**3GPP TSG-RAN WG2 Meeting #129 R2-250xxxx**

**Athens, Greece, 17th – 21st Feb., 2025**

**Agenda Item: 8.6.3**

**Source: vivo**

**Title: Summary of [POST128][109][MOB] MAC running CR – Open issues (vivo)**

**Document for: Discussion and Decision**

# 1 Introduction

This paper summarizes the post meeting email discussion for the open issues for the MAC running CR. Please note that this paper only includes some stage-3 issues related to how to generate the MAC specification or the issues which have not been proposed/discussed in companies’ contributions before.

**[POST128][109][MOB] MAC running CR (vivo)**

**Scope:** Prepare 38.321 running CR capturing all RAN2 agreements, identify stage 3 issues (possibly with rapporteur’s suggestion) that need to be discussed, and discuss them.

**Intended outcome:** 38.321 running CR, to be endorsed next meeting, and discussion summary.

**Deadline: Long email discussion**

Based on the companies' inputs, the proposals have been formulated at the conclusion section.

Please fill in the contact information in the table below

|  |  |  |
| --- | --- | --- |
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# 2. Discussion

## 2.0 General

In MAC specification (also in other specifications?), “LTM” means “intra-CU LTM” by now. After introducing Rel-19 “inter-CU LTM”, there are a lot of change places for “LTM” which are applicable for both legacy “intra-CU LTM” and Rel-19 “inter-CU LTM” “conditional intra-CU LTM”, e.g. PDCCH ordered early RACH, early TA acquisition, CG-based [and DG-based] RACH-less, etc. How to capture/Whether to differentiate them is up to further discussion.

How to capture/differentiate them in the MAC (and other specifications)?

* Option 1: “LTM” in specification means “intra-CU LTM” as legacy, “inter-CU LTM” “Conditional intra-CU LTM” in Rel-19 should be captured as “inter-CU LTM” “Conditional intra-CU LTM” specifically.
* Option 2: “LTM” in specification means “both intra-CU, inter-CU LTM and Conditional intra-CU LTM”. “intra-CU LTM”, “inter-CU LTM” “Conditional intra-CU LTM” specific part, if any, should be clearly captured for “intra-CU LTM”, “inter-CU LTM” and “Conditional intra-CU LTM”, separately.
* Others, please specify.

Note: Option 2 means we need to clean up the current MAC specification to check whether “LTM” needs to be updated as “intra-CU LTM” if “inter-CU LTM” or “Conditional intra-CU LTM” has different behaviour.

Rapporteur understands that almost all procedures in the MAC specification for Rel-18 intra-CU LTM could be reused for Rel-19 inter-CU LTM. Thus, in the latest version of running MAC CR, Option 2 is adopted, i.e. “LTM” in the specification means “intra-CU LTM, inter-CU LTM, [and Conditional intra-CU LTM”.

***Question 0:* Companies are invited to provide preference/comment if any different understanding as Rapporteur above.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option(s)** | **Comment** |
| Xiaomi | Option 2 with comments | To support Option 2, we need to update the definition of “L1/L2 Triggered Mobility”, which only covers the MAC CE triggered LTM.   |  | | --- | | In TS 38.300:  L1/L2 Triggered Mobility: a cell switch procedure that the network triggers via MAC CE based on L1 measurements.  LTM is a procedure in which a gNB receives L1 measurement report(s) from a UE, and on their basis the gNB may change UE serving cell by a cell switch command signalled via a MAC CE. | |
| MediaTek | Option 2 with comment | Agree that LTM in specification can represent both intra-CU and inter-CU. However, for Conditional LTM, it may need to be specified clearly, as many behaviors are different from legacy LTM.  The same rule can be applied to stage-2 spec. |
| Huawei, HiSilicon | Others | Existing LTM should be applicable for both Inter-CU LTM and Intra-CU LTM. Conditional LTM is separate from the existing LTM and may be newly defined |
| CATT | Others | Similar view as Mediatek and HW. Conditional LTM is quite different from NW based LTM(intra-CU LTM and inter-CU LTM),it is necessary to define it separately. |
| OPPO | Others | Agree with MTK, HW and CATT. CLTM should be defined separately. |
| NEC | Others | Agree with MediaTek, Huawei, etc. We assume that “LTM” in specification can include both intra-CU and inter-CU LTM. However, for Conditional LTM, we need separate descriptions from the other LTM. |
| Apple | Others | Agree with other companies that the current LTM in MAC spec can cover both inter-CU and inter-CU LTM, but CLTM needs to be defined separately as there will be some MAC operations which are specific for CLTM and different from legacy LTM. |
| Ericsson | Option 2 with comments | Prefer to keep the term LTM applicable for both intra- and inter CU in the MAC spec. Conditional LTM can be used when needed. |

