3GPP RAN WG2 Meeting # R2-231xxxx

, 2023

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **38.321** | **CR** | **draft** | **rev** | **-** | **Current version:** | **17.6.0** |  |
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| *For* [*HE**LP*](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **x** | Core Network |  |

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| ***Title:***  | Running CR for TS 38.321 for MIMO Evolution |
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| ***Source to WG:*** | Samsung |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | NR\_MIMO\_evo\_DL\_UL-Core |  | ***Date:*** | 2023- |
|  |  |  |  |  |
| ***Category:*** | B  |  | ***Release:*** | Rel-18 |
|  | *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 canbe 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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
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| ***Reason for change:*** | Introduction of Release-18 MIMOevo |
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| ***Summary of change:*** | This running CR captures the RAN1 input and RAN2 agreements of feMIMO in Release-18. It will be updated as WI progresses.RAN2#121b-e (April 2023)* From RAN2 perspective, per TRP UE-initiated RACH procedure is not supported.
* We will send LS to R1 asking questions. Offline drafting the LS, including the following aspects

- the possible groupings and related operation for 2TAs- other aspects based on offline comments/company contributionsWorking assumption:* Revise the legacy unified TCI state activation/deactivation MAC CE by adding a “CORESET Pool ID” field to support mDCI based mTRP operation.

RAN2#122 (Incheon, Korea, May 2023)* Configure one TAT per TAG to support two TAs for a serving cell, i.e., in this case 2 TAGs are configured for the serving cell.
* RAN2 confirm the following working assumption as an agreement:

Revise the legacy unified TCI state activation/deactivation MAC CE by adding a “CORESET Pool ID” field to support mDCI based mTRP operation.* For sDCI based mTRP operation using unified TCI state framework, introduce the new MAC CE, with the following high level design principles:
	+ - If the signaling type of the unified TCI state configuration is configured by RRC (i.e. either joint DL/UL TCI state or separate DL/UL TCI state), it applies to both TRP (i.e., as configured by RRC for both TRPs).

The following information can be indicated by the MAC CE (for joint DL/UL TCI mode):* + - if the unified TCI state is for one of the TRPs (i.e., 1st or 2nd) or for both TRPs,
		- if the indicated TCI codepoint consists of one TCI state, whether the indicated TCI state(s) is for the first or second TRP(s)

FFS for the separate DL/UL TCI mode. RAN2#123 (Toulouse, France, August 2023)* Each joint/UL TCI state is associated with either TAG1 or TAG2 by RRC configuration.
* RAN2 do not assume any restriction on grouping serving cells/TRPs to TAGs unless RAN1 indication comes.
* RAN2 assumes the current 4 TAGs per cell group is sufficient to support Rel-18 mDCI mTRP with 2 TAs.
* At least when both TATs for a SpCell are expired, 1-8 are applied to all TRPs of all serving cells.
* At least when both TATs for a SCell are expired (assuming PTAG(s) of the cell group still running), 1-7 are applied to all TRPs associated to the TAG with the expired TAT (including both TRPs of the concerned SCell).

Working assumption:* We will use the 2-PTAG model, i.e., both TAGs of SpCell are PTAGs;
	+ - When the TAT for STAG is expired and the other TAT is running for a serving cell (i.e., SCell), no impact to the TRP with running TAT; 1 and 7 are applied to the TRP with TAT expired, FFS whether 2-6 are applied to the TRP with TAT expired,
		- when the TAT for PTAG is expired and the other TAT is running for a serving cell (SpCell or SCell), no impact to the TRP with running TAT; 1 and 7 are applied to the TRP with TAT expired, FFS whether 2-6 are applied to the TRP with TAT expired.

*1. not perform any uplink transmission except the Random Access Preamble and MSGA transmission;**2. flush all HARQ buffers;**3. notify RRC to release PUCCH, if configured;**4. notify RRC to release SRS, if configured;**5. clear any configured downlink assignments and configured uplink grants;**6. clear any PUSCH resource for semi-persistent CSI reporting;**7. maintain NTA (defined in TS 38.211 [8]) of this TAG;**8. consider all running timeAlignmentTimers as expired.** For inter-cell PDCCH order CFRA to the additionalPCI,
* PDCCH order indicates which additionalPCI’s PRACH configuration to be used (according to RAN1 agreement),
* The following is taken as baseline (for intra-cell case): for CBRA, we reuse the mechanism agreed for CFRA case, i.e. use the RA RAR to indicate the TAG.
* The following information can be indicated by the MAC CE (for separate DL/UL TCI mode):
	+ - if the unified TCI state is for one of the TRPs (i.e., 1st or 2nd) or for both TRPs,
		- if the indicated TCI codepoint consists of one TCI state, whether the indicated TCI state(s) is for the first or second TRP(s)
		- if the unified TCI codepoint is for all, or sub-set of {first DL TCI state, first UL TCI state, second DL TCI state, second UL TCI state}

RAN2#123bis (Xiamen, China, October 2023)* Confirmed: We will use the 2-PTAG model, i.e., both TAGs of SpCell are PTAGs; Confirmed: We will use the 2-PTAG model, i.e., both TAGs of SpCell are PTAGs;
* The following are taken as baseline

When the TAT for STAG is expired and the other TAT is running for a serving cell (i.e., SCell), no impact to the TRP with running TAT; 1 and 3-7 are applied to the TRP with TAT expired, i.e., 2 is not applied.when the TAT for PTAG is expired and the other TAT is running for a serving cell (SpCell or SCell), no impact to the TRP with running TAT; 1 and 3-7 are applied to the TRP with TAT expired, i.e., 2 is not applied.* One R bit in Absolute TAC MAC CE is used to indicate TAG ID, i.e. which TAG’s TA is updated.
* The baseline is confirmed as agreement: One R bit in RAR is used to indicate TAG ID, i.e. which TAG’s TA is updated. FFS if the association between the TAGs and value of the R bit (0 or 1) need to be configured by RRC.
* RAN2 confirm that separate MAC CEs on the enhanced unified TCI state for Single-DCI based multi-TRP operation are introduced for joint TCI State and separate DL/UL TCI States, respectively.
* The current running CR for MAC spec is used as the base line. Details can be further discussed.
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| ***Consequences if not approved:*** | No support for MIMOevo of Release-18 |
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| ***Clauses affected:*** | X.XX |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 38.331 CR TBD  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | R2-2309850 |

