**3GPP TSG RAN WG1 #107-e R1-21xxxxx**

**e-Meeting, November 11th – 19th, 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 | 1. Duplicated description of “in slot n”:  “when the UE would transmit a PUCCH with HARQ-ACK information in slot n corresponding to the PDSCH carrying the activation command ~~is transmitted in slot n~~”  2. Clarify the reference SCS µ:  “…the UE assumptions on updating spatial relation for the SRS resource shall be applied for SRS transmission starting from the first slot that is after slot n+3N\_slot^(subframe,µ) where µ is the SCS configuration for the PUCCH.”  FL: Necessary corrections and they are editorial. | Huawei, HiSilicon | E | Apple: In principle, we are fine with the editorial CR for the first the change, for the second change, we think some discussion should be needed. In general, we think this can be considered as “H”, since the second change defines a new behavior.  Samsung: Agree with Moderator’s assessment for both issues. Regarding issue 2, since other parts related to MAC-CE activation in 214 also mentioned “µ is the SCS configuration for the PUCCH”, we are fine as “E”.  ZTE: Support the FL initial assessment.  vivo: OK as E for the first issue. The 2nd change is unnecessary.  Qualcomm: fine for E  Lenovo: Support FL’s assessment.  OPPO: we are fine with FL proposal. Regarding the 2nd change in the CR draft: 3N\_slot^(subframe, u) always equal to 3ms no matter what the u is. So the 2nd change seems not define new behavior.  Ericsson: OK to discuss  Intel: OK with editorial correction |
| MB.2 | Clarify that gNB response for SCell-BFR is associated with a PUSCH with a same HARQ process number and a same serving cell as for the PUSCH including the BFR MAC-CE rather than just with a same HARQ process number. (R1-2110966)  FL: It seems to be a good clarification. | ZTE | H (requiring discussion for the exact text) | Apple: We agree with FL proposal  Samsung: Agree with Moderator’s assessment.  LG: Fine to discuss this.  ZTE: Support the FL initial assessment.  vivo: The articulated misunderstanding does not seem to exist. We are fine if the majority would like to add more redundancy into specification.  Qualcomm: The clarification should be unnecessary. Same HARQ ID as for the 1st transmitted PUSCH implies the same serving cell. If we need to spell this out, there can be many similar places to change.  Lenovo/MotM: Fine to discuss it.  OPPO: That is not necessary. In practice, it is not a reasonable implementation to compare HARQ process number on different CCs. The clarification is not needed.  Ericsson: Agree with FL  Intel: OK to discuss |
| MB.3 | Clarify the SCS of 28 symbols based on failed serving cell(s). (R1-2110967)  FL: It was discussed twice, but there is no consensus due to concern from Qualcomm. Whether to discuss it again can be up to Qualcomm. | ZTE | N | Apple: Hopefully we can reach consensus for this issue. But if companies’ position does not change, we would suggest not to discuss this issue.  Samsung: Agree with Moderator’s assessment. Also we have similar view with Apple, if we cannot reach a consensus on this meeting, then at least a conclusion is needed that there is no consensus.  LG: Fine to discuss and agree with Apple/Samsung.  ZTE: Support the FL initial assessment. Such situation changes than before. Last meeting, we had agreement for TRP-specific beam failure recovery (e.g., considering all CCs with failed TRP(s) besides for response receiving cell). Straightforwardly, considering that TRP-specific BFR is just a specific case for SCell-BFR, we can have the similar UE behavior, i.e., to determine SCS of 28 symbols is based on the smallest SCS of the response receiving cell and all failed cells  vivo: This issue has already been concluded not to discuss anymore. We prefer not to waste time.  Qualcomm: We prefer not to spend more time on a concluded topic. The proposal is against R16 agreement as discussed before.  Lenovo/MotM: This issue has been proposed and discussed several times but without consensus, we prefer not to discuss it.  OPPO: Prefer not to spend time to discuss it again since it has been discussed in two meeting with no consensus. If we cannot agree it as E during preparation phase, suggest not to select it as H.  Ericsson: OK to discuss.  Intel: OK to discuss |
