**3GPP TSG- Meeting #**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
|  | | | | | | | | |
| *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:*** |  | | | | | | | | | |
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| ***Source to WG:*** |  | | | | | | | | | |
| ***Source to TSG:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_newRAT-Core, NR\_redcap\_enh-Core, NR\_NTN\_enh-Core | | | | |  | ***Date:*** | | |  |
|  |  | | | |  | |  | | |  |
| ***Category:*** |  |  | | | | | ***Release:*** | | |  |
|  | *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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | As NR has enhanced over several releases, LCID spaces have been depleted rapidly. Even though RAN2 introduced eLCID from Rel-16, it requires one or two additional bytes, and still the legacy LCID spaces which does not increase the msg3 size had to be used for e.g., some MAC CEs and CCCH/CCCH1. As a result, only seven values from the legacy LCID spaces remain for UL-SCH as of Rel-17.  From the Rel-18 discussion, it was concluded that several WIs require to use the legacy LCID space. Considering the remaining LCID spaces, RAN2 made the following agreements in RAN2#123bis and RAN2#124:  **Agreements in RAN2#123bis:**  - Solutions that increase the msg3 size are excluded (e.g. eLCID cannot be used as a solution for this purpose)  - RAN2 will discuss and find a solution in Rel-18  - Use first R bit for LCID extension. It is only applied to UL, and for now only CCCH/CCCH1 and enabled by network. FFS on details  - An explicit indication from network will be added to enable this feature. FFS on the details of signaling.  - A single CR will capture the extension and LCID value to be used. Only the need for LCID value usage will be agreed by each individual session. Combinations can be discussed in individual session and can be brought up to common session for discussion only if need. MAC rapporteur will provide the CRs.  **Agreements in RAN2#124:**  1. The support of CCCH/CCCH1 LCID extension is indicated implicitly by the indication(s) on the support of the specific features that need such CCCH/CCCH1 LCID extension in the system information  2. Adopt the MAC subheader format Ext/R/LCID for CCCH/CCCH1 LCID extension with LCID field kept as 6 bits, as captured in endorsed CR.  3. The UL CCCH/CCCH1 indications introduced in Rel18 by default use the LCID extension codepoints (not the legacy reserved codepoints).  4. Create a new table 6.2.1-2c with new LCID codepoint 0-63 (to be used when LX = 1).  Regarding which WI requires the LCID space, RAN2 concluded that two Rel-18 WIs i.e., eRedCap and NR-NTN require the LCID space for CCCH/CCCH1 that does not increase the msg3 size and they have to be captured from Rel-18 specifications:  - For eRedCap in RAN2#122 meeting:  => All R18 eRedCap UEs uses the two new LCIDs for Msg3/MsgA PUSCH for CCCH/CCCH1 during Random Access, i.e., both those with peak rate reduction + BB BW reduction, and those with only peak rate reduction.  - For NR-NTN in RAN2#123bis meeting:  => Updated agreement after CB session: RAN2 continues to focus on a solution to address PUCCH repetition for Msg4 HARQ-ACK in Msg3 only for random access procedure triggered by RRC connection establishment, RRC connection re-establishment or RRC connection resume, i.e. to CCCH/CCCH1 (in the future we can consider random access during RRC connected, depending on RAN1)  - For NR-NTN in RAN2#124 meeting:  Agreements:  1. Use the LCID codepoint within the Rel-18 extension space to indicate the request/capability of PUCCH repetition for Msg4 HARQ-ACK.  2. Feature combination of NTN, RedCap and eRedCap should be supported for Msg3-based early indication via LCID: 6 LCID codepoints will be specified for this in Rel-18 | | | | | | | | |
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| ***Summary of change:*** | | In clause 6.1.2, the first R bit is changed to the LX or R field in Figure 6.1.2-3 (i.e., when no L field and eLCID are present).  In clause 6.2.1, a new table for Values of LCID for UL-SCH when the LX field is set to 1 is added, and 8 values for CCCH/CCCH1 are added to the new table. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Once the remaining legacy LCID spaces are exhausted, additional MAC CE or CCCH/CCCH1 that does not increase the msg3 size cannot be introduced further. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.1.2 and 6.2.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | - | | |
| ***affected:*** | |  | **X** | Test specifications | | | | - | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | - | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