<<<<<<<<<<<<<<<<<<<< First change begins >>>>>>>>>>>>>>>>>>>>

5.1.1c Availability of the set of Random Access resources

The MAC entity shall for each set of configured Random Access resources for 4-step RA type and for each set of configured Random Access resources for 2-step RA type:

1> if *redCap* is set to *true* for a set of Random Access resources:

2> consider the set of Random Access resources as not available for a Random Access procedure for which RedCap is not applicable.

1> if *smallData* is set to *true* for a set of Random Access resources:

2> consider the set of Random Access resources as not available for the Random Access procedure which is not triggered for RA-SDT.

1> if *NSAG-List* is configured for a set of Random Access resources:

2> consider the set of Random Access resources as not available for the Random Access procedure unless it is triggered for any one of the *NSAG-ID*(s) in the *NSAG-List*.

1> if *msg3-Repetitions* is set to *true* for a set of Random Access resources:

2> consider the set of Random Access resources as not available for the Random Access procedure if Msg3 repetition is not applicable.

1> if a set of Random Access resources is not configured with *FeatureCombination*:

2> consider the set of Random Access resources to not associated with any feature.

Editor’s note: whether a note is needed to capture that RACH resource for *AdditionalPCIIndex* is applied to PDCCH order RACH for an *AdditionalPCIIndex* of a serving cell. This can be specified in RRC instead.

<<<<<<<<<<<<<<<<<<<< Change ends >>>>>>>>>>>>>>>>>>>>

<<<<<<<<<<<<<<<<<<<< Next change begins >>>>>>>>>>>>>>>>>>>>

5.1.4a MSGB reception and contention resolution for 2-step RA type

Once the MSGA preamble is transmitted, regardless of the possible occurrence of a measurement gap, the MAC entity shall:

1> start the *msgB-ResponseWindow* at the PDCCH occasion as specified in TS 38.213 [6], clause 8.2A;

1> monitor the PDCCH of the SpCell for a Random Access Response identified by MSGB-RNTI while the *msgB-ResponseWindow* is running;

1> if C-RNTI MAC CE was included in the MSGA:

2> monitor the PDCCH of the SpCell for Random Access Response identified by the C-RNTI while the *msgB-ResponseWindow* is running.

1> if notification of a reception of a PDCCH transmission of the SpCell is received from lower layers:

2> if the C-RNTI MAC CE was included in MSGA:

3> if the Random Access procedure was initiated for SpCell beam failure recovery or for beam failure recovery of both BFD-RS sets of SpCell (as specified in clause 5.17) and the PDCCH transmission is addressed to the C-RNTI:

4> consider this Random Access Response reception successful;

4> stop the *msgB-ResponseWindow*;

4> consider this Random Access procedure successfully completed.

3> else if the *timeAlignmentTimer* associated with at least one PTAG is running; or

3> if CG-SDT procedure is ongoing and *cg-SDT-TimeAlignmentTimer* is running:

4> if the PDCCH transmission is addressed to the C-RNTI and contains a UL grant for a new transmission:

5> consider this Random Access Response reception successful;

5> stop the *msgB-ResponseWindow*;

5> consider this Random Access procedure successfully completed.

3> else:

4> if a downlink assignment has been received on the PDCCH for the C-RNTI and the received TB is successfully decoded:

5> if the MAC PDU contains the Absolute Timing Advance Command MAC CE:

6> process the received Timing Advance Command (see clause 5.2);

6> consider this Random Access Response reception successful;

6> stop the *msgB-ResponseWindow*;

6> consider this Random Access procedure successfully completed and finish the disassembly and demultiplexing of the MAC PDU.

2> if a valid (as specified in TS 38.213 [6]) downlink assignment has been received on the PDCCH for the MSGB-RNTI and the received TB is successfully decoded:

3> if the MSGB contains a MAC subPDU with Backoff Indicator:

4> set the *PREAMBLE\_BACKOFF* to value of the BI field of the MAC subPDU using Table 7.2-1, multiplied with *SCALING\_FACTOR\_BI*.

3> else:

4> set the *PREAMBLE\_BACKOFF* to 0 ms.

3> if the MSGB contains a fallbackRAR MAC subPDU; and

3> if the Random Access Preamble identifier in the MAC subPDU matches the transmitted *PREAMBLE\_INDEX* (see clause 5.1.3a):

4> consider this Random Access Response reception successful;

4> apply the following actions for the SpCell:

5> process the received Timing Advance Command (see clause 5.2);

5> indicate the *msgA-PreambleReceivedTargetPower* and the amount of power ramping applied to the latest Random Access Preamble transmission to lower layers (i.e. (*PREAMBLE\_POWER\_RAMPING\_COUNTER* – 1) × *PREAMBLE\_POWER\_RAMPING\_STEP*);

5> if the Random Access Preamble was not selected by the MAC entity among the contention-based Random Access Preamble(s):

6> consider the Random Access procedure successfully completed;

6> process the received UL grant value and indicate it to the lower layers.

5> else:

6> set the *TEMPORARY\_C-RNTI* to the value received in the Random Access Response;

6> if the Msg3 buffer is empty:

7> obtain the MAC PDU to transmit from the MSGA buffer and store it in the Msg3 buffer;

6> process the received UL grant value and indicate it to the lower layers and proceed with Msg3 transmission.

NOTE: If within a 2-step RA type procedure, an uplink grant provided in the fallback RAR has a different size than the MSGA payload, the UE behavior is not defined.

