**3GPP TSG-RAN WG2 Meeting #131 R2-250xxxx**

**Bangalore, India, 25th – 29th Aug. 2025**

**Source: vivo**

**Title: Discussion summary and list of MAC open issue for Mob Ph4**

**Agenda Item: 8.6.1**

**Document for: Discussion and Decision**

1. Introduction

This document summarizes the discussion of the following email discussion and collects the MAC open issues for mobility Enhancements.

* [POST130][111][MOB] (Vivo)

**Scope:** Update 38.321 running CR (also including this meeting’s agreements and latest other WGs’ inputs) and remaining essential MAC open issues.

**Intended outcome:** 38.321 running CR and remaining essential MAC open issues.

**Deadline:** Long email discussion.

Companies are invited to provide comments/additional issues in the below table by 31st July, 2025.

# Discussion

* 1. Part I – New issues related to running CR

**Open issue MAC-20 (essential): How to design the MAC CE to activate/deactivate the SP CSI-RS resource for LTM CSI acquisition for candiate cells based on RAN1 LS**

In RAN2#130 meeting, the LS from RAN1 on the support of SP CSI-RS resource for LTM CSI acquisition for candidate cells was discussed as below, and we have the following open issue that whether a same MAC CE is used for both RRM measurement and early CSI acquisition purpose.

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| R2-2503311 LS on the support of semi-persistent CSI-RS resource for LTM CSI acquisition for candidate cells (R1-2503079; contact: Fujitsu) RAN1 LS in Rel-19 NR\_Mob\_Ph4-Core To:RAN2, RAN3   * MAC CR rapporteur will take it into account. * Noted.   **[CB session]:**  [Vivo]: We haven’t decided whether a same MAC CE is used for both RRM measurement and early CSI acquisition purpose. Would like RAN2 to make decision to prepare MAC running CR. [Ericsson]: Before RAN2 makes decision, we would like to see more RAN1 inputs (e.g. related RRC configuration). MAC CR rapporteur can take RAN1 inputs into account in the preparation of MAC running CR (directly including discussion on this issue).   * MAC CR rapporteur can discuss this issue (whether a same MAC CE is used for both RRM measurement and early CSI acquisition purpose) with the consideration of further RAN1 inputs, in running CR preparation. |

According to the latest Rel-19\_higher\_layer\_parameters\_list\_RAN1 [1], the CSI report configuration could be summarized as follows:

The CSI report is configured in *LTM-Candidate-r18* for a certain candidate cell via the current IE *ltm-CSI-ReportConfig-r18*, in this case the UE ignores the fields *ltm-ReportConfigType* and *ltm-ReportContent* for early CSI acquisition purpose;

In order to differentiate the the CSI acquisition and RRM, the *reportQuantity-r19* with CHOICE {cri-RSRP ssb-Index-RSRP, cri-RI-PMI-CQI} is introduced in current *ltm-CSI-ReportConfig-r18.*

And according to the following RAN1 agreements on CSI-RS measurement for CSI acquisition:

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| **RAN1#120**   1. After the RRC configuration and before the reception of CSC, the UE may measure CSI based on the configured CSI-RS resource(s), which is subject to UE capability  * FFS: whether or how to select a subset of CSI-RS resources to measure * FFS: when the UE may start measuring the configured CSI-RS resources  1. UE determines the CSI report configuration based on the CSC 2. After the reception of cell switch command, the UE may measure (depending on the timeline) CSI-RS resource(s) associated with determined CSI report configuration   **RAN1#120bis**  **[FL proposal 5-3-1-v3]**  Regarding CSI acquisition, for a candidate cell,   * A single CSI report configuration is configured * Multiple CSI-RS resources for CMR can be associated with the CSI report configuration   + The number of CSI-RS resources for CMR is subject to UE capability   **Agreement**  For candidate cell CSI acquisition   * In addition to periodic CSI-RS resource, semi-persistent CSI-RS resource is supported   + Support of semi-persistent CSI-RS resource is subject to separate UE capability. * MAC CE is used to activate/deactivate the semi-persistent CSI-RS resource similarly to the legacy mechanism for a serving cell which will be specified in RAN2   Send an LS to RAN2 and RAN3 to inform this agreement |

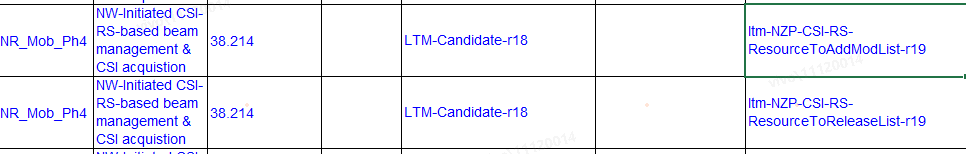
For a UE configured with LTM candidate configuration, if the UE has the capability to measure CSI before receiving CSC, it would measure CSI for the LTM candidate cell(s) which has the *ltm-CSI-ReportConfig-r18* in its *LTM-Candidate* and measure CSI based on the *ltm-CSI-ReportConfig-r18*. And after the reception of CSC, the UE may only measure CSI based the *ltm-CSI-ReportConfig-r18* in *LTM-Candidate* of target cell.

Based on the CSI report configuration as below, it is associated with the CSI-RS resource configured in *LTM-CSI-ResourceConfig*.

