3GPP RAN WG2 Meeting #131 R2-250XXXX

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

Agenda Item: 8.9.1

Source: MediaTek. Inc

Title: Remaining MAC open issues in IoT NTN

Document for: Discussion, Decision

# Introduction

The following document includes a list of open issues according to the following email discussion:

* [Post130][307][R19 IoT NTN] MAC CR (Mediatek)

Scope: discuss the running MAC CR

Intended outcome: Endorsed CR and list of remaining open issues

**Deadline:** Long

Companies are invited to provide feedback on open issue list by: TBD

# Remaining open issues for specification 36.321

**Open issue MAC-2:** CB-RNTI calculation

**Issue description:**

RAN2 had agreement to use CB-RNTI to scramble Msg3 and monitor Msg4. The CB-RNTI is derived from the transmit resource for the transmission window. A working assumption has been agreed in the RAN2#130.

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| RAN2#129bis agreement:   * For CB-msg3-EDT we adopt a Single Msg4 monitoring window and Single RNTI (the RNTI is derived on the transmit resource for the transmission window). * Introduce a new RNTI (i.e. CB-RNTI) for CB-Msg4 monitoring and CB-Msg3 scrambling. We include this agreement in the LS to RAN1   RAN2#130 agreement:  Working Assumption:   * The formula for RNTI for Msg4 monitoring is:   RNTI=X + Msg3\_W\_index modulo (Y) + Y\*CE\_level + 3\*Y\*carrier\_id.   * X is the starting RNTI for Msg4 reception, which can be defined by RAN2 e.g. X=2401 for eMTC or 4097 for NB-IoT, * Msg3\_W\_index is the index of Msg3 transmission window within a periodicity of 1024 SFNs and index 0 corresponds to the Msg3 transmission window starts at the SFN defined by IE startSFN-r19, * Y is ceil (Msg4\_WS/Msg3\_WP), * CE\_level is the CE level, 0 <= CE\_level < 3 * carrier\_id is the index of the UL carrier of the CB-Msg3 resources, anchor carrier has index 0, 0 <= carrier\_id < 16   Can come back to check if the NW can also simply configure RNTI = X  Agreements – part 2:   * The value of X is 4097 for NB-IoT and 2401 for eMTC * The value of Msg4\_WS is the maximum Msg4 window size * The value of Msg3\_WP is the minimum Msg3 window periodicity |

**Proposed resolution:**

RAN2 confirms the CB-RNTI working assumption.

Companies are invited to indicate their preference regarding the confirmation of the CB-RNTI working assumption , and to comment on whether we should allow simply configure RNTI = X.

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| **Company** | **Confirm WA?** | **Comments** |
| Qualcomm | Yes, see comment | We should avoid same RNTI for different transmission windows. In that sense, cell specific RNTI is not desirable. |
| vivo | Yes |  |
| CATT | Yes with comments | We are ok to confirm the WA.  We also support to allow simply configure RNTI = X. For example, if there is no overlap between the two adjacent Msg4 monitoring window, then RNTI=X can be used.  But we are also OK to follow the majority view. |
| Apple | Yes | As we commented online, though right now one single RNTI is used for one Msg3 window, we prefer not pursuing one RNTI within cell level, to not make the false alarm issue more severe. |
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Summary

**Open issue MAC-6:** The power ramping parameters and how the power ramping is done.

**Issue description:**

RAN2 assumes power ramping should be supported for CB-Msg3-EDT. And in LS R2-2503175, RAN2 has asked RAN1 for confirmation and in case which parameters should apply.

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| RAN2#129bis agreement:   * RAN2 assumes power ramping should be supported for CB-msg3-EDT (for both eMTC and NB-IoT) should be supported and will ask RAN1 for confirmation and in case which parameters should apply. |

In the RAN1 reply LS R2-2504962 after RAN2#130, RAN1 indicates that it has not evaluated the potential performance of power ramping for CB-msg3-EDT, and it is likely that there will not be sufficient time to evaluate this topic within the R19 timeframe. Instead, for open loop power control, RAN1 suggests the following UL power control parameters can be reused for CB-msg3-EDT: p0-UE-NPUSCH-r16 and alpha-r16 for NB-IoT NTN.

