**3GPP TSG-RAN2 #118-e R2-220xxxx**

**Electronic meeting, May 9 – May 20, 2022**

**Agenda item:**6.0.4 (TEI17)

**Source:** LG Electronics (Rapporteur)

**Title:** [AT118-e][028][NR17] Priority of MAC CEs (LGE)

**Document for:** Discussion and Decision

# 1. Introduction

This document is to kick-off the discussion of the following issue.

* [AT118-e][028][NR17] Priority of MAC CEs (LGE)

Scope: Treat R2-2204887, R2-2205261, R2-2206038. Ph1 Determine agreeable parts. Ph2 For agreeable parts progress and agree a CR.

Intended outcome: Report, Agreed CR (if applicable)

Deadline:

- Deadline for Ph1 discussion: W1 Wednesday May 11 23:59 UTC

- Rapporteur triggers Ph2 discussion: W1 Thursday May 12

- Deadline for Ph2 discussion: W2 Monday May 16 23:56 UTC

- Rapporteur proposal: W2 Tuesday May 17

- Final deadline: W2 Wednesday May 18 1200 UTC

# 2. Background information

In Rel-17, a larger number of new MAC CEs are introduced from various WIs. The new MAC CEs introduced for UL is summarized below.

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| **Index** | **LCID values** | **WI** |
| 35 | CCCH of size 48 bits (referred to as "CCCH" in TS 38.331 [5]) for a RedCap UE | RedCap |
| 36 | CCCH1 of size 64 bits (referred to as "CCCH1" in TS 38.331 [5]) for a RedCap UE | RedCap |
| 44 | Timing Advance Report | NTN |
| 292 | Enhanced Multiple Entry PHR for multiple TRP (four octets Ci) | FeMIMO |
| 293 | Enhanced Multiple Entry PHR for multiple TRP (one octets Ci) | FeMIMO |
| 294 | Enhanced Single Entry PHR for multiple TRP | FeMIMO |
| 295 | Enhanced Multiple Entry PHR (four octets Ci) | FeMIMO |
| 296 | Enhanced Multiple Entry PHR (one octets Ci) | FeMIMO |
| 297 | Enhanced Single Entry PHR | FeMIMO |
| 298 | Enhanced BFR (one octet Ci) | FeMIMO |
| 299 | Truncated Enhanced BFR (one octet Ci) | FeMIMO |
| 300 | Enhanced BFR (four octet Ci) | FeMIMO |
| 301 | Truncated Enhanced BFR (four octet Ci) | FeMIMO |
| 302 | Positioning Measurement Gap Activation/Deactivation Request | Pos |
| 303 | IAB-MT Recommended Beam Indication | IAB |
| 304 | Desired IAB-MT PSD range | IAB |
| 305 | Desired DL Tx Power Adjustment | IAB |
| 306 | Case-6 Timing Request | IAB |
| 307 | Desired Guard Symbols for Case 6 timing | IAB |
| 308 | Desired Guard Symbols for Case 7 timing | IAB |
| 309 | Extended Short Truncated BSR | IAB |
| 310 | Extended Long Truncated BSR | IAB |
| 311 | Extended Short BSR | IAB |
| 312 | Extended Long BSR | IAB |
| 313 | Extended Pre-emptive BSR | IAB |

When a new transmission is performed, the MAC entity shall allocate UL resources to the logical channels and MAC CEs based on the priority. However, in the latest version of MAC specification (v17.0.0), the new MAC CEs (except Timing Advance Report MAC CE) are not listed in the logical channel prioritization procedure, as shown below.

