), for which the MAC CE applies. The length of the field is 7 bits;

- CSI Resource Configuration ID2: This field indicates the index of the LTM CSI resource configuration corresponding to *LTM-CSI-ResourceConfigId* minus 1as specified in TS 38.331 [5] associated with SP CSI-IM resource set for the candidate cell(s), for which the MAC CE applies. If the SP CSI-IM resource set for the candidate cell(s) is not configured in TS 38.331 [5], this field and the reserved bit in the same octet are absent. The length of the field is 7 bits;

- TCI State IDi: This field contains *TCI-StateId*, as specified in TS 38.331 [5], of a TCI State, which is used as QCL source for the resource within the Semi Persistent NZP CSI-RS resource set corresponding to *LTM-CSI-ResourceConfigId* as specified in TS 38.331 [5]. TCI State ID0 indicates TCI State for the first resource within the Semi Persistent NZP CSI-RS resource set, TCI State ID1 for the second one and so on. If the A/D field is set to 0, the octets containing TCI State ID field(s) are not present. The length of the field is 7 bits;

- R: Reserved bit, set to 0.



Figure 6.1.3.12a-1: SP CSI-RS/CSI-IM Resource Set Activation/Deactivation for Candidate Cell MAC CE

Next change

#### 6.1.3.75a Enhanced LTM Cell Switch Command MAC CE

The Enhanced LTM Cell Switch Command MAC CE is identified by MAC subheader with eLCID as specified in Table 6.2.1-1b. It has a variable size with following fields (Figure 6.1.3.75a-1):

- R: Reserved bit, set to 0;

- Target Configuration ID: This field indicates the index of candidate target configuration to apply for LTM cell switch, corresponding to *ltm-CandidateId* minus 1as specified in TS 38.331 [5]. The length of the field is 3 bits;

- Timing Advance Command: This field indicates whether the TA is valid for the LTM target cell (i.e. the SpCell corresponding to the target configuration indicated by Target Configuration ID field). If the value of this field is set to FFF, this field indicates that no valid timing adjustment is available for the PTAG of the LTM target cell; otherwise, this field indicates the index value *TA* used to control the amount of timing adjustment that the MAC entity has to apply in TS 38.213 [6], and that the UE can skip the Random Access procedure for this LTM cell switch. If *tag-Id-ptr* is configured for the TCI state indicated by the UL TCI state ID field, if present, or by the TCI state ID field otherwise, in the LTM target cell and *tag-Id-ptr* is set to value *n1*, this field indicates the TA for the TAG indicated by the *tag2-Id* of the LTM target cell; otherwise, this field indicates the TA for the TAG indicated by the *tag-id* of the LTM target cell. The length of the field is 12 bits;

- TCI state ID: This field indicates and activates the TCI state for the LTM target cell (i.e. the SpCell of the target configuration indicated by the Target Configuration ID field). The TCI state is identified by *TCI-StateId* in *ltm-DL-OrJointTCI-StateToAddModList* as specified in TS 38.331 [5]. If the value of *unifiedTCI-StateType* in the *ltm-TCI-Info* of the configuration indicated by Target Configuration ID fieldis *joint*, this field is for joint TCI state, otherwise, this field is for downlink TCI state. The length of the field is 7 bits;

- UL TCI state ID: This field indicates and activates the uplink TCI state for the LTM target cell (i.e. the SpCell of the target configuration indicated by the Target Configuration ID field). The UL TCI state is identified by *TCI-UL-StateId* in *ltm-UL-TCI-StateToAddModList* as specified in TS 38.331 [5]. The octet containing this field (i.e. this field and the two reserved bits in the same octet) is included if the value of *unifiedTCI-StateType* in the *ltm-TCI-Info* of the configuration indicated by Target Configuration ID fieldis *separate*. The length of the field is 6 bits;

- C: This field indicates the presence of the contention-free Random Access Resources fields. If the value of this field is set to 1, the following fields are present: Random Access Preamble index field, S/U field, SS/PBCH index field, PRACH Mask index field, Repetition number field. If the value of this field is set to 0, the Random Access Preamble index field, S/U field, SS/PBCH index field, PRACH Mask index field, Repetition number field are absent, and the corresponding bits for S/U field and Repetition number field are reserved.