**Proposed resolution:**

Power ramping is not used for CB-Msg3 transmission. The transmission power of CB-Msg3s in the selected CE level remains the same between the replicas and attempts.

Companies are invited to provide comments on the proposed resolution.

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| **Company** | **Agreed or not** | **Comments** |
| Qualcomm | Yes |  |
| vivo | Agree | Given that the RAN1 specifications have been frozen and there remains no consensus within RAN1 regarding power ramping, we propose that RAN2 should refrain from proceeding with this (initiative/measure), in order to avoid impacting RAN1's functionality. |
| CATT | Agree |  |
| Apple | OK | At the moment, seems RAN2 cannot force to introduce power ramping. It is acceptable to us with no power ramping. |
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Summary

**Open issue MAC-9:** Whether NW/UE processing time is needed when determine the Msg4 monitoring starts.

**Issue description:**

In RAN2#129, it has been agreed that the Msg4 monitoring starts at the end of CB-Msg3-EDT transmission window plus UE-eNB RTT. FFS NW/UE processing time is needed or not. In RAN2#130, this open issue was not discussed and remains FFS.

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| RAN2#129bis agreement:   * The Msg4 monitoring starts at the end of CB-Msg3-EDT transmission window plus UE-eNB RTT (FFS NW/UE processing time is needed or not)   RAN2#130 agreement:   * We do not specify another way of starting Msg4 monitoring window, i.e. it is confirmed that the Msg4 monitoring window always starts at the end of CB-Msg3-EDT transmission window plus UE-eNB RTT (FFS NW/UE processing time is needed or not) |

**Proposed resolution:**

Based on the observations of companies’ contributions and discussions, the following options are summarized.

**Option 1**: The processing time is not needed. (i.e. 0ms)

**Option 2**: A 3 ms processing time is used.

**Option 3**: A 4 ms processing time is used.

**Option 4**: Aother processing time.

Companies are invited to choose between the options.

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| **Company** | **Prefer option** | **Comments** |
| Qualcomm | See comments | No unless any restriction applied from RAN1. |
| vivo | Option 1 | We fail to see the necessity in introducing new processing time. |
| CATT | Option 1 |  |
| Apple | Option 1 | We are fine with no processing time. |
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Summary

**Open issue MAC-15:** FFS on the details of the failure behaviour.

**Issue description:**

Whether the UE can initiate the legacy 4-step RA when the CB-Msg3 procedure fails was discussed in the RAN2#129bis. Most companies agreed. But when the CB-Msg3 procedure failes, which upper layer should be notified is still unknown. This issue was identified as an open MAC issue, but it was not discussed at RAN2#130.

**Proposed resolution:**

When the *CB-Msg3ResponseTimer* expires and the maximum number of re-attempts has been reached, MAC notifies the RRC layer. It is up to UE implementation to initial legacy connection establishment, EDT, or PUR.

Do companies agree with the proposed resolution? Other options are also welcome.

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| **Company** | **Agreed or not** | **Comments** |
| Qualcomm | Agree |  |
| vivo | Agree |  |
| CATT | Agree |  |
| Apple | Agree |  |
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Summary

**Open issue MAC-17:** Whether to allow multiple TBSs as in EDT.

**Issue description:**

In legacy EDT, the small TBS subset is supported to reduce the redundant padding on Msg3, thereby saving some power and time. Some companies have suggested to support the same mechanism for CB-Msg3-EDT.

**Proposed resolution:**

Companies are invited to provide comments to resolve the issue.

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| **Company** | **Comments** |
| Qualcomm | Yes as it is indeed EDT but without msg1 and Msg2. |
| vivo | Input from RAN1 is needed for this. It is safer to not do this in the late stage. |
| CATT | Yes, we are OK to follow the legacy behavior. |
| Apple | Small TBS subset is a RAN1 heavy design thus we need to consult with RAN1 on it. If RAN1 does not need to do any major work, we think it should be OK. |
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Summary

**Open issue MAC-18:** How to model the CB-Msg3 response window (i.e. MSG4 monitoring window) ? Should it be a timer as in legacy RA response window, and what should be the value range.