In the *LTM-CSI-ResourceConfig* in current RRC running CR [2], it has the CSI-RS resources which includes SP CSI-RS configured in the *LTM-NZP-CSI-RS-ResourceSet* as below:

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| LTM-CSI-ResourceConfig-r18 ::= SEQUENCE {  ltm-CSI-ResourceConfigId-r18 LTM-CSI-ResourceConfigId-r18,  ltm-SSB-ResourceSet-r18 LTM-SSB-ResourceSet-r18,  ... ,  [[  ltm-NZP-CSI-RS-ResourceSet-r19 LTM-NZP-CSI-RS-ResourceSet-r19 OPTIONAL, -- Need R  resourceType-r19 ENUMERATED {periodic, semi-persistent} OPTIONAL -- Cond CSI-RS  ]]  }  ….  LTM-NZP-CSI-RS-ResourceSet-r19 ::= SEQUENCE {  ltm-CSI-RS-ResourceList-r19 SEQUENCE (SIZE (1..maxNrofLTM-CSI-ResourcesPerSet-r19)) OF NZP-CSI-RS-ResourceId,  ltm-CandidateIdList-r19 SEQUENCE (SIZE (1..maxNrofLTM-CSI-ResourcesPerSet-r19)) OF LTM-CandidateId-r18,  ...  } |

And according to latest Rel-19\_higher\_layer\_parameters\_list\_RAN1, the CSI-RS resource for *LTM-NZP-CSI-RS-ResourceSet* is referred to the pool of *NZP-CSI-RS-Resource* of a candidate cell in *LTM-Candidate,* which could be used for NW-Initiated CIS-RS-based beam management and CSI acquisition as below:



Based on above, it could be observed that the configured CSI-RS in *LTM-NZP-CSI-RS-ResourceSet* could be used for both RRM measurement and early CSI acquisition purpose, and since there is no conclusion that the *LTM-CSI-ResourceConfig* configured for RRM measurement couldn’t be also associated to *ltm-CSI-ReportConfig* used for CSI acquisition. Besides, the same mechanism is used for Rel-15 serving cell RRM measurement and CSI acquisition on the CSI-RS resource configuration, and the same MAC CE is used for both RRM measurement and early CSI acquisition purpose in Rel-15.

Thus, rapporteur suggests:

**Rapporteur Proposal 1: Same SP CSI-RS Resource Set Activation/Deactivation MAC CE is used for both RRM measurement and early CSI acquisition purpose.**

**Companies are invited to provide your views on whether agree the above rapporteur proposal 1.**

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| **Company** | **Yes/No** | **Comments, if any** |
| Baicells |  | ‘*For a UE configured with LTM candidate configuration, if the UE has the capability to measure CSI before receiving CSC, it would measure CSI for the LTM candidate cell(s) which has the ltm-CSI-ReportConfig-r18 in its LTM-Candidate and measure CSI based on the ltm-CSI-ReportConfig-r18.*’  Does the above sentence mean the UE can apply the *ltm-CSI-ReportConfig-r18* configured in the LTM candidate for CSI acquisition while the UE is still in the source cell? |
| NEC | Yes |  |
| Xiaomi | Yes |  |
| Nokia | Yes, but | For RRM measurements, since the CSI-RS resource set can include RSs from multiple candidate cells, the MAC CE should indicate which cells the SP CSI-RSs are being activated for.  Otherwise, it would be unreasonable to activate SP CSI-RSs from multiple candidate cells (up to 8) simultaneously. |
| MediaTek | Yes | Regarding to Baicells’ question, it seems UE measures candidate CSI should not be based on *ltm-CSI-ReportConfig-r18*, but referring to *ltm-NZP-CSI-RS-ResourceXXXXX-r19* provided in *LTM-Candidate-r18*. |
| LGE | Yes |  |
| Samsung | Comments | UE might have different capability to measure early CSI than RRM for LTM for the same candidate cell. It means UE may have no capability to measure CSI before receiving CSC. Then UE could measure the CSI after CSC is received for a candidate cell.  In this case, if we introduce the same SP CSI-RS Resource Set Activation/Deactivation MAC CE for early CSI and LTM purpose, UE have different behavior upon receiving this MAC CE:  - For RRM LTM: UE starts to measure the activated SP CSI-RS resources  - For early CSI acquisition: UE do not measure the activated SP{ CSI-RS but UE starts to measure this RSs after receiving CSC.  In addition, we agree with Nokia’s comment that there would be RSs from multiple candidate cells for LTM RRM purpose. So, we think it would be better to differentiate the function introducing the new MAC CE for early CSI. |
| ZTE | Yes with comments | Based on RAN1 conclusion, the CSI-RS resource (not CSI-IM resource) can be used for both RRM and CSI acquisition, and CSI-IM resources are only used for CSI acquisition. Since CSI resources for both RRM and CSI acquisition are configured by the same IE, i.e. LTM-CSI-ResourceConfig, it is Ok to use the same MAC CE for SP CSI-RS activation/deactivation.  In our understanding, for a given SP CSI-RS resource, once activated, the UE is able to perform L1 RRM and/or CSI acquisition on it. But whether the UE needs to do both still based on the reporting configuration and corresponding UE capability (e.g. whether UE is able to measure it before CSC for early acquisition). So, in Samsung’s example, if the UE does not support measuring CSI before CSC, then the UE is not required to do so before receiving CSC. But different UE capabilities should not impact the way of sending activation MAC CE, so, we don’t see the need of having separate MAC CEs unless the activation granularity will be different.  Regarding Nokia’s comment, if the CSI-RS resource set configured for early CSI acquisition contains CSI-RSs from multiple candidates, if the UE is only able to measure CSI after LTM CSC, then the UE is only required to measure the RSs of target candidate cell and ignore other RSs. Actually, this issue is not specific for SP CSI-RS, it is common also for periodical CSI-RS resource set. If needed, we can ask RAN1 for confirmation. |
| Lenovo | Yes | On ZTE/Samsung comments:  After consulting with my RAN1 colleague, all the CSI-RS resources related to one LTM-CSI-ResourceConfigId cannot be applied to both RRM and CSI acquisition. Namely, the CSI-RS resources from multiple candidate cells related to one LTM-CSI-ResourceConfigId is applied to either RRC measurement or CSI acquisition. But we still think common MAC CE is sufficient.  Based on the above understanding, NW can activate LTM-CSI-ResourceConfigId based on the UE capability. Even NW activates the resource exceeding the UE capability, it is UE implementation to measure a part of the activated resource. Alternactively, UE can start to measure the resource related to only target cell after receiving CSC.  Regarding Baicells comments, it is possible that UE starts measurement for CSI acquisition for the candidate cell before leaving source cell based on the RAN1 agreement. |
| Ericsson | Yes | Actually we agree with ZTE. Here we need to differenciate the measuring part and the reporting part.  For the measuring part, which is related to the activation of the resources, if a UE is capable of measuing those reference signal for RRM we don’t see the point why it should not be able to measure those for CSI acquisition. But even is this is the case, UE just report what is able to measure and therefore is network activate resource that UE cannot measure that so be it.  For the reporting part, we think that this is already clear as the report configuration for RRM and CSI acquisition are configured in different parts of the ASN.1.  [Lenovo]  CSI-RS for L1 measurement is a CSI-RS resource in an NZP-CSI-RS-ResourceSet configured with higher layer parameter repetition, CSI-RS for CSI acquisition is a CSI-RS resource in an NZP-CSI-RS-ResourceSet configured without higher layer parameter trs-Info and without the higher layer parameter repetition.  RAN1 only specified how the UE calculates the L1-RSRP based on a CSI-RS used for beam mangement, and only the CSI-RS resource with one or two port can be used for L1 measument. However, CSI-RS for CSI acquisition is usually configured with more than 2 ports and can be up to 128 ports. RAN1 does not specify how the UE calculates the L1-RSRP based on the CSI-RS resources other than used for beam mangement. And the UE cannot calculate the L1-RSRP based on a CSI-RS resource configured with more than two ports.  The above is just to make our understanding on the same page. We still support the proposal with same MAC CE even it is the case. |
| Apple | Yes | With the assumption that the different LTM CSI resource configurations are used for measurement and CSI acquisition, common MAC CE design is sufficient. |
| Huawei | Yes |  |
| Ofinno | Yes |  |