| MB.4 | Remove an unnecessary change from editor in alignment CR in RAN1 #106b. Clarify that UE can indicate both SSB and CSI-RS for CBD to higher layer. (R1-2111851)  FL: This is an editorial change to remove one unnecessary change. | Apple | H (requiring discussion for the exact text) | Apple: We agree to handle it as editorial CR  Samsung: Agree with Moderator’s assessment.  LG: we think that it is better to revise the sentence more precisely rather than adopting Apple’s TP, i.e. one candidate RS ID is reported for one SCell according to TS38.321, e.g.  For the SCell(s), upon request from higher layers, the UE indicates to higher layers whether there is at least one periodic CSI-RS configuration index or SS/PBCH block index from the set  with corresponding L1-RSRP measurement~~s~~ that is~~are~~ larger than or equal to the Qin,LR threshold, and provides the periodic CSI-RS configuration index~~es~~ or SS/PBCH block index~~es~~ from the set  and the corresponding L1-RSRP measurement~~s~~ that is~~are~~ larger than or equal to the Qin,LR threshold, if any, for each SCell.  ZTE: Support the FL initial assessment.  vivo: OK.  Qualcomm: fine for E  Lenovo/MotM: OK.  OPPO: ok for E  Ericsson: not needed. The current text says “For the SCell”, with the natural interpretation “For each SCell”. Then ‘or’ is appropriate. Besides, there is no difference between ‘or’ and ‘and/or’. |
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| MT.1 | Add description of using Table 7.3.1.2.2-1A/2A/3A/4A for NC-JT transmission in DCI 1\_2 in 38.212 (R1-2111672)  FL: necessary editorial change | Ericsson | E | Apple: We agree to handle it as editorial CR  Samsung: Agree with Moderator’s assessment.  LG: Agree with FL’s assessment.  ZTE: Agree to handle it as editorial CR  vivo: Agree with Moderator’s assessment.  Qualcomm: Fine for E.  Lenovo/MotM: Agree with FL’s assessment.  OPPO: Ok for E.  Ericsson: We are fine with handling it as editorial CR.  Intel: Agree with FL |
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| MU.1 | Correction on RI and LI reporting  FL: Editorial. The 1st bullet may be revised as:  For Type I CSI feedback, Part 1 contains RI (if reported), CRI (if reported), CQI for the first codeword (if reported). Part 2 contains PMI (if reported) , LI (if reported) and contains the CQI for the second codeword (if reported) when RI value is larger than 4. | CATT (R1-2111219) | E | Apple: We agree to handle it as editorial CR. Both the LI part and the 2L-1 part.  Samsung: Agree that it is editorial, also agree with the FL’s revision of the 1st bullet.  LG: Agree with FL’s assessment.  ZTE: Agree to handle it as part of the editorial CR.  vivo: fine with FL proposal  Qualcomm: Fine for E.  Lenovo/MotM: Agree with FL’s assessment  OPPO: Ok for E.  Ericsson: ok with FL version.  Intel: Agree with the FL. We are OK to accept this correction as editorial. |
| MU.2 | mapping between K^NZ indicator and candidate values  FL: Not critical (may be a good clarification but not needed) | Qualcomm,  Huawei/HiSi | N | Samsung: non critical, but OK to clarify, e.g. similar to RI  LG: Agree with FL’s assessment.  ZTE: We are okay to clarify this.  vivo: agree with FL’s assessment  Qualcomm: we think it is essential. The principle is similar to RI reporting. At least a discussion on common understanding is needed.  Lenovo/MotM: Agree with FL’s assessment  Ericsson: Ok to clarify  Intel: Not essential. In our view existing specification is clear considering the range for K\_NZ {1,2,…,2K0} and bitwidth for K\_NZ ceil(log2(2K0)). |
| MU.3 | Typo corrections  FL: Editorial | Nokia/NSB (R1-2112355) | E | Apple: We agree to handle it as editorial CR  Samsung: Agree with E  LG: Agree with FL’s assessment.  ZTE: Agree to handle it as part of the editorial CR.  vivo: agree  Qualcomm: first change is not needed, “l” is already in the superscript of W^l. Second change is fine.  Lenovo/MotM: Agree  OPPO: Ok for E.  Ericsson: Ok as E  Intel: Agree with FL |
