3GPP RAN WG2 Meeting #131 R2-2505555

Bengaluru, India, Aug 25th – 29th, 2025 Revision of R2-2504526

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.

# 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:   1. 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). 2. 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:   1. 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:   1. The value of X is 4097 for NB-IoT and 2401 for eMTC 2. The value of Msg4\_WS is the maximum Msg4 window size 3. 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. |
| ZTE | Yes, see comments. | Firstly, the fundamental purpose of introducing RNTI is to differentiate UEs that perform uplink transmission on different resource locations. So with similar false alarm concern mentioned by Qualcomm and other companies, we strongly against cell specific RNTI, e.g., to simply configure RNTI = X.  Secondly, we think the discussion in last meeting on the justifications for introducing Msg3\_W\_index and modulo (Y) operation was not thorough. So we further discuss as below:   * #1: The current definition for Msg3\_W\_index is descriptive in nature. However, we think that by leveraging the factor [floor(SFN\_id/4)] in one of legacy RA-RNTI formula can achieve a similar result, and better as it’s based on a clear mathematical calculation. Here 4 corresponds to the minimum PRACH resource periodicity, so similarly, for CB-RNTI, the factor can be [floor(start SFN\_id of Tx window/minimum Tx window length)]. The only difference is that descriptive Msg3\_W\_index seems to be derived from the actual configuration (i.e., Msg3\_W\_index seems to be equivalent to [floor(start SFN\_id of Tx window /configured Tx window length). Meanwhile, in [floor(start SFN\_id of Tx window / minimum Tx window length)], since the minimum Tx window length is used, the calculated Tx window index value may be larger than the actual index. Nevertheless, this does not affect the desired outcome where UEs selecting different Tx windows can have distinct Tx window index values. In other word, the factor [floor(start SFN\_id of Tx window / minimum Tx window length)] is more general that can adapt to different configurations. * #2: Per our understanding, the “modulo (Y) and Y is ceil (maximum Msg4 window size/minimum Msg3 window periodicity)” operation is designed to further compress the Tx window index values selected by the UEs. Specifically, if two UEs select different Tx windows (for example, UE1 selects Tx window index 0 and UE2 selects Tx window index 2), and their Msg4 reception windows will not overlap (e.g., when Msg4 window size shorter than Msg3 window periodicity, or when Msg4 window size is longer than Msg3 window periodicity but shorter than or equal to two times of Msg3 window periodicity), it’s allowed to use the modulo (Y) operation to compress their indices into the same value. For example, if ceil (maximum Msg4 window size / minimum Msg3 window periodicity) = 2, UEs selecting Tx window index 0 and index 2 can both be adjusted to be with Tx window index 0. Even if other parameters (e.g., CE-level, carrier-id) are identical, the isolation of their Msg4 reception windows ensures they will not falsely detect each other's CB-RNTI.   + Here we also can consider to use configured Msg4 window size and configured Msg3 window periodicity respectively, but with legacy experience, to use maximum Msg4 window size and minimum Msg3 window periodicity can make formula more general to adapt to different configurations. This reason is simiar as the reason for our suggestion in above #1, e.g., to use [floor(start SFN\_id of Tx window / minimum Tx window length)] instead of descriptive Msg3\_W\_index.   In a summary, we can confirm CB-RNTI working assumption with a change that to use [floor(start SFN\_id of Tx window / minimum Tx window length)] instead of descriptive Msg3\_W\_index.  [Rapp] it should be minimum Tx window periodicity rather than minimum Tx window length. |
| Nokia | Yes | For the proposal to simply configure cell-level CB-RNTI=X for all the CB-Msg3 transmission windows and all the CB-Msg4 monitoring windows, the main concern with this approach is that, if the CB-Msg4 windows are overlapped, with the single CB-RNTI for Msg4 monitoring, the UE may be required to decode a large number of irrelevant CB-Msg4 with response to other CB-Msg3 transmission windows. This could lead to unnecessary power consumption due to false decoding. Agree with QC, Apple and ZTE that it is not needed.  We also agree the WA can be confirmed. On ZTE’s comments to further clarify the Msg3\_W\_index as well as either the “configured” or “maximum/minimum” value should be used for calculation, it can be further discussed in next meeting. |
| NEC | Yes | For the detailed formula, we also support Y to be a fixed value (based on max and/or min) for different configurations, simplifying the network implementation. |
| Huawei | Yes |  |
| Transsion Holdings | Yes | We are ok to confirm the WA and we prefer only one solution, thus configure RNTI = X is not needed. |
| Samsung | Yes, with comments | We do not think that RNTI = X is a good solution, even though it may work.  The formula still needs some work.  For instance the following: *Y is ceil (Msg4\_WS/Msg3\_WP)*  This is not introduced for compression but to ensure that the RNTIs do not collide when the Msg4 response windows overlap. While this is technically correct, this will likely result in a Y that is unneccesarily large. This is because the maximum values Msg4\_WS may be in the size of 10s of seconds, and Msg3 minimum periodicity may be in the range of 10 ms, which means that Y=1000. Inputting the maximum values, this would make the range [X, X+4\*16\*1000] = **[X, X+64000]**, which exceeds the number of RNTIs (!) and this also eats up RNTIs for other purposes.  So Y may need to be bounded to something more reasonable.  The original proposal was to use the configured size, not the max/min, of the Msg4\_WS and Msg3\_WP, and the challenge with this was that the sizes may be different for different carriers/CE levels, causing RNTI collisions. We think that Y can be calculated by considering the maximum ratio for Msg4\_WS/Msg3\_WP in a deployment. In most cases, the ratio will probably not be larger than 1. We think it would probably not be reasonable to have a ratio larger than 16, **so we propose Y=16**. |
| MediaTek | Yes |  |
| Ericsson | No | 1. X needs to have an option to be configurable to not collide with existing RNTI implementations    * There are many existing eNB implementations of RNTI allocation in legacy networks (TN and possibly some NTNs). To not affect existing eNB implementations, it is better to have the RNTI starting value X optionally configurable (if present use X from SIB, otherwise use X as in WA) to not affect existing implementations. 2. There shall be an option to only use one RNTI to efficiently support all useful configurations of CB-Msg3-EDT resources    * It is a simpler system    * If the load on the CB-Msg3 resources is low, it is a waste to allocate many RNTI resources    * When Msg4 windows are short, there is no overlap between Msg4 windows belonging to different Msg3 windows – thus there are scenarios where there is NO increased UE power consumption from decoding CB-Msg4 belonging to a different Msg3-window |
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Summary

