**3GPP TSG RAN WG1 #106-e R1-2106863**

**e-Meeting, August 16th – 27th, 2021**

**Agenda item:** 7.2.6

**Source:** Moderator (Samsung)

**Title:** Summary for Rel.16 NR eMIMO maintenance

**Document for:** Discussion and Decision

1. Introduction

The moderator summary of the maintenance-related issues raised in the submitted contributions for Rel.16 NR\_eMIMO maintenance is given below. The listed maintenance issues are under the usual designations:

* LP: low-PAPR RS
* MB: Multi-beam operation
* MT: Multi-TRP
* MU: Type-II enhancement for MU-CSI
* UL: UL full power transmission
* O: Other

An initial assessment on each of the issues is given (but can be revised based on the outcome of the discussion during the preparation week). The assessment will be used as a basis to select four issues (per chairman instruction) for further discussion in the upcoming weeks.

* *High priority (H):* this includes high-priority item (essential, pending issues, broken spec components) and proposed editorial changes that either enhance the clarity of the specs or correct mistakes
* *Non-essential (N)*: this includes all other purposes such as spec optimization and low priority issues
* *Editorial (E)*: this includes editorial issues that will be handled as editorial CRs (to be communicated to the editors/chairs) and thereby not counted toward the four-thread quota

1. Maintenance issues

The issues are summarized in the following table:

**Table 1 Summary**

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| **#** | **Issue (summary of CR proposal)** | **Companies** | **Initial assessment** | **Company inputs (if any)** |
| MB.1 | Clarifying that for multiple slots of PUCCH, the applied same spatial setting is determined in the first slot of the multiple slots. Besides, one typo for Clause 7.3.1 is corrected.  FL: this is for clarification. Essentiality of this CR depends on group’s view whether current wording can create such ambiguity  Summary:   * H (resolve ambiguity, capture previous agreement): Apple, Samsung, ZTE, CATT, Intel, Lenovo/MotM * N (not needed): Ericsson, OPPO, Spreadtrum, Qualcomm   Moderator assessment: Whether there is ambiguity and an agreement that is not properly captured isn’t crystal clear (the number of companies on both sides are almost equal). Therefore it is proper to resolve this via an email thread. | ZTE | H (need discussion for conclusion in this meeting) | Apple: Disagree with FL’s assessment. We think there is ambiguity in current spec, and it is reasonable to fix it.  Ericsson: Not needed. What would be the alternative?  Samsung: Our view is that the proposed TP can capture the original intention of the agreement in RAN1#101-e without ambiguity.  OPPO: Agree with the FL’s assessment. This is not needed. As specified in the spec, a same qd is applied to multiple slots, which means qd can only be determined in the first slot.  ZTE: This issue should be marked as H. There is following agreement reached in RAN1#101-e  **Agreement**   * For multiple slotsPUCCH, a spatial relation/PL RS is commonly applied across the PUCCH slots, where the spatial relation/PL RS is determined by the first PUCCH slot.   But, in the current spec, the UE behavior of determining default spatial relation and PL-RS based on **the first PUCCH slot** has NOT been specified for multi-slot PUCCH transmission. It will lead to unnecessary ambiguity about spatial setting/PL-RS determination for PUCCH in case that the TCI state update of CORESET with lowest index is applied starting from a slot of the multiple slots of PUCCH.  Spreadtrum: Seems no ambiguity.  CATT: This CR is to clarify that for multiple slots of PUCCH, the applied same spatial setting is determined by the first slot of the multiple slots. It can be discussed since the current spec doesn’t capture the corresponding agreement in RAN1# 101e:  Intel: Although there is no other option and the proposed “first slot” can be understood from the common sense, we are OK to discuss the CR to make spec clear.  Qualcomm: No need. Spec is clear on this. Same q\_d for all slots already mean beam activation time should NOT present in middle of the slots. It is even a stronger requirement than the proposal and simplifies UE behavior.  Lenovo/MotM: Fine to capture the agreement to make it clear although there is no other option. |
| MB.2 | Clarify that the slot k is counted based on the last slot with ACK transmission for the action time for MAC CE based pathloss RS update  FL: this seems a common issue for all spec text describing ack timing and the last slot would be a common understanding of the group  Summary:   * H (counting rule unclear): Apple, Intel (ok to discuss), Qualcomm * N (common understanding for MAC CE action time): Ericsson, Samsung, OPPO, Spreadtrum, CATT, Qualcomm, Lenovo/MotM   Moderator assessment: 2x # companies perceive this as common understanding for MAC CE action time. But this can benefit from some discussion so that this issue can be concluded in this meeting. | Apple | H (need discussion for conclusion in this meeting) | Apple: Disagree with FL’s assessment. We agree that there are similar issues for other MAC CE, but we can only discuss this PC MAC CE under this agenda, since it was introduced in this agenda. We are open to discuss the issue in general if companies are fine. Without any conclusion or agreement, we cannot say something is common understanding. Therefore, we think this should be fixed.  Ericsson: As long as it is common understanding, there is no need to discuss.  Samsung: Agree with FL’s assessment.  OPPO: it is common understanding for all the MAC CE action time. Maybe we can make a general conclusion to clarify that for all MAC CE, not only this one.  Spreadtrum: Agree with FL’s assessment.  CATT: Agree with FL’s assessment.  Intel: Although proposed TP is based on common sense, we are OK to discuss CR.  Qualcomm: Support this clarification. Otherwise, gNB and UE may not be aligned on which slot in case of multiple slots.  Lenovo/MotM: Agree with FL’s assessment |