- NCC value: This field indicates the NCC value used to update the KgNB key. The NCC value is identified by *NextHopChainingCount* as specified in TS 38.331 [5]. The length of the field is 3 bits.

- S/U: This field indicates which UL carrier to transmit the PRACH of the contention-free Random Access Resources. If the value of this field is set to 1, SUL is used; otherwise, NUL is used. The length of the field is 1 bit;

- Random Access Preamble index: This field indicates the Random Access Preamble index of the contention-free Random Access Resources. This field should not be set to 0b000000. The length of the field is 6 bits;

- SS/PBCH index: This field indicates the SS/PBCH that shall be used to determine the RACH occasion for the PRACH transmission of the contention-free Random Access Resources. The length of the field is 6 bits;

- PRACH Mask index: This field indicates the RACH occasion(s) associated with the SS/PBCH indicated by ‘SS/PBCH index’ for the PRACH transmission of the contention-free Random Access Resources. It indicates a subset of RACH occasion(s) from the *rach-ConfigDedicated* for the UL carrier (indicated by S/U field), (if provided, otherwise it indicates a subset of RACH occasion(s) from the *rach-ConfigCommon* for the UL carrier (indicated by S/U field) in the UL BWP configuration of *firstActiveUplinkBWP-Id* as specified in TS 38.331 [5]. When the repetition number field is not set to 0, the UE ignores this field. The length of the field is 4 bits;

- Repetition number: This field indicates the Msg1 repetition number to be applied to the contention-free Random Access. If this field is set to 0, Msg1 repetition number does not apply. If this field is set to 1, the Msg1 repetition number is 2. If this field is set to 2, the Msg1 repetition number is 4. If this field is set to 3, the Msg1 repetition number is 8. The length of the field is 2 bits;

NOTE 1: A non-zero Msg1 repetition number value may only be included in the Enhanced LTM Cell Switch Command MAC CE when the LTM target cell configuration has contention-based Random Access Resources with a *FeatureCombinationPreambles* with the same Msg1 repetition number value and *featureCombination* indicating only *msg1-Repetitions*.



Figure 6.1.3.75a-1: Enhanced LTM Cell Switch Command MAC CE

NOTE 2: If UE receives the Enhanced LTM Cell Switch Command MAC CE with a Target Configuration ID value not matching any configured *ltm-CandidateId* minus 1, as specified in TS 38.331 [5], the procedure of handling Enhanced LTM Cell Switch Command MAC CE in clause 5.18.35 does not apply.

Next change

#### 6.1.3.x Event Triggered L1 Measurement Report MAC CE

Event triggered L1 measurement report MAC CE consists of either:

- event triggered L1 measurement report format (variable size); or

- truncated event triggered L1 measurement report format (variable size).

The event triggered L1 measurement report formats are identified by MAC subheaders with an eLCIDs as specified in Table 6.2.1-2b.

For a truncated event triggered L1 measurement report MAC CE, at least the following fields should be included: report ID field, at least one triggered RS with corresponding measured quantity, and the current RS of serving cell as described in TS 38.215 [24] with corresponding measured quantity, if UE is configured to report the measurement result of current RS of the serving cell by *reportCurrentBeam*.

The fields in the (truncated) event triggered L1 measurement report MAC CE are defined as follows:

- Report ID: This field indicates corresponding measurement report ID for this *ltm-CSI-ReportConfigId* associated with this event triggered measurement report. The length of the Report ID field is 6 bits;

- Typei: This field indicates the type of the RS i of LTM candidate cell included in the event triggered L1 measurement report. The field is set to 00 to indicate the RS(s) that has satisfied the entry condition of the event associated with the report ID for TTT, triggers this measurement report MAC CE, and included in the *BEAM\_ENTERING\_LIST*; it is set to 01 to indicate the RS(s) that has satisfied the leaving condition of the event associated with the report ID for TTT, triggers this measurement report MAC CE, and included in the *BEAM\_LEAVING\_LIST*; it is set to 10 to indicate the RS(s) for which has been reported in the (Truncated) L1 measurement report MAC CE, and included in the *BEAM\_REPORTED\_LIST* associated with the report ID as specified in clause 5.x.3; it is set to 11 to indicate the RS(s) not satisfying the event for TTT, if configured by network by *allowReportAnyBeam* specified in TS 38.331 [5], i.e. the RS(s) with Type set to neither 00, 01, nor 10. The RS(s) not satisfying the event for TTT is selected based on the decending order of measured quantity. The RS(s) included in the truncated event triggered L1 measurement report MAC CE are selected based on a decreasing order of the priority for the type of beam: 00, 01, 10, 11. If the (truncated) event triggered L1 measurement report MAC CE cannot accommodate all RS(s) with the same priority, the RS(s) are selected based on a decreasing order of measured quality. The length of the field is 2 bits;

NOTE 3: For the measurement report triggered by LTM2, the RS with Type of 00 is the current beam, which is always included in the last octet, i.e. the current RS of serving cell and the corresponding RS type are not included in the first two octets.