All companies agree to confirm the CB-RNTI working assumption.There is no much support to have an alternative to define RNTI = X.

**Proposal 1: RAN2 to confirm the working assumption on CB-RNTI formula [10/11].**

Some companies suggested to further refine the equation, rapporteur think this requests further RAN2 discussion.

**Proposal 2: For the agreed CB-RNTI formula from P1, RAN2 to discuss**

* **Whether to define Msg3\_W\_index to floor(start SFN\_id of Tx window / minimum Tx window length or periodicity].**
* **Whether to define Y = 16.**
* **Whether starting value X is optionally configurable.**

**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:   1. 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. |
| ZTE | Can be agree if no further RAN1 input |  |
| Nokia | No | In legacy, to improve the RACH successful rate, UE can not only have power ramping in multiple preamble attempts but also increase its CE level with more repetitions. For CB-Msg3, RAN2 agreed that the UE shall not increase its CE level (to have more repetitions) even the number of failed attempts reached a threshold in current CE level. If the CB-Msg3 power ramping is not supported as well, the UE may finally fail after multiple CB-Msg3 attempts which is a waste of UE’s power and NW resource.  In our understanding, power ramping between CB-Msg3 windows is beneficial for the UE that remains in a certain CE level. We agree power ramping is not needed within a CB-Msg3 window (i.e. no power ramping per relica).  We think it is also an open issue whether the power level applied for CB-Msg3 is reused in case the UE falls back to 4-step RACH. |
| Huawei | Agree | We should avoid further crossing-WGs work to make sure that the WI can be completed on time. |
| Transsion Holdings | Agree |  |
| Samsung | No | In our view, we believe that RAN2 can introduce the power ramping with very little RAN1 involvement. A network may always not configure power ramping. We also echo Nokias input, since we have already made some agreements that impair falling back to other CE levels.  If we now decide to not introduce power ramping, then in our view we need to revisit the agreement on falling back to lower CE levels, because at some point “simplicity” will start affecting performance. |
| MediaTek | Agree |  |
| Ericsson | Agree | Its is simpler to not have power ramping.  With the diversity from k replicas, its fine if power is a little off as anyway another replica may be received correctly. |

Summary

8 companies agree that power ramping is not introduced. Two companies thinks power ramping between CB-Msg3 windows is beneficial. Based on the majority and considering the limited remaining time, the rapporteur suggest that power ramping is NOT supported.