**Summary:**

**x companies provided the comments:**

x

With this, x

**Proposal 1: (x/x) x.**

Besides, based on the latest Rel-19\_higher\_layer\_parameters\_list\_RAN1, the CSI-IM-Resource of a candidate cell is also introduced for IMR measurement of candidate cells as below in the latest RRC running CR:

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| LTM-CSI-ResourceConfig-r18 ::= SEQUENCE {  ltm-CSI-ResourceConfigId-r18 LTM-CSI-ResourceConfigId-r18,  ltm-SSB-ResourceSet-r18 LTM-SSB-ResourceSet-r18,  ...,  [[  ltm-NZP-CSI-RS-ResourceSet-r19 LTM-NZP-CSI-RS-ResourceSet-r19 OPTIONAL, -- Need R  ltm-CSI-IM-ResourceSet-r19 LTM-CSI-IM-ResourceSet-r19 OPTIONAL, -- Need R  resourceType-r19 ENUMERATED {periodic, semiPersistent} OPTIONAL -- Cond CSI-RS  ]]  }  LTM-SSB-ResourceSet-r18 ::= SEQUENCE {  ltm-SSB-ResourceList-r18 SEQUENCE (SIZE (1..maxNrofLTM-CSI-ResourcesPerSet-r18)) OF SSB-Index,  ltm-CandidateIdList-r18 SEQUENCE (SIZE (1..maxNrofLTM-CSI-ResourcesPerSet-r18)) OF LTM-CandidateId-r18,  ...  }  LTM-NZP-CSI-RS-ResourceSet-r19 ::= SEQUENCE {  ltm-CSI-RS-ResourceList-r19 SEQUENCE (SIZE (1..maxNrofLTM-CSI-ResourcesPerSet-r18)) OF NZP-CSI-RS-ResourceId,  ltm-CandidateIdList-r19 SEQUENCE (SIZE (1..maxNrofLTM-CSI-ResourcesPerSet-r18)) OF LTM-CandidateId-r18,  ...  } |

And the IMR is also a CSI acquisition, which has a same LTM report configuration for other CSI acquisition as below in the latest RRC running CR:

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| LTM-CSI-ReportConfig-r18 ::= SEQUENCE {  ltm-CSI-ReportConfigId-r18 LTM-CSI-ReportConfigId-r18,  ltm-ResourcesForChannelMeasurement-r18 LTM-CSI-ResourceConfigId-r18,  <--Skip-->  ltm-ReportContent-r18 LTM-ReportContent-r18,  ...,  [[  ltm-ReportContent-v19xy LTM-ReportContent-v19xy OPTIONAL, -- Need R  ltm-ResourceForInterferenceMeasurements-r19 LTM-CSI-ResourceConfigId-r18 OPTIONAL, -- Need R  ]]  } |

Based on the configuration from RAN1, the CSI-RS for IMR measurement could as be semi-persistent, and following the same mechanism in Rel-15 Activation/Deactivation of Semi-persistent CSI-RS/CSI-IM resource set MAC CE design, rapporteur suggests:

**Rapporteur Proposal 2: SP CSI-RS Resource Set Activation/Deactivation MAC CE could be also used to activate and deactivate the configured semi-persistent CSI-IM resource sets of a LTM candidate cell.**

**Companies are invited to provide your views on whether agree the above rapporteur proposal 2.**

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| **Company** | **Yes/No** | **Comments, if any** |
| Baicells |  | The same confusion as above. |
| NEC | Yes |  |
| Xiaomi | Yes |  |
| Nokia | Yes | MAC CE activating a SP CSI-RS resource set for early CSI acquisition should also contain the associated CSI-IM resource set (optional). It would be the same as in the legacy MAC CE that is used for SP CSI-RS/CSI-IM activation. |
| MediaTek | Yes |  |
| LGE | Yes |  |
| Samsung | Yes but | Agree with Nokia, plus we think this CSI-IM resource set is not needed for LTM RRM purpose because only RSRP is used for determining the LTM cell switch. So, if we decide to introduce the separate two SP CSI-RS Resource Set Activation/Deactivation MAC CEs for RRM and early CSI, the CSI-IM resource set could be skiped for RRM case. |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| Ericsson | Yes |  |
| Apple | Yes | We share Samsung’s view.  Since the usage of CSI-IM resource sets is specified in RAN1 spec, we are fine with the proposal 2 and assume there is no RAN2 spec impact. |
| Huawei, HiSilicon | Yes | About Nokia's comment: LTM CSI resource sets have no ID, each LTM CSI resource includes the definition of one CSI-RS resource set or of one LTM CSI-IM resource set, so what will be indicated is just an LTM CSI resource ID |
| Ofinno | Yes |  |

