**3GPP TSG-RAN WG2 Meeting #110-e *draftR2-2005826***

**Electronic meeting, 1st – 12th June 2020**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **36.321** | **CR** | **1473** | **rev** | **2** | **Current version:** | **16.0.0** |  |
|  | | | | | | | | |
| *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 |  |
|  | | | | | | | | | | | | | | | | | |
| ***Title:*** | Corrections to MAC for Rel-16 eMTC | | | | | | | | | | | | | | | | |
|  |  | | | | | | | | | | | | | | | | |
| ***Source to WG:*** | Ericsson | | | | | | | | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | | | | | | | | |
|  |  | | | | | | | | | | | | | | | | |
| ***Work item code:*** | LTE\_eMTC5-Core, NB\_IOTenh3-Core | | | | | | | | |  | ***Date:*** | | | 2020-06-12 | | | |
|  |  | | | | |  | | | | |  | | |  | | | |
| ***Category:*** | F |  | | | | | | | | | ***Release:*** | | | Rel-16 | | | |
|  | *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-12 (Release 12) Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | | | | |
|  |  | | | | | | | | | | | | | | | | |
| ***Reason for change:*** | | Capturing agreements and clarifications in MAC to finalize Rel-16 features for eMTC. | | | | | | | | | | | | | | | |
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| ***Summary of change:*** | | The following changes have been captured:  - For non-EDT support 2-bit CQI using R and F2 bits only in a MAC header with uplink LCID equal to any CCCH.  - The text proposal in R2-2003183 is used as a baseline for the eMTC MAC CR. The intention is not to introduce a new MAC CE.  - For non-EDT/non-PUR cases, when Rel-16 AS RAI triggered by upper layers is not included in order to avoid data segmentation, Rel-16 AS RAI is allowed not to be cancelled.  - It is up to the UE to use Rel-16 or Rel-14 AS RAI if Rel-14 is configured for the UE connected to 5GC.  - It is up to the UE to use Rel-16 or Rel-14 AS RAI if both Rel-14 and Rel-16 AS RAI are configured for the UE connected to EPC. | | | | | | | | | | | | | | | |
|  | |  | | | | | | | | | | | | | | | |
| ***Consequences if not approved:*** | | Rel-16 corrections and functionality for eMTC and NB-IoT Rel-16 will be missing from MAC. | | | | | | | | | | | | | | | |
|  | |  | | | | | | | | | | | | | | | |
| ***Clauses affected:*** | | 5.4.8, 5.25, 6.1.3.18, 6.1.3.19, 6.2.1 | | | | | | | | | | | | | | | |
|  | |  | | | | | | | | | | | | | | | |
|  | | **Y** | | **N** |  | | | | | | |  | | | | | |
| ***Other specs*** | | **X** | |  | Other core specifications | | | | | | | TS 36.300 CR 1281  TS 36.306 CR 1752  TS 36.331 CR 4239 | | | | | |
| ***affected:*** | |  | | **X** | Test specifications | | | | | | |  | | | | | |
| ***(show related CRs)*** | |  | | **X** | O&M Specifications | | | | | | |  | | | | | |
|  | |  | | | | | | | | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | | | | | | | | |
|  | |  | | | | | | | | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | | | | | | | | |

First Change

### 5.4.8 Access Stratum Release Assistance Indication

Access Stratum Release Assistance Indication is used to provide the serving eNB with information whether subsequent DL or UL transmission is expected. AS RAI uses the DCQR and AS RAI MAC Control Element. Upper layers trigger AS RAI.

For EDT and transmission using PUR, if AS RAI is triggered by upper layers but is not included in the resulting MAC PDU with the MAC SDU as a result of logical channel prioritization, AS RAI is cancelled, for other transmissions if AS RAI is not included in the resulting MAC PDU as a result of logical channel prioritization, AS RAI may be cancelled.

If *rai-Activation* is configured and a buffer size of zero bytes has been triggered for the BSR and no subsequent DL and UL data transmission is expected, and if *rai-ActivationEnh* is enabled and applicable as specified in TS 36.331 [8], it is up to UE to send BSR MAC control element or DCQR and AS RAI MAC control element.

Next Change

## 5.25 Transmission of Downlink Channel Quality Report

The MAC entity of a BL UE or UE in enhanced coverage may be configured by upper layers to report DL channel quality in Msg3. DL channel quality in Msg3 in RRC\_CONNECTED is not reported.

If the UE is a BL UE or UE in enhanced coverage or an NB-IoT UE, a Downlink Channel Quality Report (DCQR) shall be triggered if any of the following events occur:

- DCQR Command MAC control element is received, in which case the DCQR is referred below to as "Regular DCQR";

- for BL UE or UE in enhanced coverage, transmission of DCQR in Msg3 is configured by upper layers in *mpdcch-CQI-Reporting*, in which case DCQR is referred below to as "Msg3 DCQR".

If any type of DCQR has been triggered:

- start performing DL channel quality measurements according to TS 36.133 [9].