## 2.1 inter-CU LTM

For Rel-18 intra-CU LTM, we discussed the cross-feature issues for LTM and concluded the intra-CU LTM won’t coexist with the NR-U or NES. On the other hand, it could coexist with coverage enhancement, MIMO 2TA and (e)RedCap, which has the impacts on MAC specification as follows [1]:

|  |
| --- |
| 5.1.1b Selection of the set of Random Access resources for the Random Access procedure ------omit------  1> if contention-free Random Access Resources have been provided for this Random Access procedure in the LTM Cell Switch Command MAC CE and a non-zero Msg1 repetition number is indicated in the LTM Cell Switch Command MAC CE:  2> assume that Msg1 repetition is applicable and that the Msg1 repetition number applicable for the current Random Access procedure is the Msg1 repetition number indicated in the LTM Cell Switch Command MAC CE.  ------omit------  1> else if contention-free Random Access Resources have been provided for this Random Access procedure in the LTM Cell Switch Command MAC CE:  2> if RedCap is applicable for this Random Access procedure:  3> if a non-zero Msg1 repetition number is indicated in the LTM Cell Switch Command MAC CE:  4> select the set of Random Access resources that is only configured with RedCap indication and Msg1 repetition indication and associated with the indicated Msg1 repetition number for this Random Access procedure.  3> else:  4> if there is one set of Random Access resources available that is only configured with RedCap indication:  5> select this set of Random Access resources for this Random Access procedure.  4> else:  5> select the set of Random Access resources that is not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.  2> else if eRedCap is applicable for this Random Access procedure:  3> if a non-zero Msg1 repetition number is indicated in the LTM Cell Switch Command MAC CE:  4> select the set of Random Access resources that is only configured with eRedCap indication and Msg1 repetition indication and associated with the indicated Msg1 repetition number for this Random Access procedure.  3> else:  4> if there is one set of Random Access resources available that is only configured with eRedCap indication:  5> select this set of Random Access resources for this Random Access procedure.  4> else if there is one set of Random Access resources available that is only configured with RedCap indication:  5> select this set of Random Access resources for this Random Access procedure.  4> else:  5> select the set of Random Access resources that is not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.  2> else:  3> if a non-zero Msg1 repetition number is indicated in the LTM Cell Switch Command MAC CE:  4> select the set of Random Access resources that is only configured with Msg1 repetition indication and associated with the indicated Msg1 repetition number for this Random Access procedure.  3> else:  4> select the set of Random Access resources that is not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure. 6.1.3.75 LTM Cell Switch Command MAC CE The LTM Cell Switch Command MAC CE is identified by MAC subheader with eLCID as specified in Table 6.2.1-1b. It has a variable size with following fields (Figure 6.1.3.75-1):  - R: Reserved bit, set to 0;  - Target Configuration ID: This field indicates the index of candidate target configuration to apply for LTM cell switch, corresponding to *ltm-CandidateId* minus 1as specified in TS 38.331 [5]. The length of the field is 3 bits;  - Timing Advance Command: This field indicates whether the TA is valid for the LTM target cell (i.e. the SpCell corresponding to the target configuration indicated by Target Configuration ID field). If the value of this field is set to FFF, this field indicates that no valid timing adjustment is available for the PTAG of the LTM target cell; otherwise, this field indicates the index value *TA* used to control the amount of timing adjustment that the MAC entity has to apply in TS 38.213 [6], and that the UE can skip the Random Access procedure for this LTM cell switch. If *tag-Id-ptr* is configured for the TCI state indicated by the UL TCI state ID field, if present, or by the TCI state ID field otherwise, in the LTM target cell and *tag-Id-ptr* is set to value *n1*, this field indicates the TA for the TAG indicated by the *tag2-Id* of the LTM target cell; otherwise, this field indicates the TA for the TAG indicated by the *tag-id* of the LTM target cell. The length of the field is 12 bits; |

Since we have not discussed the same issue for inter-CU LTM, an FFS is kept for whether to follow the same principle as Rel-18 intra-CU LTM.