**Proposal 3: Power ramping in CB-Msg3-EDT is NOT supported [9/11].**

**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:   1. 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:   1. 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. |
| ZTE | Option 2 | We think it’s safer to have processing time with similar reason in legacy, especially considering that the last replica may be sent almost close to the end of Tx window. We can arbitrarily select a smaller value, e.g., 3ms. |
| Nokia | Option 1 | We have no strong view but would like to go Option1 for simplicity.  In TS36.321, the start time of the Msg3 response window were defined in both the legacy RACH and PUR procedure, in which 4 ms were considered in PUR while it is not added in RACH contention resolution procedure. Furthermore, the processing time may not be needed in order to start the transmission of CB-Msg4 earlier since the network can process the Msg3 transmission and prepare for Msg4 transmission well in advance for those UEs who transmit the Msg3 at the early part of CB-Msg3 transmission window. |
| NEC | Option 2 or Option 4 | We can choose a small value or ask RAN1 for a particular value. |
| Huawei | Option 1 |  |
| Transsion Holdings | Option 1 |  |
| Samsung | Option 1/2 | It feels safer to go with a processing time, but since the windows are already going to be rather large, maybe it is not necessary.  We are fine to go with a processing time if there is a good motivation. |
| MediaTek | Option 1/2 |  |
| Ericsson | Option 2 | It is a waste of UE energy if the UEs start monitoring without taking eNB processing into account as there will be nothing to receive. Further, it is a change compared to how legacy PDCCH monitoring works and may need an LS to RAN1 to check feasibility.  Simplest is to reuse how the UE starts M/N-PDCCH monitoring in legacy.  For eMTC after sending a RA preamble 36.321 5.1.4:  - RA Response window starts at the subframe that contains the end of the last preamble repetition plus 3 subframes plus UE-eNB RTT and has length *ra-ResponseWindowSize* for the corresponding enhanced coverage level;  For NB-IoT after sending a RA preamble 36.321 5.1.4:  - RA Response window starts at the subframe that contains the end of the last preamble repetition plus X subframes plus UE-eNB RTT and has length *ra-ResponseWindowSize* for the corresponding enhanced coverage level, where value X is determined from Table 5.1.4-1 based on the used preamble format and the number of NPRACH repetitions;  Where X is 4 or 41. However, preambles are special for NB-IoT, instead for a regular NB-IoT NPUSCH we have (36.213, section 16.6):   * if the NB-IoT UE has a NPUSCH transmission ending in subframe *n* , the UE is not required to monitor NPDCCH in any subframe starting from subframe *n+1* to subframe *n+3* or in a NTN serving cell, in any downlink subframe that overlaps with uplink subframe *n*+*1* to subframe *n*+*K*mac+*3*.   Where the use of Kmac and clever counting of DL subrames resp. UL subframes gives that UE starts NPDCCH monitoring UE-eNB RTT + 3 subframes after the end of an NPUSCH tx ends.  Therefore, the best choice is 3 ms processing for all cases!!! |

Summary

Option1 and option2 both have supporters. RAN2 can further discuss the need of processing time in the next meeting.