If "Regular DCQR" has been triggered:

- if an uplink grant has been received on the PDCCH for MAC entity's C-RNTI:

- instruct the Multiplexing and Assembly procedure to generate a DCQR and AS RAI MAC control element as defined in clause 6.1.3.19;

- cancel the triggered "Regular DCQR".

If "Msg3 DCQR" has been triggered:

- if an uplink grant has been received on the PDCCH for MAC entity's RA-RNTI:

- if the allocated resources can accommodate a DCQR and AS RAI MAC control element plus its subheader as a result of logical channel prioritization:

- instruct the Multiplexing and Assembly procedure to generate a DCQR and AS RAI MAC control element as defined in clause 6.1.3.19;

- else if the uplink grant is not for EDT:

- if configured by upper layers in *mpdcch-CQI-Reporting*, use R and F2 fields in the MAC PDU subheader, to transmit the measurement outcome, as defined in clause 6.2.1;

- cancel the triggered "Msg3 DCQR".

Next Change

#### 6.1.3.18 Downlink Channel Quality Report Command MAC Control Element

DCQR Command MAC control element is identified by a MAC PDU subheader with LCID as specified in Table 6.2.1-1.

It has a fixed size of zero bits.

#### 6.1.3.19 Downlink Channel Quality Report and AS RAI MAC Control Element

DCQR and AS RAI MAC control element is identified by a MAC PDU subheader with LCID as specified in Table 6.2.1-2. A MAC PDU shall contain at most one DCQR and AS RAI MAC control element.

It has a fixed size and consists of a single octet defined as follows (Figure 6.1.3.19-1):

- R: Reserved bit, set to "0";

- AS RAI: The field corresponds to Access Stratum Release Assistance Indication as shown in Table 6.1.3.19-1. The length of the field is 2 bits;

- Quality Report: For an NB-IoT UE, the field corresponds to CQI-NPDCCH-NB as defined in TS 36.331 [8]. For a BL UE or UE in CE, the field corresponds to DL channel quality report as defined in TS 36.133 [9]. The length of the field is 4 bits.



Figure 6.1.3.19-1: DCQR and AS RAI MAC control element

Table 6.1.3.19-1: Values for AS RAI

|  |  |
| --- | --- |
| Codepoint/Index | Value |
| 00 | No RAI information |
| 01 | No subsequent DL and UL data transmission is expected |
| 10 | A single subsequent DL transmission is expected |
| 11 | Reserved |

Next Change

## 6.2 Formats and parameters

### 6.2.1 MAC header for DL-SCH, UL-SCH and MCH

The MAC header is of variable size and 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 control element or padding as described in tables 6.2.1-1, 6.2.1-2 and 6.2.1-4 for the DL-SCH, UL-SCH and MCH respectively. There is one LCID field for each MAC SDU, MAC control element or padding included in the MAC PDU. In addition to that, one or two additional LCID fields are included in the MAC PDU, when single-byte or two-byte padding is required but cannot be achieved by padding at the end of the MAC PDU. If the LCID field is set to "10000", an additional octet is present in the MAC PDU subheader containing the eLCID field and this additional octet follows the octet containing LCID field. A UE of Category 0, as specified in TS 36.306 [12], except when in enhanced coverage, and *unicastFreqHoppingInd-r13* is indicated in the BR version of SI message carrying *SystemInformationBlockType2*, and UE supports frequency hopping for unicast, as specified in TS 36.306 [12], shall indicate CCCH using LCID "01011", a BL UE with support for frequency hopping for unicast, as specified in TS 36.306 [12], and a UE in enhanced coverage with support for frequency hopping for unicast, as specified in TS 36.306 [12], shall if *unicastFreqHoppingInd-r13* is indicated in the BR version of SI message carrying *SystemInformationBlockType2* indicate CCCH using LCID "01100", otherwise the UE shall indicate CCCH using LCID "00000". A short DCQR may be included in the MAC PDU subheader with LCID set to "00000", "01011", "01100" or "01101". The LCID field size is 5 bits;

- eLCID: The extended Logical Channel ID field identifies the logical channel instance of the corresponding MAC SDU or the type of the corresponding MAC control element as described in tables 6.2.1-1a and 6.2.1-2a for the DL-SCH and UL-SCH respectively. The size of the eLCID field is 6 bits.

- L: The Length field indicates the length of the corresponding MAC SDU or variable-sized MAC control element in bytes. There is one L field per MAC PDU subheader except for the last subheader and subheaders corresponding to fixed-sized MAC control elements. The size of the L field is indicated by the F field and F2 field;

- F: The Format field indicates the size of the Length field as indicated in table 6.2.1-3. There is one F field per MAC PDU subheader except for the last subheader and subheaders corresponding to fixed-sized MAC control elements and except for when F2 is set to 1. The size of the F field is 1 bit. If the F field is included; if the size of the MAC SDU or variable-sized MAC control element is less than 128 bytes, the value of the F field is set to 0, otherwise it is set to 1;

- F2: Except when this field is used for short DCQR, the Format2 field indicates the size of the Length field as indicated in table 6.2.1-3. For short DCQR, the mapping of F2 field to short DCQR value is described in table 6.2.1-x. There is one F2 field per MAC PDU subheader. The size of the F2 field is 1 bit. Except when this field is used for short DCQR, if the size of the MAC SDU or variable-sized MAC control element is larger than 32767 bytes, and if the corresponding subheader is not the last subheader, the value of the F2 field is set to 1, otherwise it is set to 0;

- E: The Extension field is a flag indicating if more fields are present in the MAC header or not. The E field is set to "1" to indicate another set of at least R/F2/E/LCID fields. The E field is set to "0" to indicate that either a MAC SDU, a MAC control element or padding starts at the next byte;

- R: Except when this field is used for short DCQR, reserved bit, set to "0". For short DCQR, the mapping of R field to short DCQR value is described in table 6.2.1-x.