# 6 Protocol Data Units, formats and parameters

## 6.1 Protocol Data Units

### 6.1.2 MAC PDU (DL-SCH and UL-SCH except transparent MAC and Random Access Response)

A MAC PDU consists of one or more MAC subPDUs. Each MAC subPDU consists of one of the following:

- A MAC subheader only (including padding);

- A MAC subheader and a MAC SDU;

- A MAC subheader and a MAC CE;

- A MAC subheader and padding.

The MAC SDUs are of variable sizes.

Each MAC subheader corresponds to either a MAC SDU, a MAC CE, or padding.

A MAC subheader except for fixed sized MAC CE, padding, and a MAC SDU containing UL CCCH consists of the header fields R/F/LCID/(eLCID)/L. A MAC subheader for fixed sized MAC CE and padding consists of the header fields R/LCID/(eLCID). A MAC subheader for a MAC SDU containing UL CCCH consists of the header fields (LX)/R/LCID.







Figure 6.1.2-1: R/F/LCID/(eLCID)/L MAC subheader with 8-bit L field







Figure 6.1.2-2: R/F/LCID/(eLCID)/L MAC subheader with 16-bit L field





Figure 6.1.2-3: (LX)/R/LCID/(eLCID) MAC subheader

MAC CEs are placed together. DL MAC subPDU(s) with MAC CE(s) is placed before any MAC subPDU with MAC SDU and MAC subPDU with padding as depicted in Figure 6.1.2-4. UL MAC subPDU(s) with MAC CE(s) is placed after all the MAC subPDU(s) with MAC SDU and before the MAC subPDU with padding in the MAC PDU as depicted in Figure 6.1.2-5. The size of padding can be zero.



Figure 6.1.2-4: Example of a DL MAC PDU



Figure 6.1.2-5: Example of a UL MAC PDU

A maximum of one MAC PDU can be transmitted per TB per MAC entity.

Next changes

### 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;

- LX: The LCID extension field indicates whether to use extended LCID space. The value 0 indicates the use of Table 6.2.1-2. The value 1 indicates the use of Table 6.2.1-2c. There is one LX field per MAC subheader for MAC SDUs containing UL CCCH. The size of the LX field is 1 bit. If the use of the LX field is not configured by upper layers, R bit is present instead;

- 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 226 | 64 to 290 | Reserved |
| 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 when the LX field is not present or set to 0

|  |  |
| --- | --- |
| 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 |

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 (referred to as "CCCH" in TS 38.331 [5]) for an eRedCap UE |
| 1 | (216 + 321) | CCCH of size 64 bits (referred to as "CCCH1" in TS 38.331 [5]) for an eRedCap UE |
| 2 | (216 + 322) | CCCH of size 48 bits (referred to as "CCCH" in TS 38.331 [5]) for PUCCH repetition of Msg4 HARQ-ACK |
| 3 | (216 + 323) | CCCH of size 64 bits (referred to as "CCCH1" in TS 38.331 [5]) for PUCCH repetition of Msg4 HARQ-ACK |
| 4 | (216 + 324) | CCCH of size 48 bits (referred to as "CCCH" in TS 38.331 [5]) for PUCCH repetition of Msg4 HARQ-ACK of a RedCap UE |
| 5 | (216 + 325) | CCCH of size 64 bits (referred to as "CCCH1" in TS 38.331 [5]) for PUCCH repetition of Msg4 HARQ-ACK of a RedCap UE |
| 6 | (216 + 326) | CCCH of size 48 bits (referred to as "CCCH" in TS 38.331 [5]) for PUCCH repetition of Msg4 HARQ-ACK of an eRedCap UE |
| 7 | (216 + 327) | CCCH of size 64 bits (referred to as "CCCH1" in TS 38.331 [5]) for PUCCH repetition of Msg4 HARQ-ACK of an eRedCap UE |
| 8 to 63 | (216 + 328) to (216 + 383) | Reserved |

End of changes