***Question1: Do companies agree that, the Rel-19 inter-CU LTM follows the same handling as Rel-18 intra-CU LTM on coexistence issues? In detail, Rel-19 inter-CU LTM could coexist with CovE, (e)RedCap and MIMO 2 TA while couldn’t coexist with NRU/NES.***

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Xiaomi | Yes | Support to follow the same handling as Rel-18 intra-CU LTM on coexistence issues without extra specification impact. If there are some specification efforts, it can be revisited. |
| MediaTek | Yes |  |
| Huawei, HiSilicon | Yes, but | OK with CovE and REDCAP, but should leave it open for MIMO 2TA whether it should co-exist with inter-CU LTM. This might be related to a more general discussion on the co-existence between inter-CU LTM and mTRP.  For NRU and NES, there is no related procedure in RACH resource set selection??? |
| CATT | Yes |  |
| OPPO | Yes |  |
| NEC | Yes | There seems to be no blocking issue to do so. |
| Apple | Yes, but | Agree with Huawei that the coexistence between LTM and MIMO (mTRP) needs to further check with RAN1. At least for the measurement part, the coexistence between mTRP and L1 LTM event triggered measurement is FFS. |
| ZTE | Yes | We think the current specification is also applicable for inter-CU case, so far, we haven’t seen additional change is needed. |
| Ericsson | Yes | We think current specification applies also to inter-CU LTM without any changes. |

For Rel-18 intra-CU LTM, we agreed the CFRA resource for cell switch could be provided in LTM Cell Switch MAC CE, which is as follows:



Figure 6.1.3.75-1: LTM Cell Switch Command MAC CE

Since we have not discussed the same issue for inter-CU LTM, an FFS is kept for whether the CFRA resource could also be included in the LTM Cell Switch Command MAC CE for inter-CU LTM.

***Question2:* Whether the CFRA resource configuration could be included in LTM cell switch command MAC CE for inter-CU LTM?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Xiaomi | Yes |  |
| MediaTek | Yes |  |
| Huawei, HiSilicon | Yes |  |
| CATT | Yes |  |
| OPPO | Yes |  |
| NEC | Yes |  |
| ZTE | Yes |  |
| Apple | Yes |  |
| Ericsson | Yes |  |

***Rapporteur believe other open issues on inter-CU LTM could be discussed based on companies contributions.***

## 2.2 L1 event triggered measurement reporting

In RAN2#126 meeting, we reached the following agreements on LTM event evaluation:

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| --- |
| For LTM event evaluation, TTT, hysteresis for entering/leaving, and/or beam specific (FFS for cell specific) offset can be applied. FFS on the need of measurement reporting once leaving condition is met. |

An FFS that whether the cell specific offset is used for the L1 event evaluation. Though in the later RAN2#127 meeting, we agreed *Beam level measurement result, not cell level measurement result, is used LTM event evaluation*. It does not exclude the corresponding cell specific offset, since UE could also consider the cell specific offset for beam measurement results.

Based on the above, we would like to ask the following question:

***Question3: Do companies agree that the cell specific offset is used for LTM L1 event evaluation?***

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Xiaomi | No | The gNB is able to control the L1 measurement report for each beam separately by using the beam specific offset and the L1 measurement event is triggered by beam-level measurement result. Beam specific offset is sufficient, and there is no need to have cell specific offset. |
| MediaTek | No | It is not clear how to use cell specific offset if cell level measurement result is not used. |
| Huawei, HiSilicon | No | CIO is for cell measurement quantity |
| CATT | No |  |
| OPPO | No |  |
| NEC | No | This may be useful only when cell level measurement result is agreed. |
| Apple | No | As the L1 LTM event triggered measurement framework is beam specific, and almost all companies proposed the beam specific offset in their proposal, we can just go for the beam specific offset and exclude the cell specific offset config. |
| ZTE | Yes | Cell specific offset means a single offset value that applies to all the beams of a candidate cell.  From network perspective, it is possible to prioritize (or deprioritize) one candidate cell among all the configured candidates, this is usually done by configuring a cell specific offset. If we don’t introduce cell specific offset to L1 measurement, it means NW has to configure the same offset value for all the beams of that candidate, this increases the signalling overhead. |
| Ericsson | No | In our view the offset per beam will be enough. |