**Proposal 4: RAN2 to choose between 3ms or 0ms processing time when determine the Msg4 monitoring starts.**

**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 |  |
| ZTE | See comments | We can propose it as a working assumption at this stage. We may need to firstly discuss another issue that whether and how to specify the priority for UE processing if all the legacy EDT, CB-Msg3-EDT and PUR are configured. After that discussion, we can double check this issue to see whether we need to further specify UE behaviour. |
| Nokia | See comments | We think it is reasonable that MAC notifies the RRC layer when maximum number of the CB-Mg3 transmission failure reached. However, if the UE fallback to legacy 4-step RACH, EDT or PUR, the CB-Msg3 buffer should be kept in MAC and transmitted in the fallback procedure to avoid UL data lost. The latter part is not up to UE implementation and there may have some MAC spec impact (e.g., the Msg3 buffer should not be flushed in 5.1.1 Random Access Procedure initialization). |
| Huawei | See comments | We agree that RRC layer should be notified and performs the fallback. Regarding fallback to which procedure can be up to RRC to decided based on the NW configuration:  When the *CB-Msg3ResponseTimer* expires and the maximum number of re-attempts has been reached, MAC notifies the RRC layer who performs the fallback procedure based on NW configuration. |
| Transsion Holdings | Agree |  |
| Samsung | See comments | We agree to “*When the CB-Msg3ResponseTimer expires and the maximum number of re-attempts has been reached, MAC notifies the RRC layer*.”.  However we do not understand the motivation to make it up to UE implementation, and it is concerning that a lot of companies seem to agree. There are already RRC/NAS procedures for EDT failing and we should aim to follow these. If these are not followed, then we need to re-work a lot of the RRC procedures. |
| MediaTek | Agree |  |
| Ericsson | Agree |  |

Summary

It appears that all the companies support MAC notifying the RRC layer about the CB-Msg3-EDT failure. However, there is no clear consesnsus on what RRC should do for this failure.

**Proposal 5: When the *CB-Msg3ResponseTimer* expires and the maximum number of re-attempts has been reached, the MAC indicates failure of CB-Msg3 transmission to the upper layer (i.e. RRC) [11/11].**

**Proposal 6: RAN2 to discuss the RRC behavior when receiving the CB-Msg3 EDT failure indication from MAC.**

**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. |
| ZTE | We prefer a simple solution in this late stage, e.g., not to support multiple TBS |
| Nokia | Yes, we agree to follow the legacy EDT principle to support small TBS selection for CB-Msg3 to avoid unnecessary padding in the message.  We are fine to either   * Option1: NW can configure multiple CB-Msg3 TBS for a CE level * Option2: UE is allowed to select TBS smaller than the configured CB-Msg3 TBS for the corresponding CE level (as legacy parameter *edt-SmallTBS-Enabled*)   Furthermore, RAN2 has agreed to support CB-msg3-EDT for MT cases, and therefore the Paging triggered CB-Msg3 message may only include the RRC message but no user data. In this case, support of a small TBS for CB-Msg3 is necessary. |
| NEC | Yes as legacy |
| Huawei | Same view with vivo. |
| Transsion Holdings | We perfer not support this in this late stage. |
| Mediatek | We perfer not support this in this late stage. |
| Ericsson | Make it simple and robust, only one TBS is needed. |

Summary

The view to support multiple TBS is split. There is no clear consensus and further discussion is needed.

**Proposal 7: RAN2 to further discuss whether to support multiple TBS.**

* **Option 1 [4/11] – Support multiple TBS per CE level**
* **Option 2 [7/11] – One TBS per CE level is enough**
  + **Note that 3 companies think R1 input is needed**

**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 |  |
| ZTE | Yes |  |
| Nokia | Agree | Fine to follow legacy, similar as Contention Resolution Timer. |
| NEC | Yes | Either is OK. |
| Huwei | Agree |  |
| Transsion Holdings | Yes |  |
| Samsung | Yes |  |
| MediaTek | Yes |  |
| Ericsson | Agree |  |

Summary

All companies agree to model the CB-Msg3 resposne window as a timer.

**Proposal 8: CB-Msg3 response window is modeled as a timer in MAC [11/11].**

**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 |  |
| ZTE | Agree |  |
| Nokia | Agree |  |
| Huawei | Agree |  |
| Transsion Holdings | Agree |  |
| Samsung | Agree |  |
| MediaTek | Agree |  |
| Ericsson | Agree |  |

Summary

All companies agree the solution.

**Proposal 9: 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. [11/11]**

**Open issue MAC-20**: Should the CQI report in Msg3 in NB-IoT be supported in CB-Msg3-EDT?

According to 36.133 section 6.6.2.6, the channel quality reporting in the anchor carrier can be derived either in the period before NPRACH transmission(T1) or during the RAR period (T2). For the non-anchor carrier, it can only be derived during the RAR period (T2).