3> else if the MSGB contains a successRAR MAC subPDU; and

3> if the CCCH SDU was included in the MSGA and the UE Contention Resolution Identity in the MAC subPDU matches the CCCH SDU:

4> stop *msgB-ResponseWindow*;

4> if this Random Access procedure was initiated for SI request:

5> indicate the reception of an acknowledgement for SI request to upper layers.

4> else:

5> set the C-RNTI to the value received in the *successRAR*;

5> apply the following actions for the SpCell:

6> process the received Timing Advance Command (see clause 5.2);

6> indicate the *msgA-PreambleReceivedTargetPower* and the amount of power ramping applied to the latest Random Access Preamble transmission to lower layers (i.e. (*PREAMBLE\_POWER\_RAMPING\_COUNTER* – 1) × *PREAMBLE\_POWER\_RAMPING\_STEP*).

4> deliver the *TPC*, *PUCCH resource Indicator*, *ChannelAccess-CPext* (if indicated), and *HARQ feedback Timing Indicator* received in successRAR to lower layers.

4> consider this Random Access Response reception successful;

4> consider this Random Access procedure successfully completed;

4> finish the disassembly and demultiplexing of the MAC PDU.

1> if *msgB-ResponseWindow* expires, and the Random Access Response Reception has not been considered as successful based on descriptions above:

2> increment *PREAMBLE\_TRANSMISSION\_COUNTER* by 1;

2> if *PREAMBLE\_TRANSMISSION\_COUNTER* = *preambleTransMax* + 1:

3> indicate a Random Access problem to upper layers;

3> if this Random Access procedure was triggered for SI request:

4> consider this Random Access procedure unsuccessfully completed.

2> if the Random Access procedure is not completed:

3> if *msgA-TransMax* is applied (see clause 5.1.1a) and *PREAMBLE\_TRANSMISSION\_COUNTER* = *msgA-TransMax* + 1:

4> set the *RA\_TYPE* to *4-stepRA*;

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

4> if the Msg3 buffer is empty:

5> obtain the MAC PDU to transmit from the MSGA buffer and store it in the Msg3 buffer;

4> flush HARQ buffer used for the transmission of MAC PDU in the MSGA buffer;

4> discard explicitly signalled contention-free 2-step RA type Random Access Resources, if any;

4> perform the Random Access Resource selection procedure as specified in clause 5.1.2.

3> else:

4> select a random backoff time according to a uniform distribution between 0 and the *PREAMBLE\_BACKOFF*;

4> if the criteria (as defined in clause 5.1.2a) to select contention-free Random Access Resources is met during the backoff time:

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

4> else:

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

Upon receiving a fallbackRAR, the MAC entity may stop *msgB-ResponseWindow* once the Random Access Response reception is considered as successful.

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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 or the TRPs of each Serving Cell 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.

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> 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 received Random Access Response message or MSGB;

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

Editor’s note: MSGB can be removed if TAG indication in FallbackRAR is not needed.

2> else if the *timeAlignmentTimer* associated with the TAG indicated in 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 *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 configured with only one TAG or in a MSGB for an SpCell configured with only one TAG:

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:

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 SRS transmission in RRC\_INACTIVE is ongoing:

4> 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 for a SpCell configured with two TAGs as specified in clause 5.1.4a:

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 for a SpCell configured with only one TAG as specified in clause 5.1.4a:

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

2> start the *TimeAlignmentTimer* associated with PTAG.

1> when a *timeAlignmentTimer* expires:

2> if the *timeAlignmentTimer* is associated with the PTAG and only one PTAG is configured for SpCell; or

2> if the *timeAlignmentTimer* is associated with the PTAG, and if 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 if the *timeAlignmentTimer* is associated with an STAG, then for all Serving Cells belonging to this TAG and configured with only one TAG; or

2> if the *timeAlignmentTimer* is associated with an STAG, then for all Serving Cells configured with this TAG and the other TAG for which *the timeAlignmentTimer* is not running:

3> flush all HARQ buffers;

3> notify RRC to release PUCCH, if configured;

3> notify RRC to release SRS, if configured;

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

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

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

2> else if the *timeAlignmentTimer* is associated with a TAG, then for all Serving Cells configured with this TAG and the other TAG for which the *timeAlignmentTimer* is running;

3> notify RRC to release PUCCH, if the corresponding activated TCI states are associated with the TAG of the expired *timeAlignmentTimer*,

3> notify RRC to release SRS, if the corresponding activated TCI states are associated with the TAG of the expired *timeAlignmentTimer*;

3> clear any configured downlink assignments and configured uplink grants applied with TCI state(s) that is associated with the TAG of the expired *timeAlignmentTimer*;

3> clear any PUSCH resource for semi-persistent CSI reporting scheduled with TCI state(s) that is associated with the TAG of the expired *timeAlignmentTimer*;

3> 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 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.

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 are not running, CG-SDT procedure is not ongoing and SRS transmission in RRC\_INACTIVE as in clause 5.26 is not on-going. Furthermore, when the *timeAlignmentTimer(s)* associated with all PTAG(s) are not running, CG-SDT procedure is not ongoing and 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* 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.

Editor’s note: FFS TAT expiry when maximum uplink transmission time difference is exceeded

<<<<<<<<<<<<<<<<<<<< Change ends >>>>>>>>>>>>>>>>>>>>

<<<<<<<<<<<<<<<<<<<< Next change begins >>>>>>>>>>>>>>>>>>>>

5.3.2.2 HARQ process

When a transmission takes place for the HARQ process, one or two (in case of downlink spatial multiplexing) TBs and the associated HARQ information are received from the HARQ entity.