| MB.3 | Replace *spatialRelationInfo* with spatial relation to clarify UE behavior when both features of default spatial relation and simultaneous multi-CC spatial relation update are enabled for a CC.  FL: discussed in #102-e pre-phase but could not conclude this. Either adopting the CR or making a conclusion to preclude this case would be necessary.  Summary:   * H (need conclusion): Samsung, Spreadtrum, CATT, vivo, Lenovo/MotM * N (this is a new feature): Apple, Ericsson, OPPO, Qualcomm   Moderator assessment: The number of companies on both sides are almost equal. It seems good to conclude this issue in this meeting. | Vivo | H (need discussion for conclusion in this meeting) | Apple: Disagree with FL’s assessment. This introduces a new feature and we have mentioned that this new feature has a problem when gNB updates the beam for CORESET in different CCs.  Ericsson: We do not share this interpretation. In our understanding, the multi-CC update of spatial relations is only applicable to explicit signaling. Default spatial relation is defined/configured per CC, and including a CC with a default spatial relation in a CC list is an error case, with undefined UE behaviour.  Samsung: Agree with FL’s assessment that at least a conclusion for this issue would be necessary.  OPPO: The default spatial relation feature shall not be applied to multi-CC case.  Spreadtrum: Agree with FL’s assessment, at least a conclusion is needed.  CATT: Agree with FL’s assessment.  vivo: agree with FL’s comment and Samsung’s comment that at least we need a conclusion on this issue.  @Apple: for UL heavy scenarios, e.g., single DL CC and two UL CCs, the problem does not exist and the default beam of two UL CCs should be clarified when enabled CC\_list and default beam. For DL heavy scenarios, it is not necessary to configure default beam and UL CC list together.  Qualcomm: There may not be any issue. Because the original agreement for applying activated SRS spatial relation across multiple CCs is only for MAC-CE activating the SRS spatial relation. It is not for extending the default UL beam following the lowest CORESET ID to the case of multiple CCs. The default UL beam rule is only applied per CC, not simultaneously across multiple CCs. So the spatialRelationInfo in current spec is accurate. |
| MB.4 | To correct that for SCell candidate beam detection, UE should indicate whether it identifies one new beam instead of one new beam from CSI-RS and another one new beam from SSB. (R1-2107717)  FL: The correction is aligned with previous agreement and suggest considering it as “E” | Apple | E | Apple: Agree with FL’s assessment.  Ericsson: We agree to the CR. But we think the same change should be made in the next sentence. The paragraph describes the procedure per cell, and then it is only one value that is reported to higher layers.  Samsung: Agree with FL’s assessment.  OPPO: Agree with FL’s assessment. Re Ericsson’s comment, we think the change should be made in this sentence, as described in Apple’s CR, not in the next sentence. Because this sentence says that the PHY layer indicates “whether there exist at least **one** ..”, but the next sentence says that the PHY reports one or more .. to the higher layer.  ZTE: Agree with FL’s initial assessment.  LG: agree with ‘E’  Spreadtrum: Agree with the CR  CATT: Agree with FL’s assessment.  vivo: agree with FL’s assessment  Intel: Agree with CR  Qualcomm: Agree it is “E”  Lenovo/MotM: Agree with FL’s assessment |
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| MT.1 | In R1-2106539, ZTE suggested to Clarifying that for a same group of candidate PDSCHs corresponding to a same  value, the UE does not expect to receive more than one PDSCH in a same DL slot per TRP rather than across two TRPs for multi-DCI based MTRP in section 9.1.2.1 of 38.213.  FL: this is a good clarification for the cases of non-mDCI-based mTRP and m-DCI based mTRP. Suggest to correct it | ZTE | H (need discussion for conclusion in this meeting) | Apple: We suggest we mark it as “E”. This does not require new agreement.  Ericsson: Ok to discuss further.  Samsung: We understand the intention and okay to discuss further.  OPPO: Ok with the CR  LG: Fine to discuss this issue  Spreadtrum: Fine to discuss  CATT: Ok to discuss this issue.  vivo: OK for discussion.  Qualcomm: Based on the existing text above the pseudo-code, this should be already clear as the condition is separately applied to S0 and S1:“…the UE generates a Type-1 HARQ-ACK codebook for the set and the set of serving cells separately by setting and in the following pseudo-code.”. Hence, it seems clarification is not needed.  Lenovo/MotM: Fine to discuss |
| MT.2 | R1-2106934 suggests to correct on Typo in 5.1.6.1.1 of 38.214: correct “type-A” to “typeA”  FL: typo correction | CATT | E | Apple: Agree with FL’s assessment.  Ericsson: Agree with the CR.  Samsung: Agree with FL’s assessment.  OPPO: Agree with the CR.  LG: OK  Spreadtrum: Agree with the CR  CATT: OK.  vivo: Agree with the CR  Qualcomm: Ok to correct the typo, but we are not sure if the typo is related to Rel. 16 mTRP/MIMO spec text.  Lenovo/MotM: OK |