Since the Msg1 and Msg2 are skipped in the CB-Msg3-EDT, it appears that CQI report in anchor carrier can be supported, but CQI report in non-anchor may not.

**Proposal 10: CQI reporting in anchor carrier is supported in CB-Msg3-EDT, but CQI reporting in non-anchor is not.**

Additionally, if the CQI reporting in anchor carrier is supported in CB-Msg3-EDT, the RAN4 spec should be updated accordingly. The T1 should be the period before the CB-Msg3 transmission in this case.

**Proposal 11: Send a LS to RAN4 to request support for CQI reporting in anchor carrier in CB-Msg3-EDT.**

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| 36.1336.6.2.6 MSG3-based channel quality report for UE Category NB1 The requirements in this clause shall apply for UE supporting DL channel quality reporting for UE Category NB1 as defined in TS 36.331 [2] section 5.3.3.3, 5.3.3.3a, and 5.3.7.4.  The DL channel quality provides the serving eNB with information about the minimum NPDCCH repetition level to satisfy the hypothetical NPDCCH block error rate of 1% with the parameters specified in Table 6.6.2.6-1.  Table 6.6.2.6-1: NPDCCH transmission parameters for downlink quality reporting.   |  |  | | --- | --- | | Parameters | Values | | DCI format | Format N1 | | Number of information bits (excluding CRC) | 23bits | | System bandwidth | 200kHz | | Aggregation level | 2 | | DRX | OFF |   For channel quality reporting in the anchor carrier, the reported NPDCCH repetition level shall be derived from the channel quality measured in the period T1 or T2 in the carrier where the random access response is transmitted, where  - T1 is the period before NPRACH transmission used for NRSRP measurement for enhanced coverage level estimation  - T2 is the period from the beginning of the random access response to the beginning of PUSCH format 1 for DL channel quality reporting.  For channel quality reporting in the non-anchor carrier, the reported NPDCCH repetition level shall be derived from the channel quality measured in the period T2 in the carrier where UE monitors Random Access Response where T2 is defined above.  The NPDCCH repetition level for CQI-NPDCCH-NB and CQI-NPDCCH-Short-NB is chosen from the supported NPDCCH repetition levels [3]. The report mapping is defined in 9.1.22.15.  The UE shall satisfy the downlink channel quality measurement accuracy requirements as specified in 9.1.22.16. |

Do companies have comment on P10/P11

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| **Company** | **Agreed or not** | **Other comments** |
| Huawei | See commnets | It seems the main issue is whether the generation of the CQI report can meet RAN4 requirements (legacy or new) in anchor carrier and non-anchor carrier before MSG3 transmission during CB-MSG3 EDT. So it is better that we stay open for now and ask RAN4 about this. And RAN1 is better to be in cc. |
| vivo | No | The network can know the channel RSRP based on the resource corresponding to a given CE level selected by the UE. Additional RSRP measurement and reporting may not be useful in IoT-NTN case, considering that the near-far effect is not obvious.  Meanwhile, RAN4 is also set to warp up the work at the upcoming August meeting. It isn’t ideal to push RAN4 at the last moment. |
| Ericsson | P10 and P11 are not needed | CQIs are anyway not very useful in EDT as most of the time, the UE will just go back to IDLE – thus it is best to not support for CB-Msg3. |
| Nokia | P10 and P11 are not needed | The CQI is not useful in CB-Msg3 as most of the CB-Msg3 procedure terminate with Msg4, and the CB-Msg4 is designed to address multiple UEs therefore NW would have to use conservative link adaptation to cover the worst UE. Furthermore, we understand that, even in legacy, it is an optional feature in UE which means not all UEs will report that to NW. Agree with vivo and E/// this is not needed. |
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Summary

Three companies thinks that the CQI is not useful in CB-Msg3 as most of the CB-Msg3 procedure terminate with Msg4. Given that there is not so many companies comment on this open issue, rapporteur think that further RAN2 discussion is needed. The original P10 and P11 is not pursue and we have below P12 instead.