**Summary:**

**x companies provided the comments:**

x

With this, x

**Proposal 1: (x/x) x.**

**Open issue MAC-21: Whether indicate the selected RS index to the lower layer for RACH-less CLTM.**

In RAN2#130 meeting, whether UE needs to determine the target TCI state upon the RACH-less conditional LTM execution and indicate it to lower layer was discussed as below:

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| R2-2503411 Discussion on Conditional Intra-CU LTM CATT discussion Rel-19 NR\_Mob\_Ph4-Core  Proposal 9: Send LS to RAN1 to confirm whether UE needs to determine the target TCI state upon the RACH-less conditional LTM execution and indicate it to lower layer.   * Can be treated as part of running CR discussion. |

In the current running CR, during CLTM execution, the RS is selected for RACH-less CLTM as described in 5.y.3. Rapporteur understands the selected RS should be informed to the lower layer to determine the QCL assumption for DL channel/RS reception after CLTM. Thus, the corresponding part was captured in 5.8.2 as below, similar as the legacy LTM procedure:

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| 1> if a SSB corresponding to the configured UL grant has the same SSB index as the selected SSB, as specified in clause 5.y.3:  2> indicate the SSB index to the lower layer;  2> consider this configured uplink grant as valid.  1> if a CSI-RS associated with SSB corresponding to the configured UL grant has the same CSI-RS index as the selected CSI-RS, as specified in clause 5.y.3:  2> indicate the CSI-RS index to the lower layer;  2> consider this configured uplink grant as valid. |

**Companies are invited to provide your views on whether agree the above text in running CR.**

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| **Company** | **Yes/No** | **Comments, if any** |
| Baicells | Yes |  |
| NEC | See comment | Prefer to use the similar wording as used in Rel-18, i.e., TCI state in LTM cell switch command MAC CE which can be associated with either SSB or CSI-RS:  1> if an SSB corresponding to the configured UL grant has the same SSB index as the SSB associated with the TCI state indicated by the TCI state ID field in (Enhanced) LTM Cell Switch Command MAC CE, as specified in clause 5.18.35:  2> select the SSB associated with the TCI state indicated by (Enhanced) LTM Cell Switch Command MAC CE.  2> indicate the SSB index to the lower layer;  And suggest to merge and update the the two branches as below:  1> if a SSB corresponding to the configured UL grant has the same SSB index as the selected SSB or the SSB associated with the selected CSI-RS, as specified in clause 5.y.3:  2> indicate the SSB index to the lower layer;  2> consider this configured uplink grant as valid. |
| Xiaomi | Yes |  |
| Nokia | Agree with the Rapporteur’s understanding |  |
| MediaTek | Yes | And agree with NEC’s comment |
| LGE | Yes |  |
| Samsung | No strong view |  |
| ZTE | Yes |  |
| Lenovo | Yes | It is better to merge them as NEC said. |
| Ericsson | Yes |  |
| Apple | Yes |  |
| Huawei, HiSilicon | See comments | In Rel-18, the condition is:  1> if an SSB corresponding to the configured UL grant has the same SSB index as the SSB associated with the TCI state indicated by the UL TCI state ID field, if present, or by the TCI state ID field otherwise, in the LTM Cell Switch Command MAC CE, as specified in clause 21.1 in TS 38.213 [6]:  2> select the SSB associated with the TCI state indicated by LTM Cell Switch Command MAC CE.  2> indicate the SSB index to the lower layer;  So:  1) it is better to align with this the wording for conditional LTM, e.g.  1> if an SSB corresponding to the configured UL grant has the same SSB index as the SSB associated, as specified in clause 21.1 in TS 38.213 [6], with the SSB or CSI-RS selected according to 5.y.3, as  (we don't need two conditions, moved the reference to TS 38.213 next to "associated", because this is what is described in TS 38.213)  2) in Rel-18, even when CSI-RS is used in the TCI state, what is indicated to lower layer is anyway SSB, so we wonder whether it should not be the same in Rel-19 (e.g. because, CG occasions are associated with SSBs to the network is only aware of a good SSB and using a narrower beam for inital transmission is risky). If there is any doubts, we should ask RAN1. |
| Ofinno | Yes |  |

**Summary:**

**x companies provided the comments:**

x

With this, x

**Proposal 1: (x/x) x.**

**Open issue MAC-22: whether multiple MR should be triggered and wether only one or multiple L1 measurement report MAC CE should be generated in case multiple beams associated with an LTM report configuration satisfies triggering condition for TTT.**

Before RAN2#130 meeting, LG commented that it is not crystal clear for the case multiple beams associated with an LTM report configuration satisfies triggering condition for TTT at adjacent times: whether multiple MR should be triggered and wether only one or multiple L1 measurement report MAC CE should be generated. Details could be found in section MAC-LG1 in [R2-2504639]. Rapporteur thinks it is necessary to align the understanding with all companies to ensure everyone is on the same page.

In this caes, rapporteur understands in this case, multiple MR will be triggered and only one L1 measurement report MAC CE will be generated, i.e. option 2 in LG’s contribution, which is captured in the current running CR as below:

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| In 5.x.3: //there may be multiple triggering beam, each one will initiate the measurement report in 5.x.4  2> if the entry condition for the event associated with *ltm-CSI-ReportConfigId* is fulfilled for one or more applicable beams, i.e. reference signalling associated with *SSB-Index* or *NZP-CSI-RS-ResourceID* in the *LTM-CSI-ResourceConfig* associated with the *LTM-CSI-ReportConfig*, which is not in the *BEAM\_TRIGGERED\_LIST*,for the measurement from lower layer during *timeToTrigger* defined for this event:  ….  3> initiate the measurement reporting procedure, as specified in 5.x.4.  2> else if the leaving condition for the event associated with *ltm-CSI-ReportConfigId* is fulfilled for one or more applicable beams included in the *MR\_LIST* for the measurement from lower layer during *timeToTrigger* defined for this event:  ….  4> initiate the measurement reporting procedure, as specified in 5.x.4;  In 5.x.4: // when there is UL grant, MR MAC CE will be generated. At this time there may be more than one measurement report has been triggered as in 5.x.3.  1> if at least one L1 measurement report has been triggered as specified in 5.x.3 and not cancelled:  2> if UL-SCH resources are available for a new transmission in the serving cell and these UL-SCH resources can accommodate the L1 measurement report MAC CE plus its subheader as a result of logical channel prioritization:  3> instruct the Multiplexing and Assembly procedure to generate the L1 measurement report MAC CE associated with the *ltm-CSI-ReportConfigId* as befined in clause 6.1.3.x according to the measurement report information in the *MR\_LIST*;  … |