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| 5.4.3.1.3 Allocation of resources Logical channels shall be prioritised in accordance with the following order (highest priority listed first):  - C-RNTI MAC CE or data from UL-CCCH;  - Configured Grant Confirmation MAC CE or MAC CEs for BFR or Multiple Entry Configured Grant Confirmation MAC CE;  - Sidelink Configured Grant Confirmation MAC CE;  - LBT failure MAC CE;  - MAC CE for Timing Advance Report;  - MAC CE for SL-BSR prioritized according to clause 5.22.1.6;  - MAC CE for BSR, with exception of BSR included for padding;  - Single Entry PHR MAC CE or Multiple Entry PHR MAC CE;  - MAC CE for the number of Desired Guard Symbols;  - MAC CE for Pre-emptive BSR;  - MAC CE for SL-BSR, with exception of SL-BSR prioritized according to clause 5.22.1.6 and SL-BSR included for padding;  - data from any Logical Channel, except data from UL-CCCH;  - MAC CE for Recommended bit rate query;  - MAC CE for BSR included for padding;  - MAC CE for SL-BSR included for padding. |

To perform the LCP procedure, the UE must set the priority of MAC CEs. There are several methods proposed in this meeting.

[1] propose to stick to the current rule, i.e. LCP priority of each MAC CE is statically specified in MAC specification, with following proposals:

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| **Proposal 1: LCP priority of Rel-17 UL MAC CEs is statically specified in the MAC spec (i.e. it is not NW-configurable).**  **Proposal 2: LCP priority of Timing Advance Report MAC CE shall not be rediscussed in the cross WI MAC CE coordination.**  **Proposal 3: Discussion on the LCP priority of IAB-MT Recommended Beam Indication MAC CE, Desired IAB-MT PSD range MAC CE, and Desired DL Tx Power Adjustment MAC CE should be postponed until their format is completely specified.**  **Proposal 4: Same LCP priority is reused for the legacy MAC CE and the corresponding Extended/Enhanced MAC CE(s).**  **Proposal 5: The Positioning Measurement Gap Activation/Deactivation Request MAC CE has higher priority than Recommended bit rate MAC CE, but lower priority than data from any Logical Channel.**  **Proposal 6: The Case-6 Timing Request MAC CE has lower priority than MAC CEs for the number of Desired Guard Symbols, but higher priority than Pre-emptive BSR MAC CE.**  **Proposal 7: Adopt the text proposal in Annex.** |

[2] propose to keep the legacy rule except that extension/enhancement of legacy MAC CE has the same LCP priority as the legacy MAC CE, and all the completely new MAC CEs have a same LCP priority which needs to be defined. The LCP priority of the completely new MAC CEs within the same LCP priority is determined by UE implementation.

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| **Proposal 1: For a Rel-17 UL MAC CE which is the extension/enhancement of a legacy MAC CE, the LCP priority is the same as that of the legacy MAC CE.**  **Proposal 2: For the completely newly designed Rel-17 UL MAC CEs (other than extension of the legacy MAC CEs), it is up to UE implementation to determine the LCP prioritization among them. The absolute priority of them is as the TP below.** |

[3] propose to categorize MAC CEs into High/Middle/Low priority, and within each High/Middle/Low priority, the LCP priority of MAC CEs is determined by UE implementation:

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| **Proposal 1: RAN2 keeps the following LCP priority order for LCP procedure.**  **- C-RNTI MAC CE or data from UL-CCCH**  **- High priority MAC CEs**  **- Middle priority MAC CEs**  **- data from any Logical Channel, except data from UL-CCCH**  **- Low priority MAC CEs**  **Proposal 2: Only categorize MAC CEs into High/Middle/Low priority and do not specify LCP priority order within High/Middle/Low priority category.**  **Proposal 3: Use the proposed MAC CE priority table as a baseline for further discussion.**  **Proposal 4: Within each priority category, the LCP priority of each MAC CE is determined by UE implementation.** |

# 3. Phase I Discussion

Before going into details, it is asked for companies to decide first high-level principle for LCP priority of MAC CEs, considering bunch of new MAC CEs introduced in Rel-17.