**Proposal 12: RAN2 to discuss whether to support CQI reporting in anchor carrier and/or non-anchor in CB-Msg3-EDT procedure. If yes, RAN2 to discuss how does the UE prepare DL channel quality measurement result in CB-Msg3 without Msg1/Msg2.**

# Other identified open issues

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

|  |  |
| --- | --- |
| **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.  [Rapp] Since the next RAN2 meeting will be the last meeting for Rel-19, we should focus only on the open issues that need to be addressed. According to the rapporteur’s understanding, this is considered an enhancement.  [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.  [Rapp] RAN2 has discussed the network-indicated fallback before but no agreement on this. From Rapporteur point of view, although network-indicated fallback looks beneficial, it is not critical for CB-MSG3 EDT procedure. It is suggested not to have this additional enhancement..  [3] Can group RNTI and Msg4 enhancements be applicable to normal EDT or 4 step RACH?  [Rapp] Changing legacy EDT or 4-step RACH procedure is not within the WID scope and is not considered an open issue.  [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.  [Rapp] Yes, this should be discussed. Add open issue MAC-20. |
| Nokia | Although RAN2 agreed that the CB-Msg3 re-attempt may apply backoff as indicated in CB-Msg4, repeated re-attempts using the CB-Msg3 resource in the same CE level may continue to fail if the CB-Msg3 resource is overloaded. Based on figure2-a from R2-2405202, DSA will worse the system performance if the system load is high. Therfore, we propose discussing whether to support the network-indicated fallback to legacy RACH, EDT, or PUR—such as by introducing a single bit or a new subhead type in CB-Msg4 to indicate NW-initiated fallback.  Figure2-a from R2-2405202.    [Rapp] RAN2 has discussed the network-indicated fallback before but no agreement on this. From Rapporteur point of view, although network-indicated fallback looks beneficial, it is not critical for CB-MSG3 EDT procedure. It is suggested not to have this additional enhancement.. |
| Transsion Holdings | We agree with Qualcomm that there may be a case that the network does not have any response to send in the CB-Msg3 response window for some reason(e.g. inferference, msg3 resource collision), for this scenario there is no need for the UE keep monitoring the response in the window, the network can just send a indication to tell all the UEs monitoring with the same CB-RNTI to stop monitoring the response to save the UE power.  [Rapp] Since the next RAN2 meeting will be the last meeting for Rel-19, we should focus only on the open issues that need to be addressed. According to the rapporteur’s understanding, this is considered an enhancement. |
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# Conclusions

[Potential easy agreement]

**Proposal 5: When the *CB-Msg3ResponseTimer* expires and the maximum number of re-attempts has been reached, the MAC indicates failure of CB-Msg3 transmission to the upper layer (i.e. RRC) [11/11].**

**Proposal 8: CB-Msg3 response window is modeled as a timer in MAC [12/12].**

**Proposal 9: 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. [11/11]**

[Need some discussion]

* WA: the formula for RNTI for mMsg4 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

* 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

**Proposal 1: RAN2 to confirm the working assumption on CB-RNTI formula [10/11].**

**Proposal 2: For the agreed CB-RNTI formula from P1, RAN2 to discuss**

* **Whether to define Msg3\_W\_index to floor(start SFN\_id of Tx window / minimum Tx window length or periodicity].**
* **Whether to define Y = 16.**
* **Whether starting value X is optionally configurable.**

**Proposal 3: Power ramping in CB-Msg3-EDT is NOT supported [9/11].**

**Proposal 4: RAN2 to choose between 3ms or 0ms processing time when determine the Msg4 monitoring starts.**

**Proposal 6: RAN2 to discuss the RRC behavior when receiving the CB-Msg3 EDT failure indication from MAC.**

**Proposal 7: RAN2 to further discuss whether to support multiple TBS.**

* **Option 1 [4/11] – Support multiple TBS per CE level**
* **Option 2 [7/11] – One TBS per CE level is enough**
  + **Note that 3 companies think R1 input is needed**

**Proposal 12: RAN2 to discuss whether to support CQI reporting in anchor carrier and/or non-anchor in CB-Msg3-EDT procedure. If yes, RAN2 to discuss how does the UE prepare DL channel quality measurement result in CB-Msg3 without Msg1/Msg2.**