**Issue description:**

During the MAC running CR discussion, the question of how to model the CB-Msg3 response window was raised. Most companies preferred to model it as a timer. An MAC open issue was identified, but it was not discussed at the RAN2#130. This issue is only about how to capture the agreement, so it should not be a major concern. Since most companies preferred the timer approch, the rapporteur has adopted this assumption in the MAC running CR.

**Proposed resolution:**

The CB-Msg3 response window(i.e., Msg4 monitoring window) is modeled as a timer (e.g., *CB-Msg3ResponseTimer*)

Do companies agree with the proposed resolution?

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| **Company** | **Agreed or not** | **Other comments** |
| Qualcomm | Yes |  |
| vivo | Yes | Either window modeling or timer modeling is okay to us. |
| CATT | Yes |  |
| Apple | Yes |  |
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Summary

**Open issue MAC-19**: The CB-Msg4 is decoded after CB-Msg3 response timer expired.

When the *CB-Msg3ResponseTimer* expires, UE will stop monitoring PDCCH. If the PDCCH is successfully decoded before *CB-Msg3ResponseTimer* expires, but the corresponding PDSCH is successfully decoded after the *CB-Msg3ResponseTimer* has expired, the UE behavior has not been discussed and is therefore unknow.

The same scenario for legacy RA is defined in 36.321 as follows:

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| - if *mac-ContentionResolutionTimer* expires:  - for BL UEs or UEs in CE or NB-IoT UEs:  - if notification of a reception of a PDCCH transmission has been received from lower layers before *mac-ContentionResolutionTimer* expired; and  - if the MAC PDU received until the subframe that contains the last repetition of the corresponding PDSCH transmission is successfully decoded; and  - if the MAC PDU contains a UE Contention Resolution Identity MAC control element; and  - if the UE Contention Resolution Identity included in the MAC control element matches the 48 first bits of the CCCH SDU transmitted in Msg3:  - consider this Contention Resolution successful and finish the disassembly and demultiplexing of the MAC PDU;  - set the C-RNTI to the value of the Temporary C-RNTI;  - discard the Temporary C-RNTI;  - consider this Random Access procedure successfully completed. |

It essentially states a PDSCH decoded afte the *mac-ContentionResolutionTimer* has been expired will be treated the same as the one successfully decoded before the timerhas been expired.

**Proposed resolution:**

We follow the legacy approach. If the PDCCH is successfully decoded before *CB-Msg3ResponseTimer* expires, but the corresponding PDSCH is successfully decoded after the timer has expired, the MAC PDU is treated the same as the one successfully decoded before the timerexpires.

Do companies agree with the proposed resolution?

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| **Company** | **Agreed or not** | **Other comments** |
| Qualcomm | Agree | Yes its better to follow legacy approach, if the PDCCH has been received, we should let UE to decode the PDU. |
| vivo | Agree |  |
| CATT | Agree | We are OK to follow the legacy approach. |
| Apple | Agree |  |
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Summary

# Other identified open issues

Companies are invited to describe any other identified open issues not currently included within this document

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| **Company** | **Other identified open issues? (please describe)** |
| Qualcomm | [1] Do we support backoff indicator without waiting to expire the Msg4 response window. In case network does not have any response to send, it may want UE to execute backoff immediately.  [2] We have 2 bits for different MAC PDU formats. Three are used for backoff indicator, success response and data. The remnaing one should be used for UL grant to be used for fallback to contention free transmission(e.g., fall back to EDT or to smaller TBS for only RRC request without UL data) or re-transmission.  [3] Can group RNTI and Msg4 enhancements be applicable to normal EDT or 4 step RACH?  [4] How does UE prepare DL channel quality measurement result in CB-Msg3 without Msg1/Msg2.  - if the UE is an NB-IoT UE and *cqi-Reporting* is configured by upper layers:  - the MAC entity shall update the MAC PDU in the Msg3 buffer in accordance with the DL channel quality measurement result. |
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# Conclusions

[Proposals for easy agreement]

[Proposals for discussion]