- RSRIi: This field indicates the reference signaling resource index of the beam i of LTM candidate cell for the event triggered L1 measurement report (i.e. SS/PBCH Block Resource indicator (SSBRI) or CSI-RS resource indicator (CRI)). The maximum number of non-serving RS reported is configured by *maxNumberOfReportedBeams* if the measurement of current RS of serving cell is not included, or is *maxNumberOfReportedBeams*-1 if the measurement of current RS of serving cell is included. The first RS is the RS with the highest measured quality for non-serving RS in this measurement report MAC CE. The length of the RSRI index field is 9 bits;

- RSRP1: This field indicates the measured quantity of the first beam based on SS/PBCH block or CSI-RS (i.e. the L1-RSRP) as described in TS 38.215 [24]. The length of the RSRP1 field is 7 bits;

- DiffRSRPi: This field indicates the derived differential measured quantity for the beam i of LTM candidate cell based on SS/PBCH block or CSI-RS (i.e. the L1-RSRP) as described in TS 38.215 [24], with the reference of measured quality of the first beam. The length of the DiffRSRPi field is 4 bits;

- RSRPserving: This field indicates the measured quantity based on SS/PBCH block or CSI-RS (i.e. the L1-RSRP) for current RS of serving cell as described in TS 38.215 [24] used for LTM event evaluation in clause 5.x.2, if UE is configured to report the measurement result of current RS of the serving cell by *reportCurrentBeam*. The length of the RSRPserving field is 7 bits;

- R: Reserved bit, set to 0.



Figure 6.1.3.x-1: event triggered L1 measurement report and truncated event triggered L1 measurement report MAC CE

Next change

### 6.2.1 MAC subheader for DL-SCH and UL-SCH

The MAC subheader consists of the following fields:

- LCID: The Logical Channel ID field identifies the logical channel instance of the corresponding MAC SDU or the type of the corresponding MAC CE or padding as described in Tables 6.2.1-1 and 6.2.1-1c for the DL-SCH and Tables 6.2.1-2 and 6.2.1-2c for the UL-SCH. There is one LCID field per MAC subheader. The size of the LCID field is 6 bits. If the LCID field is set to 34 as in Table 6.2.1-1 or 6.2.1-2, one additional octet is present in the MAC subheader containing the eLCID field and follow the octet containing LCID field. If the LCID field is set to 33 as in Table 6.2.1-1 or 6.2.1-2, two additional octets are present in the MAC subheader containing the eLCID field and these two additional octets follow the octet containing LCID field;

NOTE 1: For MBS broadcast, a logical channel is identified based on G-RNTI and LCID if the same LCID is allocated for logical channels corresponding to different G-RNTIs.

- eLCID: The extended Logical Channel ID field identifies the logical channel instance of the corresponding MAC SDU or the type of the corresponding MAC CE as described in tables 6.2.1-1a, 6.2.1-1b, 6.2.1-2a and 6.2.1-2b for the DL-SCH and UL-SCH respectively. The size of the eLCID field is either 8 bits or 16 bits.

NOTE 2: The extended Logical Channel ID space using two-octet eLCID and the relevant MAC subheader format is used, only when configured, on the NR backhaul links between IAB nodes or between IAB node and IAB Donor, or for multicast MTCHs.

- L: The Length field indicates the length of the corresponding MAC SDU or variable-sized MAC CE in bytes. There is one L field per MAC subheader except for subheaders corresponding to fixed-sized MAC CEs, padding, and MAC SDUs containing UL CCCH. The size of the L field is indicated by the F field;

- F: The Format field indicates the size of the Length field. There is one F field per MAC subheader except for subheaders corresponding to fixed-sized MAC CEs, padding, and MAC SDUs containing UL CCCH. The size of the F field is 1 bit. The value 0 indicates 8 bits of the Length field. The value 1 indicates 16 bits of the Length field;

- LX: The LCID extension field indicates the use of extended LCID space. The size of the LX field is 1 bit. The LX field set to 1 indicates the use of Table 6.2.1-2c, otherwise R bit is present instead (i.e. set to 0);

- R: Reserved bit, set to 0.