| MT.3 | R1-2107202 suggests to clarify in Section 5.1 of 38.214 that “the UE is expected to be scheduled with the same active BWP and the same SCS” is only applied to PDCCHs associated with different values of CORESETPoolIndex.  FL: As in previous agreement, the UE expects same BWP and SCS for PDSCHs scheduled by different TRPs in m-DCI based mTRP. This correction is aligned with previous agreement.  Moderator assessment: Although the majority agrees that this is editorial, 3 companies opine that this is not necessary. This needs to be concluded in this meeting. | OPPO | H (need discussion for conclusion in this meeting) | Apple: Agree with FL’s assessment.  Ericsson: Agree with the CR.  Samsung: Agree with FL’s assessment.  LG: Agree with FL’s assessment  Spreadtrum: Agree with FL’s assessment  CATT: Agree with FL’s assessment  vivo: we think this is not necessary, as the previous sentences already says: If a UE is configured by higher layer parameter PDCCH-Config that contains two different values of coresetPoolIndex in ControlResourceSet, the UE may expect to receive multiple PDCCHs scheduling fully/partially/non-overlapped PDSCHs in time and frequency domain. There is no other cases for a UE can be scheduled with fully/partially/non-overlapped PDSCHs.  Intel: This may not be necessary as the first sentence of the paragraph defines “full/partially/non-overlapped PDSCHs”  QC: In the CR, it is mentioned that “It is misleading that BWP switching for single TRP trasnsmission is not allowed for a UE supporting multi-DCI based M-TRP transmission”. In our understanding, this part of the spec is not related to BWP switching. BWP switching is allowed **within** and **across** CORESETPoolIndex values as there is no such restriction in 38.213 Section 12. This part of the spec just clarifies that BWP and SCS remains same as Rel. 15 and not changed because of mTRP. Hence, it seems change is not needed.  Lenovo/MotM: Agree with FL’s assessment |
| MT.4 | R1-2107320 suggests to Specify that each PDSCH repetition of TDMschemeA and FDMschemeB is counted separately for data rate limitation in Section 5.1.3 of 38.214.  FL: current specification of data rate limitation does not cover the case of mTRP repetition schemes with > 1 PDSCH repetition in one slot. So suggest to discuss this issue and make specification | Qualcomm | H | Apple: We suggest we mark it as “E”. This does not require new agreement.  Ericsson: Ok to discuss this CR.  Samsung: Agree with FL’s assessment and okay to discuss further.  OPPO: Agree with the CR  ZTE: We think the current spec is clear since the same TB is assumed for TDMschemeA and FDMschemeB as below in 38.214:  ‘the UE shall receive two PDSCH transmission occasions of the same TB with each TCI state associated to a PDSCH transmission occasion’  Thus, for data rate limitation, the same TB should also be assumed.  LG: Fine to discuss this issue  Spreadtrum: Fine to discuss  CATT: Ok to discuss this issue.  vivo: Clarification is needed  Qualcomm: Agree with FL. Also, 38.214 Section 6.1.4, already has similar clarification for multiple PUSCH repetitions in the same slot (PUSCH repetition type B). Similar clarification is needed for DL.  Lenovo/MotM: Fine to discuss. |
| MT.5 | R1-2107990 (along with the discussion paper R1-2107989) suggest to specify the default TCI state for AP CSI-RS for the case of that trigger PDCCH and CSI-RS has different SCS in mTRP systems.  FL: This CR suggests to specify the default TCI state for AP CSI-RS in cross-carrier scheduling case for mTRP systems. The default TCI state for PDSCH of mTRP in cross-carrier scheduling case was discussed in previous meeting and we made the following conclusion in RAN1#105-e meeting:  **Conclusion**  **No spec change is needed in Rel-16 for the issue of default TCI states of multi-TRP PDSCH in the case of cross-carrier scheduling**  **For the issue of default TCI state of AP CSI-RS in cross-carrier scheduling, we might discuss and at least make a conclusion.** | Vivo | H (need discussion for conclusion in this meeting) | Apple: Since we concluded in last meeting no further conclusion on default beam for PDSCH in R16, we do not think it is necessary to enhance default beam for CSI-RS. The default beam behavior should be common for PDSCH and CSI-RS, since UE is not able to generate >2 default beams.  Ericsson: While we understand the intention of the CR, we do not think this should be discussed since we have already made the conclusion in last meeting that there will be no spec impact in Rel-16.  Samsung: Agree with FL’s assessment that at least a conclusion for this issue would be necessary. Since several new features have not been adopted in this R16 CR phase, the default beam for AP CSI-RS in cross-carrier scheduling case for mTRP may also not be introduced.  OPPO: share similar understanding as Apple and Ericsson, prefer not to discuss this.  ZTE: We are OK to make a conclusion and stop further discussion.  