RAN1 has agreed the L1-RSRP measurement is used for event triggered reporting which is as follows:

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| --- |
| Agreement   * SSB based L1-RSRP measurements is supported for event triggered reporting * CSI-RS based L1-RSRP measurements is supported for event triggered reporting * FFS: CSI-RS based L1-SINR measurements is supported for event triggered reporting   **Conclusion**  There is no consensus in RAN1 on the support L1-SINR measurement based on CSI-RS for candidate cells |

In the legacy L3 measurement based event triggered report, the “trigger quantity” could be different from the “report quantity” [2]:

|  |
| --- |
| For cell and beam measurements, reporting quantities can be any combination of quantities (i.e. only RSRP; only RSRQ; only SINR; RSRP and RSRQ; RSRP and SINR; RSRQ and SINR; RSRP, RSRQ and SINR; only RSCP; only EcN0; RSCP and EcN0), irrespective of the trigger quantity, and for CLI measurements, reporting quantities can be either SRS-RSRP or CLI-RSSI. |

However, there is no report quantity in Rel-18 LTM L1 measurement, in this case, the UE always performs L1-RSRP measurement. According to the RAN1 agreement, it seems the L1-SINR may be introduced for Rel-19 LTM. While for simplicity, the trigger quantity for LTM L1 event triggered measurement should be the same as the report quantity. In this way, there is no need to introduce the report quantity.

***Question4: Do companies agree that the trigger quantity for LTM L1 event triggered measurement should be the same as the report quantity?***

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Xiaomi | Yes |  |
| MediaTek | Yes |  |
| Huawei, HiSilicon |  | Can wait for R1 progress. Now, R1 has only agreed on RSRP. Only if in the future some other quantities are defined, there is necessity to discuss the question. Otherwise, both triggering and report quantity will be RSRP |
| CATT | Yes |  |
| OPPO | Yes |  |
| NEC | Yes |  |
| ZTE | Yes |  |
| Apple | Yes |  |
| Ericsson | Yes |  |

***Rapporteur believe other open issues on L1 event triggered measurement report could be discussed based on companies contributions.***

## 2.3 Conditional LTM

***Rapporteur believe all open issues could be discussed based on companies contributions.***

# 3 Examining the running CR

This section is used to collect general comments on Running MAC CR for Mob Ph4.