The MAC subheader is octet aligned.

Table 6.2.1-1: Values of LCID for DL-SCH

|  |  |
| --- | --- |
| Codepoint/Index | LCID values |
| 0 | CCCH |
| 1–32 | Identity of the logical channel of DCCH, DTCH and multicast MTCH |
| 33 | Extended logical channel ID field (two-octet eLCID field) |
| 34 | Extended logical channel ID field (one-octet eLCID field) |
| 35–46 | Reserved |
| 47 | Recommended bit rate |
| 48 | SP ZP CSI-RS Resource Set Activation/Deactivation |
| 49 | PUCCH spatial relation Activation/Deactivation |
| 50 | SP SRS Activation/Deactivation |
| 51 | SP CSI reporting on PUCCH Activation/Deactivation |
| 52 | TCI State Indication for UE-specific PDCCH |
| 53 | TCI States Activation/Deactivation for UE-specific PDSCH |
| 54 | Aperiodic CSI Trigger State Subselection |
| 55 | SP CSI-RS/CSI-IM Resource Set Activation/Deactivation |
| 56 | Duplication Activation/Deactivation |
| 57 | SCell Activation/Deactivation (four octets) |
| 58 | SCell Activation/Deactivation (one octet) |
| 59 | Long DRX Command |
| 60 | DRX Command |
| 61 | Timing Advance Command |
| 62 | UE Contention Resolution Identity |
| 63 | Padding |

Table 6.2.1-1a: Values of two-octet eLCID for DL-SCH

|  |  |  |
| --- | --- | --- |
| Codepoint | Index | LCID values |
| 0 to (216 – 1) | 320 to (216 + 319) | Identity of the logical channel |

Table 6.2.1-1b: Values of one-octet eLCID for DL-SCH

|  |  |  |
| --- | --- | --- |
| Codepoint | Index | LCID values |
| 0 to 212 | 64 to 276 | Reserved |
| 213 | 277 | SP CSI-RS/CSI-IM Resource Set Activation/Deactivation for Candidate Cell |
| 214 | 278 | Enhanced LTM Cell Switch Command |
| 215 | 279 | LTM Candidate Timing Advance Command MAC CE |
| 216 | 280 | Aggregated SP Positioning SRS Activation/Deactivation |
| 217 | 281 | Enhanced SP CSI reporting on PUCCH Activation/Deactivation |
| 218 | 282 | Cross-RRH TCI State Indication for UE-specific PDCCH |
| 219 | 283 | LTM Cell Switch Command |
| 220 | 284 | Candidate Cell TCI States Activation/Deactivation |
| 221 | 285 | PSI-Based SDU Discard Activation/Deactivation |
| 222 | 286 | Enhanced Unified TCI states Activation/Deactivation MAC CE for Joint TCI States |
| 223 | 287 | Enhanced Unified TCI states Activation/Deactivation MAC CE for Separate TCI States |
| 224 | 288 | NCR Access Link Beam Indication |
| 225 | 289 | NCR Downlink Backhaul Link Beam Indication |
| 226 | 290 | NCR Uplink Backhaul Link Beam Indication |
| 227 | 291 | Serving Cell Set based SRS TCI State Indication |
| 228 | 292 | SP/AP SRS TCI State Indication |
| 229 | 293 | BFD-RS Indication |
| 230 | 294 | Differential Koffset |
| 231 | 295 | Enhanced SCell Activation/Deactivation (one octet Ci field) |
| 232 | 296 | Enhanced SCell Activation/Deactivation (four octet Ci field) |
| 233 | 297 | Unified TCI States Activation/Deactivation |
| 234 | 298 | PUCCH Power Control Set Update for multiple TRP PUCCH repetition |
| 235 | 299 | PUCCH spatial relation Activation/Deactivation for multiple TRP PUCCH repetition |
| 236 | 300 | Enhanced TCI States Indication for UE-specific PDCCH |
| 237 | 301 | Positioning Measurement Gap Activation/Deactivation Command |
| 238 | 302 | PPW Activation/Deactivation Command |
| 239 | 303 | DL Tx Power Adjustment |
| 240 | 304 | Timing Case Indication |
| 241 | 305 | Child IAB-DU Restricted Beam Indication |
| 242 | 306 | Case-7 Timing advance offset |
| 243 | 307 | Provided Guard Symbols for Case-6 timing |
| 244 | 308 | Provided Guard Symbols for Case-7 timing |
| 245 | 309 | Serving Cell Set based SRS Spatial Relation Indication |
| 246 | 310 | PUSCH Pathloss Reference RS Update |
| 247 | 311 | SRS Pathloss Reference RS Update |
| 248 | 312 | Enhanced SP/AP SRS Spatial Relation Indication |
| 249 | 313 | Enhanced PUCCH Spatial Relation Activation/Deactivation |
| 250 | 314 | Enhanced TCI States Activation/Deactivation for UE-specific PDSCH |
| 251 | 315 | Duplication RLC Activation/Deactivation |
| 252 | 316 | Absolute Timing Advance Command |
| 253 | 317 | SP Positioning SRS Activation/Deactivation |
| 254 | 318 | Provided Guard Symbols |
| 255 | 319 | Timing Delta |