For each received TB and associated HARQ information, the HARQ process shall:

1> if the NDI, when provided, has been toggled compared to the value of the previous received transmission corresponding to this TB; or

1> if the HARQ process is equal to the broadcast process, and this is the first received transmission for the TB according to the system information schedule indicated by RRC; or

1> if the HARQ process is associated with a transmission indicated with a MCCH-RNTI for MBS broadcast, and this is the first received transmission for the TB according to the MCCH schedule indicated by RRC; or

1> if the HARQ process is associated with a transmission indicated with a G-RNTI for MBS broadcast, and this is the first received transmission for the TB according to the MTCH schedule indicated by RRC or according to the scheduling indicated by DCI as specified in TS 38.214 [7]; or

1> if this is the very first received transmission for this TB (i.e. there is no previous NDI for this TB):

2> consider this transmission to be a new transmission.

1> else:

2> consider this transmission to be a retransmission.

The MAC entity then shall:

1> if this is a new transmission:

2> attempt to decode the received data.

1> else if this is a retransmission:

2> if the data for this TB has not yet been successfully decoded:

3> instruct the physical layer to combine the received data with the data currently in the soft buffer for this TB and attempt to decode the combined data.

1> if the data which the MAC entity attempted to decode was successfully decoded for this TB; or

1> if the data for this TB was successfully decoded before:

2> if the HARQ process is equal to the broadcast process:

3> deliver the decoded MAC PDU to upper layers.

2> else if this is the first successful decoding of the data for this TB:

3> deliver the decoded MAC PDU to the disassembly and demultiplexing entity.

1> else:

2> instruct the physical layer to replace the data in the soft buffer for this TB with the data which the MAC entity attempted to decode.

1> if the HARQ process is associated with a transmission indicated with a Temporary C-RNTI and the Contention Resolution is not yet successful (see clause 5.1.5); or

1> if the HARQ process is associated with a transmission indicated with a MSGB-RNTI and the Random Access procedure is not yet successfully completed (see clause 5.1.4a); or

1> if the HARQ process is equal to the broadcast process; or

1> if the HARQ process is associated with a transmission indicated with a MCCH-RNTI or a G-RNTI for MBS broadcast; or

1> if the HARQ process is associated with a transmission indicated with a G-RNTI or a G-CS-RNTI or a configured downlink assignment for MBS multicast and HARQ feedback is disabled for this G-RNTI or G-CS-RNTI, as specified in clause 18 of TS 38.213 [6]; or

1> if the HARQ process is associated with a transmission indicated with a G-RNTI or a G-CS-RNTI or a configured downlink assignment for MBS multicast and NACK only HARQ feedback is configured for this G-RNTI or G-CS-RNTI and the data for this TB is successfully decoded and the transmission is not the first transmission of PDSCH where the configured downlink assignment was (re-)initialised; or

1> if the *timeAlignmentTimer*, associated with the TAG containing the Serving Cell on which the HARQ feedback is to be transmitted, is stopped or expired and if the *cg-SDT-TimeAlignmentTimer*, if configured, is not running; or

1> if the HARQ process is configured with disabled HARQ feedback:

2> if *harq-FeedbackEnablingforSPSactive* is configured with value *true* and the transmission is the first transmission on the configured downlink assignment after activation of the configured downlink assignment:

3> instruct the physical layer to generate acknowledgement(s) of the data in this TB.

2> else:

3> not instruct the physical layer to generate acknowledgement(s) of the data in this TB.

1> else:

2> instruct the physical layer to generate acknowledgement(s) of the data in this TB.

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

NOTE: If the MAC entity receives a retransmission with a TB size different from the last TB size signalled for this TB, the UE behavior is left up to UE implementation.

Editor’s note: FFS how to handle HARQ feedback for the serving cell when TAT(s) expire(s) in case of two TAGs.

<<<<<<<<<<<<<<<<<<<< Change ends >>>>>>>>>>>>>>>>>>>>

<<<<<<<<<<<<<<<<<<<< Next change begins >>>>>>>>>>>>>>>>>>>>

5.22.1.3.2 PSFCH reception

The MAC entity shall for each PSSCH transmission:

1> if an acknowledgement corresponding to the PSSCH transmission in clause 5.22.1.3.1a is obtained from the physical layer:

2> deliver the acknowledgement to the corresponding Sidelink HARQ entity for the Sidelink process;

1> else:

2> deliver a negative acknowledgement to the corresponding Sidelink HARQ entity for the Sidelink process;

1> if the PSSCH transmission occurs for a pair of Source Layer-2 ID and Destination Layer-2 ID corresponding to a PC5-RRC connection which has been established by upper layers:

2> perform the HARQ-Based Sidelink RLF Detection procedure as specified in clause 5.22.1.3.3.

If *sl-PUCCH-Config* is configured by RRC, the MAC entity shall for a PUCCH transmission occasion:

1> if the *timeAlignmentTimer*, associated with the TAG containing the Serving Cell on which the HARQ feedback is to be transmitted, is stopped or expired:

2> not instruct the physical layer to generate acknowledgement(s) of the data in this TB.

1> else if a MAC PDU has been obtained for a sidelink grant associated to the PUCCH transmission occasion in clause 5.22.1.3.1, the MAC entity shall:

2> if the most recent transmission of the MAC PDU was not prioritized as specified in clause 5.22.1.3.1a:

3> instruct the physical layer to signal a negative acknowledgement on the PUCCH according to clause 16.5 of TS 38.213 [6].

2> else if HARQ feedback has been disabled for the MAC PDU and next retransmission(s) of the MAC PDU is not required; or

2> else if all PSCCH duration(s) and PSSCH duration(s) for initial transmission of a MAC PDU of the dynamic sidelink grant or the configured sidelink grant is not in SL DRX Active time as specified in clause 5.28.3 of any destination that has data to be sent:

3> instruct the physical layer to signal a positive acknowledgement corresponding to the transmission on the PUCCH according to clause 16.5 of TS 38.213 [6].