**Companies are invited to provide your views on 1) whether agree with rapporteur’s understanding, and 2) if yes, whether the current text in the running CR is clear enough.**

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| --- | --- | --- | --- |
| **Company** | **Yes/No on 1)** | **Yes/No on 2)** | **Comments, if any** |
| **Baicells** | **Yes** | **Yes** |  |
| **NEC** | **Yes** | **Yes** | **We are also fine with Option 3 to have single measurement report being triggered per report configuration ID.** |
| **Xiaomi** | **Yes** | **Yes** |  |
| Nokia | Yes | Yes | We have agreed to signal different beam types in MR MAC CE. So in our understanding, it is possible to include multiple triggering beams in the same MR MAC CE, if the UL grant is sufficient. That should be a default option if the scenario described above occurs. |
| **MediaTek** | Yes | Yes | Prefer current running CR (i.e., option2 from LG).  For option3 from LG, not sure if it means only one beam measurement result per MAC CE or how to make sure the UL grant is enough for multiple beams results. |
| **LGE** | **Yes** | **See comments** | We think option2 is fine. One thing to note is that these behavours are applicable only for the MRs triggered by the same LTM report config. That is, if MRs are triggered by the different LTM report configs, those MR should be treated independently. We think this intention is implicitly written in the heading sentence just prior to the“1> if at least one L1 measurement report has been triggered…” in section 5.x.4.  For the event triggered L1 measurement reporting, for each *ltm-CSI-ReportConfigId* of the serving cell included in the *LTM-CSI-ReportConfig*, the MAC entity shall:  1> if at least one L1 measurement report has been triggered as specified in 5.x.3 and not cancelled:  This green part may work if read carefully. Instead we can consider adding a Note to clarify this for better clarity. |
| Samsung | Yes | Yes |  |
| ZTE | Yes | See comments | We agree with the principle, but we think the current CR is not crystal clear about the handling of different types of beams.  For example, in the running CR, the MR\_LIST only includes the beam that the L1 measurement report triggering conditions have been met for TTT, i.e. Type 1 and Type 3 beams. So it’s unclear how does the UE generate the MR MAC CE to include Type 2 and Type 4 beams according to the measurement report information in the MR\_LIST.  Besides, it’s agreed that “For the truncated MR MAC CE, the UE determines the beam to be included in the MAC CE, based on the priority: Type 1 beam > Type 2 beam > Type 3 beam > Type 4 beam.”. In our understanding, at least the UE needs to “remember” Type 1/2/3 beams from the time the MR(s) is triggered to the time the UL grant is received. In order to make the measurement reporting and MR generation procedure clearer, we suggest to introduce separate UE variables to restore the different types of beams, e.g. BEAM\_LEAVING\_LIST (for Type 2 beam), BEAM\_REPORTED\_LIST (for Type 3 beam), in addition to the current BEAM\_TRIGGERED\_LIST.  We also provide a corresponding TP in our contribution (R2-2504028) submitted to the last meeting. |
| Lenovo | Yes | Yes with comments | We agree that only one MR MAC CE for each reportconfigID will be generated if multiple beams satisfy the entering condition. We can further clarify as follows:  if at least one L1 measurement report has been triggered associated with one *ltm-CSI-ReportConfigId* as specified in 5.x.3 and not cancelled |
| Ericsson | Yes | See comments | We have some sympathy for ZTE comment and we also think that current procedure is not really crystal clear. We don’t have a strong view on how to fix this but probably introducing separate UE variables is one option. Otherwise, we would need to capture in the procedural text that UE should report in the MR MAC CE also beam which has been reported in previously sent MR MAC CE (but this is not super nice). |
| Apple | Yes | See comments | Option 2 is our understanding.  We share ZTE’s concern about how to clearly reflect the priority of beam type (Type 1/2/3/4) during the MR assembly. We should further discuss how to make it clearly. |
| Huawei | Yes | Not sure | We don't understand the distinction between the MR\_LIST and the BEAM\_TRIGGERED\_LIST, what they contain exactly is not clearly described, so we can't say whether the conditions are doing what is described above. |
| Ofinno | Yes | See comments | We have similar view as ZTE that the current procedure is not clear. We think either the MR\_LIST should be expanded to accommodate information of other beams that can be included in L1 MR MAC CE, or separate UE variables for different beams can be introduced.  Further, we think the description in the L1 MR MAC CE format is also not clear in this regard. It is not clear where the UE takes the information of the different types of beams from. |

**Summary:**

**x companies provided the comments:**

x

With this, x

**Proposal 1: (x/x) x.**

**Open issue MAC-23: whether support CG resource associated with CSI-RS.**

In RAN2#130 meeeting, it was agreed that:

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| * In case CG resource is only associated with SSB, if the beam meeting the execution condition is CSI-RS, the UE determines whether a CG resource is valid based on the SSB associated with the CSI-RS. |

But it is still open whether support CG resource associated with CSI-RS. The corresponding Editor’s Note is captured in the current running CR as below:

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| Editor’s NOTE: Currently, CG resource is only associated with SSBs. FFS whether support CG resource associated with CSI-RS. |