The MAC header and subheaders are octet aligned.

Table 6.2.1-1 Values of LCID for DL-SCH

|  |  |
| --- | --- |
| Codepoint/Index | LCID values |
| 00000 | CCCH |
| 00001-01010 | Identity of the logical channel |
| 01011-01111 | Reserved |
| 10000 | Extended logical channel ID field |
| 10001 | DCQR Command |
| 10010 | Activation/Deactivation of PDCP Duplication |
| 10011 | Hibernation (1 octet) |
| 10100 | Hibernation (4 octets) |
| 10101 | Activation/Deactivation of CSI-RS |
| 10110 | Recommended bit rate |
| 10111 | SC-PTM Stop Indication |
| 11000 | Activation/Deactivation (4 octets) |
| 11001 | SC-MCCH, SC-MTCH (see note) |
| 11010 | Long DRX Command |
| 11011 | Activation/Deactivation (1 octet) |
| 11100 | UE Contention Resolution Identity |
| 11101 | Timing Advance Command |
| 11110 | DRX Command |
| 11111 | Padding |
| NOTE: Both SC-MCCH and SC-MTCH cannot be multiplexed with other logical channels in the same MAC PDU except for Padding and SC-PTM Stop Indication | |

Table 6.2.1-1a Values of eLCID for DL-SCH

|  |  |  |
| --- | --- | --- |
| Codepoint | Index | LCID values |
| 000000-000110 | 32-38 | Identity of the logical channel |
| 000111-111111 | 39-95 | Reserved |

For NB-IoT only the following LCID values for DL-SCH are applicable: CCCH, Identity of the logical channel, DCQR Command, SC-PTM Stop Indication, SC-MCCH/SC-MTCH, UE Contention Resolution Identity, Timing Advance Command, DRX Command and Padding.

Table 6.2.1-2 Values of LCID for UL-SCH

|  |  |
| --- | --- |
| Codepoint/Index | LCID values |
| 00000 | CCCH |
| 00001-01010 | Identity of the logical channel |
| 01011 | CCCH |
| 01100 | CCCH |
| 01101 | CCCH and Extended Power Headroom Report |
| 01110-01111 | Reserved |
| 10000 | Extended logical channel ID field |
| 10001 | DCQR and AS RAI |
| 10010 | AUL confirmation (4 octets) |
| 10011 | AUL confirmation (1 octet) |
| 10100 | Recommended bit rate query |
| 10101 | SPS confirmation |
| 10110 | Truncated Sidelink BSR |
| 10111 | Sidelink BSR |
| 11000 | Dual Connectivity Power Headroom Report |
| 11001 | Extended Power Headroom Report |
| 11010 | Power Headroom Report |
| 11011 | C-RNTI |
| 11100 | Truncated BSR |
| 11101 | Short BSR |
| 11110 | Long BSR |
| 11111 | Padding |

Table 6.2.1-2a Values of eLCID for UL-SCH

|  |  |  |
| --- | --- | --- |
| Codepoint | Index | LCID values |
| 000000-000110 | 32-38 | Identity of the logical channel |
| 000111-111111 | 39-95 | Reserved |

For NB-IoT only the following LCID values for UL-SCH are applicable: CCCH (LCID "00000"), Identity of the logical channel, CCCH and Extended Power Headroom Report, DCQR and AS RAI, SPS confirmation, C-RNTI, Short BSR and Padding.

Table 6.2.1-3 Values of F and F2 fields:

|  |  |  |
| --- | --- | --- |
| Index of F2 | Index of F | Size of Length field (in bits) |
| 0 | 0 | 7 |
| 1 | 15 |
| 1 | - | 16 |

Table 6.2.1-4 Values of LCID for MCH

|  |  |
| --- | --- |
| Index | LCID values |
| 00000 | MCCH (see note) |
| 00001-11100 | MTCH |
| 11101 | Reserved |
| 11110 | MCH Scheduling Information or Extended MCH Scheduling Information |
| 11111 | Padding |
| NOTE: If there is no MCCH on MCH, an MTCH could use this value. | |

Table 6.2.1-x: Values of R and F2 fields for short DCQR

|  |  |  |
| --- | --- | --- |
| Index of R | Index of F2 | Short DCQR value |
| 0 | 0 | No short DCQR |
| 0 | 1 | Short DCQR 1 |
| 1 | 0 | Short DCQR 2 |
| 1 | 1 | Short DCQR 3 |

End of changes