LG: Fine to discuss this issue  Spreadtrum: Fine to make a conclusion  CATT: Agree with FL’s assessment.  vivo: this should be discussed or at least made a conclusion. Firstly, even though we have agreed that the default QCL for AP CSI-RS behavior is applied at least for the same carrier scheduling case, it does not preclude further discussion on that for cross carrier scheduling. Secondly, the above behavior of AP CSI-RS is captured for the case of that triggering PDCCH and CSI-RS has same SCS, which does not preclude cross carrier scheduling with same SCSs. Thirdly, previous agreement of without further spec enhancement for cross carrier PDCSH scheduling is that default QCL of PDSCH for S-DCI-based cross-carrier scheduling is supported with current spec so default QCL of AP CSI-RS for cross-carrier scheduling can also be considered.  Intel: we understand the issue. However, the spirit of the conclusion in RAN1#105-e of no spec change for default TCI states in Rel-16 should apply here and further discussion is not beneficial  Qualcomm: Our understanding is that cross-carrier scheduling is not even supported by current spec for multi-DCI based mTRP (CORESETPoolIndex does not exist in the scheduled CC since there is no CORESET configured if it is scheduled by another CC).  Lenovo/MotM: Fine to make a conclusion on this issue. |
| MT.6 | R1-2107011 suggests aligning RRC parameter between 38.331 and 38.213, i.e. Revise RRC parameter “ACKNackFeedbackMode = JointFeedback” to “ackNackFeedbackMode = joint” | ZTE | E | LG: ok with ‘E’  Spreadtrum: Fine with the CR  CATT: Agree with the CR.  vivo: OK  Qualcomm: Ok.  Lenovo/MotM: OK |
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| MU.1 | R1-2106933: Clarification that PMI component i1,2 may not be reported  FL: Valid and editorial | CATT | E | Apple: Agree with FL’s assessment.  Ericsson: tdoc is R1-2106933. Seems ok.  Samsung: Agree with FL’s assessment.  OPPO: ok with E.  ZTE: Fine with FL’s assessment.  LG: ok with E  Spreadtrum: Fine with the CR  CATT: OK.  vivo: ok with E  Intel: Tdoc number is not correct in this document. The correct tdoc number is R1-2106933. We are OK with with editorial change. |
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| O.1 | R1-2106470: Correction on QCL acquisition in TS38.214  Claim: The description “*if the qcl-Type is set to 'typeD' of the PDSCH DM-RS is different from that of the PDCCH DM-RS with which they overlap in at least one symbol*” is unclear and not aligned with agreement in RAN1#92 (stating irrespective of the time offset between the reception of the DL DCI and the corresponding PDSCH)  FL: Claim seems valid and needs some discussion | Huawei, HiSi | E | Apple: We suggest we mark it as “E”. This does not require new agreement.  Ericsson: This seems to be two independent changes: 1) on the “no typed” and 2) editorial change of overlap. We do not see that 1) is needed: if the scheduling offset is larger than timeDurationForQcl, the UE uses the QCL properties of the provided QCL source in any case. 2) seems not essential.  Samsung: As Ericsson mentioned, this CR contains two issues. Regarding 1) no typeD, the case when the scheduling offset is equal to or greater than timeDurationForQCL is already captured in the current spec regardless of the condition whether all configured TCI states do not contain QCL-TypeD or not. Regarding 2) editorial change of overlap, we can live with that marked as “E”.  OPPO: Agree with Ericsson. It should be editorial.  LG: fine to discuss this. Either ‘H’ or ‘E’ is fine to us.  Spreadtrum: It should be ‘E’, and also fine with the CR  vivo: OK with E.  Qualcomm: The 1st change can be “E”. The 2nd change is not needed. Because it is common understanding that QCL assumptions in the TCI should be used if offset > threshold. Only “offset < threshold” is worth of clarification as in current spec. Also, the issue is discussed in R15, and should not be addressed in R16 CR.  Lenovo/MotM: Fine with the CR |
| O.2 | R1-2106471: Correction on DM-RS position in TS38.211  Remove the placeholder in the table 7.4.1.1.2-4 in TS 38.211, where new values are introduced in Rel-16  FL: If the new values are simply placeholders, either clarification is needed or they need to be removed | Huawei, HiSi | E | Apple: We suggest we mark it as “E”. This does not require new agreement.  Ericsson: ok as editorial but Cat.F is not appropriate, this is one of the most editorial thing I have ever seen so it should be D. It’s also something that comes from MCC implementation of the editor’s version.  Samsung: Agree with FL’s assessment and we can live with that marked as “E”.  OPPO: It is editorial and shall be E.  ZTE: This should be editorial issue.  LG: should be ‘E’  Spreadtrum: It should be ‘E’, and also fine with the CR  vivo: OK with E  Qualcomm: Ok.  Lenovo/MotM: Ok |
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1. Discussion and proposal