2> else if HARQ feedback has been disabled for the MAC PDU, and no sidelink grant is available for next retransmission(s) of the MAC PDU (including immediately after all PSSCH duration(s) in an *sl-PeriodCG* for the sidelink grant, the number of transmissions of the MAC PDU has not reached *sl-MaxTransNum* corresponding to the highest priority of the logical channel(s) in the MAC PDU, if configured in *sl-CG-MaxTransNumList* for the sidelink grant by RRC), if any; or

2> else if PSCCH duration(s) and PSSCH duration(s) for one or more retransmissions of a MAC PDU of the dynamic sidelink grant or the configured sidelink grant is not in SL DRX Active time as specified in clause 5.28.3 of the destination that has data to be sent:

3> instruct the physical layer to signal a negative acknowledgement corresponding to the transmission on the PUCCH according to clause 16.5 of TS 38.213 [6].

2> else:

3> instruct the physical layer to signal an acknowledgement corresponding to the transmission on the PUCCH according to clause 16.5 of TS 38.213 [6]

1> else:

2> instruct the physical layer to signal a positive acknowledgement on the PUCCH according to clause 16.5 of TS 38.213 [6].

Editor’s note: FFS how to handle HARQ feedback for the serving cell when TAT(s) expire(s) in case of two TAGs.

<<<<<<<<<<<<<<<<<<<< Change ends >>>>>>>>>>>>>>>>>>>>

<<<<<<<<<<<<<<<<<<<< Next change begins >>>>>>>>>>>>>>>>>>>>

## 5.18 Handling of MAC CEs

### 5.18.23 Unified TCI States Activation/Deactivation MAC CE

The network may activate and deactivate the configured unified TCI states of a Serving Cell or a set of Serving Cells configured in *simultaneousU-TCI-UpdateList1*, *simultaneousU-TCI-UpdateList2*, *simultaneousU-TCI-UpdateList3* or *simultaneousU-TCI-UpdateList4* by sending the Unified TCI States Activation/Deactivation MAC CE described in clause 6.1.3.47. The configured unified TCI states are initially deactivated upon (re-)configuration by upper layers and after reconfiguration with sync.

The MAC entity shall:

1> if the MAC entity receives a Unified TCI States Activation/Deactivation MAC CE on a Serving Cell:

2> indicate to lower layers the information regarding the Unified TCI States Activation/Deactivation MAC CE.

### 5.18.ZZ Enhanced Unified TCI States Activation/Deactivation MAC CE

The network may activate and deactivate the configured unified TCI states of a Serving Cell or a set of Serving Cells configured in *simultaneousU-TCI-UpdateList1*, *simultaneousU-TCI-UpdateList2*, *simultaneousU-TCI-UpdateList3* or *simultaneousU-TCI-UpdateList4* by sending the Enhanced Unified TCI States Activation/Deactivation MAC CE described in clause 6.1.3.XX and 6.1.3.YY. The configured unified TCI states are initially deactivated upon (re-)configuration by upper layers and after reconfiguration with sync.

The MAC entity shall:

1> if the MAC entity receives a Enhanced Unified TCI States Activation/Deactivation MAC CE on a Serving Cell:

2> indicate to lower layers the information regarding the Enhanced Unified TCI States Activation/Deactivation MAC CE.

Editor's note: *simultaneousU-TCI-UpdateList1*, *simultaneousU-TCI-UpdateList2*, *simultaneousU-TCI-UpdateList3* or *simultaneousU-TCI-UpdateList4* can be updated if RAN1 decides to use different parameters.

<<<<<<<<<<<<<<<<<<<< Change ends >>>>>>>>>>>>>>>>>>>>

<<<<<<<<<<<<<<<<<<<< Next change begins >>>>>>>>>>>>>>>>>>>>

5.29 Activation/Deactivation of SCG

The network may activate and deactivate the configured SCG.

The MAC entity shall for the configured SCG:

1> if upper layers indicate that SCG is activated:

2> if *BFI\_COUNTER* >= *beamFailureInstanceMaxCount* for the PSCell or the *timeAlignmentTimer* associated with PTAG is not running:

3> indicate to upper layers that a Random Access Procedure (as specified in clause 5.1.1) is needed for SCG activation.

2> activate the SCG according to the timing defined in TS 38.133 [11].

2> (re-)initialize any suspended configured uplink grants of configured grant Type 1 associated with this PSCell according to the stored configuration, if any, and to start in the symbol according to rules in clause 5.8.2.2;

2> apply normal SCG operation including:

3> SRS transmissions on the PSCell;

3> CSI reporting for the PSCell;

3> PDCCH monitoring on the PSCell;

3> PUCCH transmissions on the PSCell;

3> transmit on RACH on the PSCell;

3> initialize *Bj* for each logical channel to zero.

1> else if upper layers indicate that the SCG is deactivated:

2> deactivate all the SCells of the SCG according to clause 5.9;

2> deactivate SCG according to the timing defined in TS 38.133 [11];

2> clear any configured downlink assignment and any configured uplink grant Type 2 associated with the PSCell respectively;

2> suspend any configured uplink grant Type 1 associated with the PSCell;

2> reset MAC according to clause 5.12.

1> if the SCG is deactivated:

2> not transmit SRS on the PSCell;

2> not report CSI for the PSCell;

2> not transmit on UL-SCH on the PSCell;

2> not transmit PUCCH on the PSCell;

2> not transmit on RACH on the PSCell;

2> not monitor the PDCCH on the PSCell.

Editor’s note: FFS for SCG activation, if two PTAGs are configured, when is RA needed (e.g., both PTAG TATs are not running)?

<<<<<<<<<<<<<<<<<<<< Change ends >>>>>>>>>>>>>>>>>>>>

<<<<<<<<<<<<<<<<<<<< Next change begins >>>>>>>>>>>>>>>>>>>>

# 6 Protocol Data Units, formats and parameters

## 6.1 Protocol Data Units

### 6.1.3 MAC Control Elements (CEs)

#### 6.1.3.4 Timing Advance Command MAC CE

The Timing Advance Command MAC CE is identified by MAC subheader with LCID as specified in Table 6.2.1-1.