**Question 1: For a high-level principle, which way is preferred for LCP priority of MAC CEs?**

**- Option 1: Define LCP priority of each MAC CE.**

**- Option 2: Define LCP priority of each MAC CE except that extension/enhancement of legacy MAC CE has the same LCP priority as the legacy MAC CE, and all the completely new MAC CEs have a same LCP priority which needs to be defined. The LCP priority of the completely new MAC CEs within the same LCP priority is determined by UE implementation.**

**- Option 3: Categorize MAC CEs into High/Middle/Low priority, and within each High/Middle/Low priority, the LCP priority of MAC CEs is determined by UE implementation.**

**- Option 4: Other options.**

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| Company | Preferred option | Detailed Comments |
| LG Electronics | Option 3 | Proponent.  We think Option 3 makes spec maintenance easier and avoids time-consuming discussion for future. |
| Huawei, HiSilicon | Option 2 | Proponent.  Option 2 to us is simpler. |
| OPPO | Option 2/Option1 | Meanwhile, given large number of MAC CEs are introduced in R17, and possibly more MAC CEs in future releases, we show sympathy that we can save the efforts on defining priority for each individual MAC CE without impacts the legacy.  However, We also understand the LCP priority for some MAC CEs has been discussed in WI-specific, e,g., Positioning Measurement Gap Activation/Deactivation Request, for which the priority was agreed to be higher than the Recommended bit rate MAC CE but lower than data from any logical channel.  We are not sure whether other MAC CEs, the priority has been discussed or not in a per-WI basis.  If there are already per-WI conclusion, we should avoid reverting those conclusions by introducing new priority. |
| Samsung | Option 1 | Option 1 can still work, even if the list of MAC CEs becomes a bit lengthy. With Option 1, some of them will have same priority (as in the legacy) and some may be different, and that can be determined based on the importance of each MAC CE, once a new release is frozen.  For Option 2, we wonder how all the "completely new" MAC CEs can be assumed to have a same priority. We think the priority should be determined based on the importance of each MAC CE considering the principle of LCP procedure, so it is not a viable solution.  For Option 3, in general, we think that the LCP priority order of legacy MAC CEs should not be touched, and the discussion should be focused on the new MAC CEs. If we keep the legacy principle, then Option 1 with less granularity would still work. |
| Ericsson | Option 1 | Option 1 always work.  Option 2 is unclear what is meant, and there is no motivation why this is better. If the priority for some of the MAC CEs do not matter, then it is also fine if RAN2 select a priority.  Option 3, there is no motivation why this would be better. This do not save discussion time in 3GPP – just change to which group instead of which prio level. |
| vivo | Option 1/2 | In our understanding, Option 2 can be regarded as Option 1 as anyway we will define an LCP priority for the Enhanced/Extended MAC CEs (i.e. same LCP priority for the legacy one and the Enhanced/Extended one). There is no essential difference between Opt 1/2 and we are fine with these two options.  For Option 3, the LCP priority of legacy UL MAC CEs is also changed, which may incur the backward compatibility issue. |
| Qualcomm Incorporated | Option 1/2 | We see option 2 is just a result of option 1 exercise. We see the benefit of option 2 where we can put multiple MAC-CEs in the same priority level and help avoiding much amount of unnecessary discussion.  Option 3 is interesting and can be considered in the future, but so far option 1/2 look manageable. |
| Nokia | Option 1/2 | We do not see much difference between 1 and 2. For option 1, for those with same priority, it would be up to UE implemementation like in legacy where we already have same priority MAC CEs. |

# 4. Phase II Discussion

Phase II discussion will be triggered after Phase I discussion is concluded. Follow-up discussion shown below is needed depending on which option is selected in Phase I discussion.

- Option 1: Define LCP priority of each MAC CE.

- Option 2: Define what is extension/enhancement of legacy MAC CEs and what is completely new MAC CEs. Define one LCP priority for completely new MAC CEs.

- Option 3: Define which priority category each MAC CE belongs to.

# Conclusions

To be filled later..

# Contact Information

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# References

[1] R2-2205261 Discussion on LCP Priority of Rel-17 MAC CEs vivo

[2] R2-2206038 Cross WI coordination on LCP prioritization for UL MAC Ces Huawei, HiSilicon

[3] R2-2204887 LCP priority of MAC CEs LG Electronics Inc.