**Companies are invited to provide your views on whether support CG resource associated with CSI-RS.**

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| **Company** | **Yes/No** | **Comments, if any** |
| Baicells | No | Wonder if the CG resource associated with SSB can be used for the CSI-RS which is QCL-ed with the SSB? |
| NEC | No | It is too late to support, as it will have RAN1 impact but the work item is already completed in RAN1. |
| Xiaomi | No | The above agreement has solved the issue how to select the CG resource when condition evaluation is based on the CSI-RS. Hence, support for CG resource associated with CSI-RS is not essential. |
| Nokia | No | Since each CSI-RS is associated with an SSB, the SSB-based CG is sufficient and can also apply to CSI-RS-based beams. There is no need to configure separate CGs specifically for CSI-RSs. |
| MediaTek | No | Agree with comments above |
| LGE | No | The RAN2#130 agreement given above is enough. We don’t see the need of CG resource associated with CSI-RS. |
| Samsung | No |  |
| ZTE | No |  |
| Lenovo | No |  |
| Ericsson | No |  |
| Apple | No |  |
| Huawei | No | See our input on Open issue MAC-21. If we adopt this TP, everything works fine and there is nothing to do. |
| Ofiinno | No |  |

**Summary:**

**x companies provided the comments:**

x

With this, x

**Proposal 1: (x/x) x.**

* 1. Part II – Other open issue list

**Rapporteur provides the list of open issues as below, and the corresponding suggestions on how to address them. Some of them could be further discussed based on contributions or resoved based on further progress. Companies are invited to provide comments on whether it is open issue and whether the suggestions from reapporteur is accuracy enough.**

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| **Company** | **Comments, if any** |
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### Closed open issues

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| **Index** | **Issue description** | **Status** |
| MAC-1 | **Open issue MAC-1 (essential): Whether the beam specific offset for serving cell Obs is needed for LTM event evaluation** | **Closed** |
| MAC-2 | **Open issue MAC-2 (essential): How to ensure UE be able to report the event-triggered beam(s) that were not included in the truncated MR MAC CE by the following grant** |  |
| MAC-3 | **Open issue MAC-3 (essential): The initial status for Semi-persistent CSI-RS resoruce set for candidate cell** | **Closed** |
| MAC-4 | **Open issue MAC-4 (essential): Whethe keep L1-SINR quantity for L1 event triggered MR as FFS.** | **Closed** |
| MAC-5 | **The content of L1 MR MAC CE triggered by LTM2**  Editor’s NOTE: FFS For MR triggered by LTM2, whether only include the current beam information in the MR MAC CE or the MR can include measurements for LTM candidates. | **Closed** |
| MAC-6 | **Truncated L1 MR MAC CE details. E.g.**  **Except the triggered beam, whether any beam should be prioritised to be included in the truncated L1 MR MAC CE?**  **In case the UL grant could include at least 2 beams in truncated L1 MR MAC CE, which beam should be included as the first beam in the truncated L1 MR MAC CE?**  **Based on following agreement:**  For differential L1-RSRP reporting, the best quality beam among the beams included in L1 MR MAC CE is taken as the reference beam as the first one. The differential L1-RSRP value is derived based on the absolute L1-RSRP of the reference beam. FFS for truncated MAC CE. | **Closed** |
| MAC-7 | **Whether one UL TB could include more than one truncated MAC CE or only one?**  For the case more than 1 triggering events are pending, if UL grant is sufficient for one regular L1 MR MAC CE or for two truncated L1 MR MAC CEs but insufficient for two regular L1 MR MAC CEs, the UE behaviour should be discussed. | **Closed** |
| MAC-9 | **In case UE considers RACH-less CLTM is ongoing, i.e., UE has valid TA for CLTM target cell, how UE selectes the valid CG resource for L3 based CLTM?**  Editor’s NOTE: FFS in case UE considers RACH-less CLTM is ongoing, i.e., UE has valid TA for CLTM target cell, how UE selectes the valid CG resource for L3 based CLTM. | **Closed** |
| MAC-10 | **Beam selection for L3 based RACH-less CLTM determination**  Editor’s NOTE: FFS how to determine the selected beam in case the CLTM is triggered by L3 event. | **Closed** |
| MAC-11 | **In case UE considers RACH-less CLTM is ongoing, i.e., UE has valid TA for LTM target cell, while UE couldn’t obtain valid CG resource, whether UE will fall back to RACH-based LTM? Or we need to change the condition to determine the RACH-less CLTM?** | **Closed** |
| MAC-12 | **How UE selece the CG resource if the selected beam is CSI-RS or if the indicated TCI stae is associated with CSI-RS?**  Editor’s NOTE: This part will be further updated based on RAN1 progress on CSI-RS. E.g. whether there is agreement on CSI-RS associated with CG for LTM and CLTM. | **Update to MAC-23** |
| MAC-13 | **FFS the coexistence between CLTM and (e)RedCap, CovEnh?**  Editor’s NOTE: Whether/How CLTM could co-exist with (e)RedCap is FFS, i.e. whether follow Rel-18 intra-CU LTM as below.  Editor’s NOTE: Whether/How CLTM could co-exist with CovEnh is FFS, i.e. whether follow Rel-18 intra-CU LTM as below. | **Closed** |
| MAC-15 | **Whether the triggered MR should be cancelled in the below case: if all the triggered beam(s), i.e. Type#00 and Type#01, have been reported, no matter whether truncated MR MAC CE or regular MR MAC CE is used before, the trigger MR should be cancelled.**  [Rapp]: Raised by Apple during the discussion. | **Closed** |
| MAC-16 | **Whether the triggered MR should be cancelled in the below two cases:**   * Case 1: When a beam (or multiple beam) meents the entry condition for TTT (Type#00), a MR will be triggered. Before getting the UL grant, if this beam (or all these beams) meets the leaving condition, then, whether this MR is still triggered or should be cancelled? * Case 2: When a beam (or multiple beam) in the reporting list meents the leaving condition for TTT (Type#01), a MR will be triggered. Before getting the UL grant, if this beam (or all these beams) meets the entry condition again, then, whether this MR is still triggered or should be cancelled?   [Rapp]: Raised by Apple during the discussion. | **Closed** |
| MAC-17 | **FFS how to handle the case if the dedicated SR configuration for L1 measurement report MAC CE transmission is not configured, when MR is triggered**  Editor’s NOTE: FFS how to handle the case if the dedicated SR configuration for L1 measurement report MAC CE transmission is not configured, when MR is triggered, e.g. trigger RACH directly*.*  [Rapp]: Based on comments from ZTE and Samsung. | **Closed** |
| MAC-18 | **FFS whether CFRA resource can be associated with CSI-RS**  Editor’s NOTE: FFS whether CFRA resource can be associated with CSI-RS*.*  [Rapp]: Based on comments from ZTE and Samsung. | **Closed** |
| MAC-19 | **FFS whether NCC is optional present in Enhanced LTM Cell Switch Command MAC CE. FFS for which cases should this Enhanced LTM Cell Switch Command MAC CE is used, e.g. whether only for inter-CU case with security key update.**  Editor’s NOTE: FFS whether NCC is optional present in Enhanced LTM Cell Switch Command MAC CE. FFS for which cases should this Enhanced LTM Cell Switch Command MAC CE is used, e.g. whether only for inter-CU case with security key update.  [Rapp]: Based on comments from ZTE and Samsung. | **Closed** |