It has a fixed size and consists of a single octet defined as follows (Figure 6.1.3.4-1):

- TAG Identity (TAG ID): This field indicates the TAG Identity of the addressed TAG. The TAG with the Identity 0 contains the SpCell. The length of the field is 2 bits;

- Timing Advance Command: This field indicates the index value *TA* (0, 1, 2… 63) used to control the amount of timing adjustment that MAC entity has to apply (as specified in TS 38.213 [6]). The length of the field is 6 bits.



Figure 6.1.3.4-1: Timing Advance Command MAC CE

#### 6.1.3.4a Absolute Timing Advance Command MAC CE

The Absolute 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 6.1.3.4a-1):

- Timing Advance Command: 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]. The size of the field is 12 bits;

- R: Reserved bit, set to 0.

- T: If two TAGs are configured, this field indicates one of the two TAGs to which the Timing Advance Command is applied. The field set to 0 indicates the first TAG ID and the field set to 1 indicates the second TAG ID. If only one TAG is configured, the R bit is present instead;



Figure 6.1.3.4a-1: Absolute Timing Advance Command MAC CE

#### 6.1.3.47 Unified TCI States Activation/Deactivation MAC CE

The Unified TCI States Activation/Deactivation MAC CE is identified by a MAC subheader with eLCID as specified in Table 6.2.1-1b. It has a variable size consisting of following fields:

- CORESET Pool ID: This field indicates that mapping between the activated TCI states and the codepoint of the DCI *Transmission Configuration Indication* set by field *TCI-StateId* is specific to the *ControlResourceSetId* configured with CORESET Pool ID as specified in TS 38.331 [5]. This field set to 1 indicates that this MAC CE shall be applied for the DL or UL transmission scheduled by CORESET with the CORESET pool ID equal to 1, otherwise, this MAC CE shall be applied for the DL or UL transmission scheduled by CORESET pool ID equal to 0. If the *coresetPoolIndex* is not configured for any CORESET or only one *coresetPoolIndex* is configured for any CORESET, the R bit is present instead.

- Serving Cell ID: This field indicates the identity of the Serving Cell for which the MAC CE applies. The length of the field is 5 bits. If the indicated Serving Cell is configured as part of a *simultaneousU-TCI-UpdateList1*, *simultaneousU-TCI-UpdateList2*, *simultaneousU-TCI-UpdateList3* or *simultaneousU-TCI-UpdateList4* as specified in TS 38.331 [5], this MAC CE applies to all theServing Cells in the set *simultaneousU-TCI-UpdateList1*, *simultaneousU-TCI-UpdateList2*, *simultaneousU-TCI-UpdateList3* or *simultaneousU-TCI-UpdateList4*, respectively;

Editor's note: *simultaneousU-TCI-UpdateList1*, *simultaneousU-TCI-UpdateList2*, *simultaneousU-TCI-UpdateList3* or *simultaneousU-TCI-UpdateList4* can be updated if RAN1 decides to use different parameters.

- DL BWP ID: This field indicates a DL BWP for which the MAC CE applies as the codepoint of the DCI *bandwidth part indicator* field as specified in TS 38.212 [9]. The length of the BWP ID field is 2 bits;

- UL BWP ID: This field indicates a UL BWP for which the MAC CE applies as the codepoint of the DCI *bandwidth part indicator* field as specified in TS 38.212 [9]. If value of *unifiedTCI-StateType* in the Serving Cell indicated by Serving Cell IDis *joint*, this field is considered as the reserved bits. The length of the BWP ID field is 2 bits;

- Pi: This field indicates whether each TCI codepoint has multiple TCI states or single TCI state. If Pi field is set to 1, it indicates that ith TCI codepoint includes the DL TCI state and the UL TCI state. If Pi field is set to 0, it indicates that ith TCI codepoint includes only the DL/joint TCI state or the UL TCI state. The codepoint to which a TCI state is mapped is determined by its ordinal position among all the TCI state ID fields;

- D/U: This field indicate whether the TCI state ID in the same octet is for joint/downlink or uplink TCI state. If this field is set to 1, the TCI state ID in the same octet is for joint/downlink. If this field is set to 0, the TCI state ID in the same octet is for uplink;

- TCI state ID: This field indicates the TCI state identified by *TCI-StateId* as specified in TS 38.331 [5]. If D/U is set to 1, 7-bits length TCI state ID i.e. *TCI-StateId* as specified in TS 38.331 [5] is used. If D/U is set to 0, the most significant bit of TCI state ID is considered as the reserved bit and remainder 6 bits indicate the *TCI-UL-State-Id* as specified in TS 38.331 [5]. The maximum number of activated TCI states is 16;

- R: Reserved bit, set to 0.



Figure 6.1.3.47-1: Unified TCI state activation/deactivation MAC CE

<<<<<<<<<<<<<<<<<<<< Change ends >>>>>>>>>>>>>>>>>>>>

<<<<<<<<<<<<<<<<<<<< Next change begins >>>>>>>>>>>>>>>>>>>>

#### 6.1.3.XX Enhanced Unified TCI States Activation/Deactivation MAC CE for Joint TCI States

The Enhanced Unified TCI States Activation/Deactivation MAC CE CE for Joint TCI States is identified by a MAC subheader with eLCID as specified in Table 6.2.1-1b. It has a variable size consisting of following fields:

- Serving Cell ID: This field indicates the identity of the Serving Cell for which the MAC CE applies. The length of the field is 5 bits. If the indicated Serving Cell is configured as part of a *simultaneousU-TCI-UpdateList1*, *simultaneousU-TCI-UpdateList2*, *simultaneousU-TCI-UpdateList3* or *simultaneousU-TCI-UpdateList4* as specified in TS 38.331 [5], this MAC CE applies to all theServing Cells in the set *simultaneousU-TCI-UpdateList1*, *simultaneousU-TCI-UpdateList2*, *simultaneousU-TCI-UpdateList3* or *simultaneousU-TCI-UpdateList4*, respectively;

Editor’s note: FFS if the simultaneous applies the activated/deactivated TCI states for the serving cell list is valid in this case. If not the above text to support simultaneous update for the serving cell list could be removed.