Table 6.2.1-1c: Values of LCID for MBS multicast MCCH and MBS broadcast on DL-SCH

|  |  |
| --- | --- |
| Codepoint/Index | LCID values |
| 0 | Broadcast MCCH or multicast MCCH |
| 1–32 | Identity of the logical channel of broadcast MTCH |
| 33–63 | Reserved |

Table 6.2.1-2: Values of LCID for UL-SCH when the LX field is not present or is set to 0

|  |  |
| --- | --- |
| Codepoint/Index | LCID values |
| 0 | CCCH of size 64 bits, except for an (e)RedCap UE |
| 1–32 | Identity of the logical channel of DCCH and DTCH |
| 33 | Extended logical channel ID field (two-octet eLCID field) |
| 34 | Extended logical channel ID field (one-octet eLCID field) |
| 35 | CCCH of size 48 bits for a RedCap UE |
| 36 | CCCH of size 64 bits for a RedCap UE |
| 37–42 | Reserved |
| 43 | Truncated Enhanced BFR (one octet Ci) |
| 44 | Timing Advance Report |
| 45 | Truncated Sidelink BSR |
| 46 | Sidelink BSR |
| 47 | Reserved |
| 48 | LBT failure (four octets) |
| 49 | LBT failure (one octet) |
| 50 | BFR (one octet Ci) |
| 51 | Truncated BFR (one octet Ci) |
| 52 | CCCH of size 48 bits, except for an (e)RedCap UE |
| 53 | Recommended bit rate query |
| 54 | Multiple Entry PHR (four octets Ci) |
| 55 | Configured Grant Confirmation |
| 56 | Multiple Entry PHR (one octet Ci) |
| 57 | Single Entry PHR |
| 58 | C-RNTI |
| 59 | Short Truncated BSR |
| 60 | Long Truncated BSR |
| 61 | Short BSR |
| 62 | Long BSR |
| 63 | Padding |
| NOTE: CCCH of size 48 bits and CCCH of size 64 bits are referred to as CCCH and CCCH1, respectively, in TS 38.331 [5]. | |

Table 6.2.1-2a: Values of two-octet eLCID for UL-SCH

|  |  |  |
| --- | --- | --- |
| Codepoint | Index | LCID values |
| 0 to (216 – 1) | 320 to (216 + 319) | Identity of the logical channel |