***Question6: Any comments on the running CR?***

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| --- | --- | --- |
| **Company** | **Issue** | **Suggestion** |
| Xiaomi | In 5.2x of the running CR, some sentences as follows:  “start or restart the *ltm-Candidate-TimeAlignmentTimer* associated with **the indicated LTM candidate cell**”  This may lead to the misunderstanding that *ltm-Candidate-TimeAlignmentTimer* is per candidate cell.  However, whether the LTM Candidate TA timer is per candidate cell or per candidate TAG is FFS. | Suggest to add Editor’s NOTE for the open issue. |
| Xiaomi | In 5.y.2 of the running CR, some wording as follows:  “if the **eventLTM3 or eventLTM5** is configured in the corresponding ltm-CSI-ReportConfigId **for l1-Conditions**:”  For CLTM L1 conditions, the following agreement has been reached:  “**Event LTM3-like and LTM5-like** are used as the conditional LTM execution condition.”  As in L3, LTM events configured for L1 MR and CLTM shall be independent. | L1 LTM events associated with CLTM can be indicated by different fields, e.g., condEventLTM3 /condEventLTM5, like condEventA3/A5 for CHO. |
| Xiaomi | In 5.x.4, “if UL-SCH resources are available for a new transmission in the SpCell and these UL-SCH resources can accommodate the L1 measurement report MAC CE plus its subheader as a result of logical channel prioritization:”  We’re not sure there is agreement to restrict that L1 measurement report MAC CE can only be transmitted in SpCell. | Some discussion is needed on whether to restrict that L1 measurement report MAC CE can only be transmitted in SpCell. |
| MediaTek | Please refer to the comments in the MAC CR for details. |  |
| Apple | Section 5.2x  1) Whether UE is required to maintain the new TATimer per candidate cell needs further discussion.  2) The usage of “FFF” in LTM candidate TAC MAC CE is not discussed in RAN2. So it should be removed from the procedural text. |  |
| Apple | Section 5.2, about the description of candidate cell’s TA validity  As the candidate cell’s TA and TATimer maintenance is captured in 5.2x, we can capture all related behaviour in this new section, and clarify the TA validity is based on whether the new TATimer is running or not.  And in section 5.2, when CLTM cell switch is triggered, TA validity description can just refer to the section 5.2x. |  |
| Apple | Section 5.2, about the CLTM cell switch trigger  The CLTM cell switch is triggered not only based on MAC evaluation but also based on RRC evaluation.  So the description only referring to clause 5.y.2 in MAC spec is not enough. |  |
| Apple | Section 5.2, about the TATimer operation of the target cell when CLTM cell switch is triggered.  According to current description as below, UE will start the TATimer directly, and refer to LTM CS command section.    1) The reference to section 6.1.3.75 is wrong.  2) Whether to start the TATimer directly may need further discussion. |  |
| Apple | Section 5.8.2 about the supported RS type and the associated CG resource  Current description only indicates the SSB associated with the TCI state and use it to find the associated CG resource.  With the support of CSI-RS, the CSI-RS can be associated with TCI state, and MAC spec may need to cover the CSI-RS in this section.  For example, the SSB below may needs to extend to cover CSI-RS? |  |
| Apple | Section 5.8.2 about the beam selection for CG transmission.  In current description, during the RACH-less CLTM, for the beam selection to determine the CG resource for 1st UL transmission, it applies the same way as R18 RACH-less LTM, i.e. based on RSRP threshold.  As the beam selection for the 1st UL transmission in RACH-less CLTM (for both CG and DG) are still open, maybe wen can add an Editor’s NOTE here to say it needs further discussion/confirmation in RAN2. |  |
| Apple | Section 5.12 MAC reset  1) The new branch for CLTM is not needed. All the operation can be covered by current description.  2) The L1 event triggered measurement operation can be simplified to one bullet. |  |
| Apple | Section 5.x.4, about triggering SR operation  We can just indicate in this section to trigger SR for L1 MR MAC CE purpose. And in section 5.4.4 (SR) it will describe whether to select the dedicated SR or RACH for it. |  |
| Apple | Section 5.x.4, about the truncated L1 MR MAC CE condition  Current condition needs further discussion, since how to assemble truncated L1 MR MAC CE depends on the UL grant size. |  |
| Apple | Section 5. x.1  This L1 event measurement report section is also applicable for CLTM condition evaultion, so we should also address this part in the instruction part. |  |
| Apple | Section 5.y.2  The CLTM L1 event condition evaluation can be merged into the 5.x |  |
| Apple | Section 5.y.3  The MAC operation in this section, especially on the interaction between MAC and RRC, can be described more clearly.  Our understanding on the interaction between MAC and RRC is like this:  MAC decides CLTM condition is met, and inform RRC/Upper layer, as the UE oepration when receiving the LTM CS command;  RRC decides to apply the target cell’s configuration and initiates the cell switch exeuction (it can be based on L1 or L3 condition).  3) when RRC inform MAC to initaites cell switch exeuction, MAC can check the current TA/TCI information to decides whether to start RACH-less or RACH based LTM cell switch. |  |
| Apple | Section 5.4.3.1.3 (LCP)  The new L1 MR MAC CE should be added in the LCP priority list.  *Logical channels shall be prioritised in accordance with the following order (highest priority listed first):* |  |
| Ericsson | From the MAC CR it seems that for the L1 measurement RRC variable are used (lower case letters) but this would require an unnecessary MAC-RRC coordination, which was not even agreed. This could very well be just a typo. | We should use MAC variables rather than RRC variable for the L1 measurements. |
| Ericsson | The L1 report MAC CE design seems to have some serious drawback. In the proposed version, no spare bits are available per beam report and this means that some information may be missing. For instance, we have agreed to report measurements when a cell meets the leaving condition, but if the UE does not indicate which cell met the leaving condition this information would not be useful. Also, we have agreed to report beams which did not meet the event criteria, but we should also tag such beams in order to not give misleading information to the network. This is why we have earlier proposed to not use SSBRI as beam identifier. | The L1 report MAC CE format should be further discussed. Maybe we can leave an FFS and discuss this based on company contributions. Differential reporting of RSRP might help. |

4 Conclusion

Based on the discussion above, we propose that

5 Reference

1. TS 3GPP 38.321 V18.4.0
2. TS 3GPP 38.331 V18.4.0