Editor's note: *simultaneousU-TCI-UpdateList1*, *simultaneousU-TCI-UpdateList2*, *simultaneousU-TCI-UpdateList3* or *simultaneousU-TCI-UpdateList4* can be updated if RAN1 decides to use different parameters.

- DL BWP ID: This field indicates a DL BWP for which the MAC CE applies as the codepoint of the DCI *bandwidth part indicator* field as specified in TS 38.212 [9]. The length of the BWP ID field is 2 bits;

- Fi,j: This field indicates whether the joint TCI state indicated by TCI state ID field for codepoint i applies for the first TRP and/or the second TRP. If Fi,j field is set to 1, it indicates that the indicated TCI state ID for codepoint i applies for the jth TRP. If Fi,j field is set to 0, it indicates that the there is no TCI state ID being applied for codepoint i for the jth TRP. The codepoint to which a TCI state is mapped is determined by its ordinal position among all the TCI state ID fields;

- TCI state ID: This field indicates the 7-bits length TCI state ID identified by *TCI-StateId* as specified in TS 38.331 [5]. The maximum number of activated TCI states is 16;

- R: Reserved bit, set to 0.



Figure 6.1.3.XX-1: Enhanced TCI state activation/deactivation MAC CE for Joint TCI State Mode

<<<<<<<<<<<<<<<<<<<< Change ends >>>>>>>>>>>>>>>>>>>>

<<<<<<<<<<<<<<<<<<<< Next change begins >>>>>>>>>>>>>>>>>>>>

#### 6.1.3.YY Enhanced Unified TCI States Activation/Deactivation MAC CE for Separate TCI States

The Enhanced Unified TCI States Activation/Deactivation MAC CE CE for Separate TCI States is identified by a MAC subheader with eLCID as specified in Table 6.2.1-1b. It has a variable size consisting of following fields:

- Serving Cell ID: This field indicates the identity of the Serving Cell for which the MAC CE applies. The length of the field is 5 bits. If the indicated Serving Cell is configured as part of a *simultaneousU-TCI-UpdateList1*, *simultaneousU-TCI-UpdateList2*, *simultaneousU-TCI-UpdateList3* or *simultaneousU-TCI-UpdateList4* as specified in TS 38.331 [5], this MAC CE applies to all theServing Cells in the set *simultaneousU-TCI-UpdateList1*, *simultaneousU-TCI-UpdateList2*, *simultaneousU-TCI-UpdateList3* or *simultaneousU-TCI-UpdateList4*, respectively;

Editor’s note: FFS if the simultaneous applies the activated/deactivated TCI states for the serving cell list is valid in this case. If not the above text to support simultaneous update for the serving cell list could be removed.

Editor's note: *simultaneousU-TCI-UpdateList1*, *simultaneousU-TCI-UpdateList2*, *simultaneousU-TCI-UpdateList3* or *simultaneousU-TCI-UpdateList4* can be updated if RAN1 decides to use different parameters.

- DL BWP ID: This field indicates a DL BWP for which the MAC CE applies as the codepoint of the DCI *bandwidth part indicator* field as specified in TS 38.212 [9]. The length of the BWP ID field is 2 bits;

- UL BWP ID: This field indicates a UL BWP for which the MAC CE applies as the codepoint of the DCI *bandwidth part indicator* field as specified in TS 38.212 [9]. The length of the BWP ID field is 2 bits;

- Fi,j: This field indicates whether the codepoint i includes the DL and/or UL TCI state for the first TRP. If Fi,1 field is set to 1, it indicates that ith TCI codepoint includes the DL TCI state for the first TRP. If Fi,1 field is set to 0, it indicates that ith TCI codepoint doesn’t include the DL TCI state for the first TRP. If Fi,2 field is set to 1, it indicates that ith TCI codepoint includes the UL TCI state for the first TRP. If Fi,2 field is set to 0, it indicates that ith TCI codepoint doesn’t include the UL TCI state for the first TRP;

- Si,j: This field indicates whether the codepoint i includes the DL and/or UL TCI state for the second TRP. If Si,1 field is set to 1, it indicates that ith TCI codepoint includes the DL TCI state for the second TRP. If Si,1 field is set to 0, it indicates that ith TCI codepoint doesn’t include the DL TCI state for the second TRP. If Si,2 field is set to 1, it indicates that ith TCI codepoint includes the UL TCI state for the second TRP. If Si,2 field is set to 0, it indicates that ith TCI codepoint doesn’t include the UL TCI state for the second TRP;

- TCI state ID: This field indicates the TCI state identified by *TCI-StateId* as specified in TS 38.331 [5]. If the indicated TCI state ID is DL TCI state, 7-bits length TCI state ID i.e. *TCI-StateId* as specified in TS 38.331 [5] is used. If the indicated TCI state ID is UL TCI state, the most significant bit of TCI state ID is considered as the reserved bit and remainder 6 bits indicate the *TCI-UL-State-Id* as specified in TS 38.331 [5]. TCI state IDs are in the order of indication of Fi,j and Si,j fields. The maximum number of activated TCI states is 32;

- R: Reserved bit, set to 0.