### Inter-CU LTM

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| **Index** | **Issue description** | **Rapporteur suggestion** |
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### Event triggered L1 measurement

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| **Index** | **Issue description** | **Rapporteur suggestion** |
| MAC-8 | **FFS the coexistence between event triggered report and mTRP, e.g.**  how UE determine the current beam or candidate beam in this case? | **Issue Type:** Not essential  **How to address it:** can be discussed based on companies’ contribution |
| MAC-24 | **It is still working assumption on the details for truncated L1 MR MAC CE**  Editor’s NOTE: It is working assumption: *If network configures to include the current serving beam in MR, the UE always includes the current serving beam in the truncated MR MAC CE. In this case, minimum size of truncated MR MAC CE is {at least one triggered beam + the current serving beam}. If grant is not enough for that, the UE does not assemble a truncated MR MAC CE*. | **Issue Type:** Essential  **How to address it:** based on companies’ contribution |
| MAC-25 | **Handling of the activated SP CSI-RS for target cell after LTM cell switch**  Editor’s NOTE: After reconfiguration with sync that is triggered by LTM, it is FFS how to handle the configured Semi-persistent CSI-RS/CSI-IM resource sets for target cell.  **Based on the following agreement:**  *UE deactivates SP CSI-RS resource of candidate cells (other than the target cell) after cell switch. FFS on the target cell* | **Issue Type:** Essential  **How to address it:** based on companies’ contribution |
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### Conditional intra-CU LTM

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| **Index** | **Issue description** | **Rapporteur suggestion** |
| MAC-14 | **FFS for the case when CLTM candidate TAT timer is running, an (Enhanced) LTM Cell switch Command MAC CE is received**  Editor’s NOTE: FFS for the case when CLTM candidate TAT timer is running, an (Enhanced) LTM Cell switch Command MAC CE is received.  [Rapp]: New added based on Anil’s comments. | **Issue Type:** Not essential but important  **How to address it:** based on companies’ contribution |
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### RACH-less intra-/inter-CU LTM and Conditional intra-CU LTM with two TAGs

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| **Index** | **Issue description** | **Rapporteur suggestion** |
| MAC-26 | **How to consider the TAG ID when determining whether to set the *REAMBLE\_POWER\_RAMPING\_COUNTER* to 1 for an (C)LTM candidate cell which is configured with two TAGs in RACH-less (C)LTM\_**  Editor’s NOTE: In RACH-less (C)LTM, for an (C)LTM candidate cell which is configured with two TAGs, TAG ID is not considered when determining whether to set the *REAMBLE\_POWER\_RAMPING\_COUNTER* to 1. Rapporteur realized the same issue exists for Rel-18 LTM, which was missing. | **Issue Type:** Essential  **How to address it:** based on companies’ contribution |