Table 6.2.1-2b: Values of one-octet eLCID for UL-SCH

|  |  |  |
| --- | --- | --- |
| Codepoint | Index | LCID values |
| 0 to 216 | 64 to 280 | Reserved |
| 217 | 281 | Event Triggered L1 Measurement Report |
| 218 | 282 | Truncated Event Triggered L1 Measurement Report |
| 219 | 283 | Enhanced Multiple Entry PHR for multiple TRP STx2P (four octets Ci) |
| 220 | 284 | Enhanced Multiple Entry PHR for multiple TRP STx2P (one octets Ci) |
| 221 | 285 | Enhanced Single Entry PHR for multiple TRP STx2P |
| 222 | 286 | SL LBT Failure |
| 223 | 287 | Multiple Entry PHR with assumed PUSCH (four octets Ci) |
| 224 | 288 | Multiple Entry PHR with assumed PUSCH (one octets Ci) |
| 225 | 289 | Single Entry PHR with assumed PUSCH |
| 226 | 290 | SL-PRS Resource Request |
| 227 | 291 | Refined Long BSR |
| 228 | 292 | Delay Status Report |
| 229 | 293 | Enhanced Multiple Entry PHR for multiple TRP (four octets Ci) |
| 230 | 294 | Enhanced Multiple Entry PHR for multiple TRP (one octets Ci) |
| 231 | 295 | Enhanced Single Entry PHR for multiple TRP |
| 232 | 296 | Enhanced Multiple Entry PHR (four octets Ci) |
| 233 | 297 | Enhanced Multiple Entry PHR (one octets Ci) |
| 234 | 298 | Enhanced Single Entry PHR |
| 235 | 299 | Enhanced BFR (one octet Ci) |
| 236 | 300 | Enhanced BFR (four octet Ci) |
| 237 | 301 | Truncated Enhanced BFR (four octet Ci) |
| 238 | 302 | Positioning Measurement Gap Activation/Deactivation Request |
| 239 | 303 | IAB-MT Recommended Beam Indication |
| 240 | 304 | Desired IAB-MT PSD range |
| 241 | 305 | Desired DL Tx Power Adjustment |
| 242 | 306 | Case-6 Timing Request |
| 243 | 307 | Desired Guard Symbols for Case 6 timing |
| 244 | 308 | Desired Guard Symbols for Case 7 timing |
| 245 | 309 | Extended Short Truncated BSR |
| 246 | 310 | Extended Long Truncated BSR |
| 247 | 311 | Extended Short BSR |
| 248 | 312 | Extended Long BSR |
| 249 | 313 | Extended Pre-emptive BSR |
| 250 | 314 | BFR (four octets Ci) |
| 251 | 315 | Truncated BFR (four octets Ci) |
| 252 | 316 | Multiple Entry Configured Grant Confirmation |
| 253 | 317 | Sidelink Configured Grant Confirmation |
| 254 | 318 | Desired Guard Symbols |
| 255 | 319 | Pre-emptive BSR |

Table 6.2.1-2c: Values of LCID for UL-SCH when the LX field is set to 1

|  |  |  |
| --- | --- | --- |
| Codepoint | Index | LCID values |
| 0 | (216 + 320) | CCCH of size 48 bits for an eRedCap UE |
| 1 | (216 + 321) | CCCH of size 64 bits for an eRedCap UE |
| 2 | (216 + 322) | CCCH of size 48 bits for PUCCH repetition of Msg4 HARQ-ACK, except for an (e)RedCap UE |
| 3 | (216 + 323) | CCCH of size 64 bits for PUCCH repetition of Msg4 HARQ-ACK, except for an (e)RedCap UE |
| 4 | (216 + 324) | CCCH of size 48 bits for PUCCH repetition of Msg4 HARQ-ACK of a RedCap UE |
| 5 | (216 + 325) | CCCH of size 64 bits for PUCCH repetition of Msg4 HARQ-ACK of a RedCap UE |
| 6 | (216 + 326) | CCCH of size 48 bits for PUCCH repetition of Msg4 HARQ-ACK of an eRedCap UE |
| 7 | (216 + 327) | CCCH of size 64 bits for PUCCH repetition of Msg4 HARQ-ACK of an eRedCap UE |
| 8 to 63 | (216 + 328) to (216 + 383) | Reserved |
| NOTE 1: The MAC entity may use the code point corresponding to a given feature or feature combination in Table 6.2.1-2c only if network indicates support for the corresponding feature or feature combination.  NOTE 2: CCCH of size 48 bits and CCCH of size 64 bits are referred to as CCCH and CCCH1, respectively, in TS 38.331 [5].  NOTE 3: For UE capable of PUCCH repetition of Msg4 HARQ-ACK, the MAC entity uses the code points corresponding to PUCCH repetition of Msg4 HARQ-ACK if *numberOfMsg4HARQ-ACK-Repetitions* is configured and *rsrp-ThresholdMsg4HARQ-ACK* is not configured, or if both are configured and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg4HARQ-ACK.* | | |

End of chang