Figure 6.1.3.YY-1: Enhanced TCI state activation/deactivation MAC CE for Separate TCI State Mode

<<<<<<<<<<<<<<<<<<<< Change ends >>>>>>>>>>>>>>>>>>>>

<<<<<<<<<<<<<<<<<<<< Next change begins >>>>>>>>>>>>>>>>>>>>

## 6.2 Formats and parameters

### 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, 6.2.1-1c and 6.2.1-2 for the DL-SCH and UL-SCH respectively. 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, 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, 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;

- 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 224 | 64 to 288 | Reserved |
| 225 | 289 | Enhanced Unified TCI state Activation/Deactivation MAC CE for Joint TCI State Mode |
| 226 | 290 | Enhanced Unified TCI state Activation/Deactivation MAC CE for Separate TCI State Mode |
| 227 | 291 | Serving Cell Set based SRS TCI State Indication MAC CE |
| 228 | 292 | SP/AP SRS TCI State Indication MAC CE |
| 229 | 293 | BFD-RS Indication MAC CE |
| 230 | 294 | Differential Koffset |
| 231 | 295 | Enhanced SCell Activation/Deactivation MAC CE with one octet Ci field |
| 232 | 296 | Enhanced SCell Activation/Deactivation MAC CE with four octet Ci field  |
| 233 | 297 | Unified TCI States Activation/Deactivation MAC CE |
| 234 | 298 | PUCCH Power Control Set Update for multiple TRP PUCCH repetition MAC CE |
| 235 | 299 | PUCCH spatial relation Activation/Deactivation for multiple TRP PUCCH repetition MAC CE |
| 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 broadcast on DL-SCH

|  |  |
| --- | --- |
| Codepoint/Index | LCID values |
| 0 | 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

|  |  |
| --- | --- |
| Codepoint/Index | LCID values |
| 0 | CCCH of size 64 bits (referred to as "CCCH1" in TS 38.331 [5]), except for a 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 (referred to as "CCCH" in TS 38.331 [5]) for a RedCap UE  |
| 36 | CCCH of size 64 bits (referred to as "CCCH1" in TS 38.331 [5]) 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 (referred to as "CCCH" in TS 38.331 [5]), except for a 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 |

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 228 | 64 to 292 | Reserved |
| 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 |

<<<<<<<<<<<<<<<<<<<< Change ends >>>>>>>>>>>>>>>>>>>>

<<<<<<<<<<<<<<<<<<<< Next change begins >>>>>>>>>>>>>>>>>>>>

6.2.3 MAC payload for Random Access Response

The MAC RAR is of fixed size as depicted in Figure 6.2.3-1, and consists of the following fields:

- R: Reserved bit, set to 0;

- T: If two TAGs are configured, this field indicates one of the two TAGs to which the Timing Advance Command is applied. The field set to 0 indicates the first TAG ID and the field set to 1 indicates the second TAG ID. If only one TAG is configured, the R bit is present instead;

- Timing Advance Command: The Timing Advance Command 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]. The size of the Timing Advance Command field is 12 bits;

- UL Grant: The Uplink Grant field indicates the resources to be used on the uplink in TS 38.213 [6]. The size of the UL Grant field is 27 bits;

- Temporary C-RNTI: The Temporary C-RNTI field indicates the temporary identity that is used by the MAC entity during Random Access. The size of the Temporary C-RNTI field is 16 bits.

The MAC RAR is octet aligned.

****

**Figure 6.2.3-1: MAC RAR**

6.2.3a MAC payload for MSGB

The fallbackRAR is of fixed size as depicted in Figure 6.2.3a-1, and consists of the following fields:

- R: Reserved bit, set to 0;

- T: If two TAGs are configured, this field indicates one of the two TAGs to which the Timing Advance Command is applied. The field set to 0 indicates the first TAG ID and the field set to 1 indicates the second TAG ID. If only one TAG is configured, the R bit is present instead;

- Timing Advance Command: The Timing Advance Command 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]. The size of the Timing Advance Command field is 12 bits;

- UL Grant: The Uplink Grant field indicates the resources to be used on the uplink in TS 38.213 [6]. The size of the UL Grant field is 27 bits;

- Temporary C-RNTI: The Temporary C-RNTI field indicates the temporary identity that is used by the MAC entity during Random Access. The size of the Temporary C-RNTI field is 16 bits.

The fallbackRAR is octet aligned.

****

**Figure 6.2.3a-1: fallbackRAR**

The successRAR is of fixed size as depicted in Figure 6.2.3a-2, and consists of the following fields:

- UE Contention Resolution Identity: This field contains the UL CCCH SDU. If the UL CCCH SDU is longer than 48 bits, this field contains the first 48 bits of the UL CCCH SDU.

- R: Reserved bit, set to 0;

- ChannelAccess-CPext: The channel access type and CP extension for the PUCCH resource containing the HARQ feedback for MSGB in shared spectrum channel access as specified in TS 38.213 [6]. The field is only present when the MSGB HARQ feedback is to be transmitted with shared spectrum channel access as specified in TS 37.213 [18]. Otherwise, the field is not present and R bits are present instead. The size of the ChannelAccess-CPext field is 2 bits;

- TPC: The TPC command for the PUCCH resource containing HARQ feedback for MSGB, as specified in TS 38.213 [6]. The size of the TPC field is 2 bits;

- HARQ Feedback Timing Indicator: The PDSCH-to-HARQ feedback timing indicator field for MSGB HARQ feedback as specified in TS 38.213 [6]. The size of the HARQ Feedback Timing Indicator field is 3 bits;

- PUCCH Resource Indicator: The PUCCH resource indicator for HARQ feedback for MSGB, as specified in TS 38.213[6]. The size of the PUCCH resource Indicator field is 4 bits;

- Timing Advance Command: The Timing Advance Command 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]. The size of the Timing Advance Command field is 12 bits;

- C-RNTI: The C-RNTI field indicates the identity that is used by the MAC entity upon completion of Random Access. The size of the C-RNTI field is 16 bits.

The successRAR is octet aligned.

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**Figure 6.2.3a-2: successRAR**

Editor’s note: FFS whether TAG indication is needed in successRAR in initial access.

<<<<<<<<<<<<<<<<<<<< End of Changes >>>>>>>>>>>>>>>>>>>>