From the inputs shared by participating companies during the preparation phase, the following **observation** can be made:

* The following issues can be handled as E (a part of editorial CR): MB.4, MT.2, MT.6, MU.1, O.1, O.2
* The following issues can be designated as H (requiring discussion and additional agreements/conclusions): MB.1 (ZTE), MB.2 (Apple), MB.3 (vivo), MT.1 (ZTE), MT.3 (OPPO), MT.4 (Qualcomm), MT.5 (vivo)

Per guidance from the Chairman, all E issues can be grouped in one thread (moderator to be appointed by the Chairman). Each of the H-rated issues will be assigned an email thread. Therefore, the following moderator proposal is made:

**Proposal**: The following email threads are to be assigned:

1. Editorial CRs (MB.4, MT.2, MT.6, MU.1, O.1, O.2 combined): moderator TBD (per Chairman’s discretion)
2. MB.1 (spatial setting for multi-slot PUCCH): moderator ZTE
3. MB.2 (action time counting for MAC-CE PL-RS update): moderator Apple
4. MB.3 (conflict between default and updated spatial relation for multi-CC): moderator vivo
5. MT.1 (candidate PDSCH for mDCI): moderator ZTE
6. MT.3 (alignment of PDSCH BWP and SCS for mDCI): moderator OPPO
7. MT.4 (PDSCH repetition counting): moderator Qualcomm
8. MT.5 (default TCI state for AP-CSI-RS when trigger and CSI-RS have different SCSs): moderator vivo

# References

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| --- | --- | --- | --- |
| 1 | R1-2106470 | Correction on QCL acquisition in TS 38.214 | Huawei, HiSilicon |
| 2 | R1-2106471 | Correction on DM-RS position in TS 38.211 | Huawei, HiSilicon |
| 3 | R1-2106538 | Clarification on default spatial setting of PUCCH with multiple slots | ZTE |
| 4 | R1-2106539 | Draft CR on number of received PDSCHs for multi-TRP transmission | ZTE |
| 5 | R1-2106863 | Summary for Rel.16 NR eMIMO maintenance | Moderator (Samsung) |
| 6 | R1-2106933 | Correction on MU-CSI enhancement | CATT |
| 7 | R1-2106934 | Correction on QCL-type set for aperiodic CSI-RS | CATT |
| 8 | R1-2107202 | Draft CR for M-DCI based M-TRP transmission | OPPO |
| 9 | R1-2107320 | Draft CR on sum data rate for tdmSchemeA and fdmSchemeB | Qualcomm Incorporated |
| 10 | R1-2107716 | Draft CR on Action Time for Pathloss Reference Signal Update | Apple |
| 11 | R1-2107717 | Draft CR on SCell candidate beam detection | Apple |
| 12 | R1-2107987 | Discussion on spatial relation update across CCs for SRS | vivo |
| 13 | R1-2107988 | Draft CR on spatial relation update across CCs for SRS | vivo |
| 14 | R1-2107989 | Discussion on default QCL assumption of AP CSI-RS in MTRP operation when the triggering PDCCH and the CSI-RS have different numerologies | vivo |
| 15 | R1-2107990 | Draft CR on default QCL assumption of AP CSI-RS in MTRP operation when the triggering PDCCH and the CSI-RS have different numerologies | vivo |
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