**Proposal x: RAN2 to consider the above open issues related to MAC for mobility enhancement: MAC-x.**

### Others, please specify

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) or other comments** |
| Samsung | Since the event triggered MR procedure is triggered based on the current beam, the procedure may be cancelled upon the beam failure on the SpCell. The TTT also may be stopped.  i.e. the following may be needed.  Upon beam failure on the SpCell:  1>cancel, if any, triggered Event Triggered L1 Measurement Report;  1>reset TTT for event triggered L1 measurement report triggering condition evaluation;  Since the issue is not discussed yet, the issue may be added in the open issue list. |
| Samsung | We may need an open issue for reporting of beam measurements for LTM2, to be discussed in next meeting.  Here are some aspects which are not clear in current CRs.  1.Whether the UE reports the current beam for LTM2 irrespective of the reportCurrentBeam or whether the network will alway configure the reportCurrentBeam while LTM2 is configured. There is no conditional presence defined in RRC spec for LTM2, and it is not clearly mentioned in the MAC spec that UE always reports current beam.  2. allowReportAnyBeam indicates whether the UE can report the measurement results for the beams not satisfying the conditions of the events. However it is not clear whether other beams of the serving cell can be reported, as those beams are not evaluated (and hence we can not say they are “not satisfying the LTM2 condition”)  3. In running CR,the Type field is specified to indicates the type of the RS i of LTM candidate cell. LTM2 is associated with the current beam and not any candidate cell. So it is not clear what needs to be set. |
| ASUSTeK | For C-LTM execution:  1. In the current running CR, when performing C-LTM, the UE select RS satisfying entry condition, and then checks if the selected RS(s) have valid TA for RACH-less C-LTM:  The MAC entity shall:  1> if the MAC entity determines that the event for conditional LTM is satisfied based on L1 measurements as specified in clause 5.y.2:  2> select the RS(s) satisfying the entry condition for the event associated with *ltm-CSI-ReportConfigId* for TTT as specified in clause 5.y.2;  …  3> if the *ltm-Candidate-TimeAlignmentTimer* or *ltm-Candidate-TimeAlignmentTimerTAG2* associated with the Target Configuration ID for the TAG associated with a selected SSB or selected CSI-RS is running in the first available CG occasion for initial CG transmission according to clause 5.8.2 in case two TAGs are configured for the CLTM candidate cell:  4> process the stored Timing Advance Command associated with the *ltm-Candidate-TimeAlignmentTimer* or *ltm-Candidate-TimeAlignmentTimerTAG2* (see clause 5.2);  4> consider the RACH-less CLTM cell switch to be ongoing;  For a target candidate cell with 2 TAGs, a part of the candidate beams may be associated with a valid TA while the other part of the candidate beams are not. To avoid initiate a RACH-based C-LTM even though there’s candidate RS(s) with valid TA, it should be discussed whether the UE should consider TA validity of a candidate RS in addition to checking RSRP value during RS selection step.  2. When performing LTM to a target cell, the TA associated with a source cell of the LTM, which could be a C-LTM candidate Cell, can still be valid. It should be discussed whether to store the TA for source cell and maintain ltm-Candidate-TimeAlignmentTimer for the source cell if it’s a C-LTM candidate Cell. |
| Lenovo | Last meeting, we made the following agreement based on the offline [R2-2504921](file:///D:\OneDrive%20-%20Lenovo\3GPP\RAN2\TSGR2_130\Docs\R2-2504921.zip). They are captured in section 5.y.3 of the latest running CR.   * Upon CLTM execution, if TA is valid (i.e. TAT timer is running) at the first available CG occasion, and there is CG resource configured, RACH-less CLTM will be performed. * During CLTM is ongoing, after the first transmission, if TAT timer expires while RACH-less LTM is ongoing, fallback to RACH-based CLTM.   As we commented in the last meeting, UE based TA is also supported besides PDCCH order based early TA. The above agreement is related to the case that only PDCCH order based TA is provided without UE based TA. Therefore, we need to further consider the case that **both PDCCH order based TA and UE based TA are available upon CLTM execution**. |
| Ericsson | Current way on how the NCC value has been introduced in the LTM cell switch MAC CE is very inefficient.  Re-using the spare bits on the Oct 5 brings some problems. In fact, in case there is a security key change for a RACH-less inter-CU LTM this means that the network should still include the fields “S/U” and “Repetition number” but such field should indeed be ignored by the UE. Same for Oct 6 and Oct 7.  This is a very inefficient way of doing things. Because to include 3 bits the network is forced to include 3 octects.  For this reason, a better way would be to include the NCC in a new octet and use e.g., the spare bit in octect 3 to indicate whether the NCC is present or not. In this way we save 2 octects.  If we don’t go the way we proposed, then we need to clarify that when the LTM cell switch is rach-less but with security change, then UE should ignore all the field in Octets 5, 6, and 7 except for the NCC value. |
| Apple | <CLTM>  In section 5.2 of current CR version,  When CLTM cell switch procedure is triggered, UE apply the stored TA value and (re)start the TAT for the taget cell directly if the LTM-C-TATimer is running.  But if the CLTM cell switch procedure is initiated, UE has available TA for the taget cell, but UE has not the available CG grant which is associated with the triggered RS, UE will initiate RACH-based CLTM CS procedure. In this case, UE donot need to do the TA operation for target cell (incl. apply stored TA value and start TATimer). |
| Apple | <L1 measurement>  1) The priority of different beam type (1/2/3/4) during the truncated MR MAC CE assembly is not captured in current running CR. We may need to add some description.  2) The usage and definition of the MR-LIST and BEAM-TRIGGER-LIST is not very clear, which may introduce some ambiguity when reading the running CR. |
| Ofinno | For L1 measurement:  1) It is possible that UE does not receive an UL grant after sending a truncated L1 MR MAC CE. Based on the current procedure, the UE cannot recover from this unless another procedure triggers a RACH or SR. We think RAN2 should discuss how to handle this issue.  2a) It is possible that a L1 MR MAC CE is transmitted without any type 1/2 beams e.g., in a UL grant after transmitting a truncated L1 MR MAC CE. We think this may cause some ambiguity to the network, as the network may expect a L1 MR MAC CE with a type 1/2 beams.  2b)Multiple beams (e.g., based on entering condition) may trigger an L1 MR MAC CE. Of multiple candidate beams triggering an L1 MR MAC CE, only some of the triggered beams are included in a truncated L1 MR MAC CE. Before receiving UL grant for subsequently transmitting the remaining beam information that is not included in the truncated L1 MR, a condition to cancel the triggered MR for the remaining triggered beams may be fulfilled e.g., leaving condition fulfilled for the remaining beam). This may lead to cancelling the triggered MR. It is possible that the network wrongly assumes that another MR MAC CE transmitted for the same report configuration is a continuation of the previous truncated MR.  We think some information is needed in the MR MAC CE that indicates whether the MR MAC CE is a new MR MAC CE or a continuation of a previously transmitted truncated MR MAC CE. |
| Ofinno | For CLTM:  Accoording to the current running CR, a UE may continue the candidate TA timers after a candidate cell is removed/ released from the LTM configuration. We think the candidate TA timers need to be stopped when the corresponding candidate cell, for which the candidate TA timer is running, is released. |
| OPPO | For CLTM：  If RACH-less CLTM fallback to RACH-based CLTM is declared due to PTAG expiration, how does UE obtain the MAC PDU from HARQ buffer to Msg3/A buffer? |
| vivo | the UE deactivates the activated Candidate TCI state upon receiving the LTM CSC MAC CE in Rel-18, it is not clear that whether the same behaviour should be applied in CLTM in R19, i.e. upon the CLTM execution, activated candidate TCI state(s), other than the TCI state associated with the triggered beam, should be deactivated. |

# Conclusion

In this contribution, we discuss some open issues related to MAC running CR for mobility enhancements and collect the open issues for mobility enhancements in MAC. Based on the discussion, the following proposals have been achieved:

**Open issue MAC-x**

**Proposal 1:**

**Other open issues:**

**Proposal x: RAN2 to consider the above open issues related to MAC for mobility enhancement: MAC-x.**

# References

1. R2-25xxxx, Running MAC CR for Mob Ph4, vivo