| MU.4 | if , the value is negative  FL: This has been discussed in the past. This is a corner case, will not in practice almost surely. | Qualcomm | N | Samsung: agree with N. As discussed previously, this is an optimization of corner case, whose probability of occurrence is extremely small. The UE will not report such small K^NZ values. Or, the NW can avoid this from happening by configuring paraComb values that don’t have this issue.  LG: Agree with FL’s assessment.  ZTE: We are okay to clarify this.  vivo: agree with FL’s assessment, it had been discussed in past.  Qualcomm: We think this is essential because spec is broken. If not changed, the original text implies that KNZ > 2v. However, in RAN1 #98, there was a conclusion that no restriction that UE has to report >=1 NZC per polarization. It means that there is no restriction on other than KNZ <= K0 per layer and KNZ <= 2K0 across all layers.  Conclusion:  In RAN1#98, there is no consensus on the following issues:  • Refining the agreement on bitmap size of 2LMi for all RI values to 2LMi-1 only for RI>1  • Refining the agreement on KNZ,TOT definition/encoding to allow joint encoding with M’  • Specifying restriction on at least 1 NZC per polarization per layer  @FL: it might be a corner case, but it is a valid case, and it may happen in LOS. Spec needs to address the issues in all valid cases.  @SS: This is about KNZ reported by UE, not K0 values, so cannot be handled by gNB configuration.  Lenovo/MotM: OK to clarify  Ericsson: Agree with N  Intel: Agree with FL |
| MU.5 | CSI frequency granularity when Mv=1  A CSI Reporting Setting is said to have a wideband frequency-granularity if  - *reportQuantity* is set to 'cri-RI-PMI-CQI', or 'cri-RI-LI-PMI-CQI', *cqi-FormatIndicator* is set to 'widebandCQI' and *pmi-FormatIndicator* is set to 'widebandPMI', or  *- reportQuantity* is set to 'cri-RI-PMI-CQI', or 'cri-RI-LI-PMI-CQI', *codebookType* is set to 'typeII -r16' or 'typeII-PortSelection-r16' with and *cqi-FormatIndicator* is set to 'widebandCQI', or  - *reportQuantity* is set to 'cri-RI-i1' or  FL: This was agreed in RAN1#106b-e for Rel-17 FDD CSI codebook (for Mv=1). But the need for Rel-16 CB is unclear since with Mv=1 and WB CQI, WB PMI should be implied even without the added condition.  If added, this could be perceived as E. Otherwise N | Samsung | N | Apple: We are open to discuss. But we have concern since wideband frequency-granularity will impact the low latency AP-CSI reporting, i.e., Table 5.4-1 in 38.214, at least.  Samsung: since we already agreed to this for R17 codebook, the intension here is to fix this issue for R16 codebook also.  LG: It is not essential that the design of eTypeII CB in Rel-16 is mainly focused on Mv >1 case. Besides, in case of Mv=1, there is no problem for UE to report CSI.  ZTE: We think the need to have this for Rel-16 is not clear. It has been agreed in Rel-16 that PMI format is not useful in Rel-16, i.e., all Rel-16 eType II CSI configurations belong to neither subband PMI nor wideband PMI reporting.  vivo: agree with FL’s assessment, open to discuss  Qualcomm: Not needed.  Lenovo/MotM: Unlike Rel-17 FeTypeII, configuring the UE with M=1 in Rel-16 eTypeII is a corner case; no need to discuss  Ericsson: Agree with LG. Non-essential.  Intel: Not essential. From our perspective Rel-16 PMI codebook with M = 1 is a corner case. Also, current spec is not broken without any change for M = 1. |
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| UL.1 | When higher layer parameter *ul-FullPowerTransmission* is set to 'fullpowerMode2',  - the UE can be configured with one SRS resource or multiple SRS resources with same or different number of SRS ports within an SRS resource set with *usage* set to 'codebook', and only one SRS resource in the SRS resource set may be transmitted at a given time instant.  FL: Rel-15 also supports configured 2 SRS resources for usage “codebook”, where SRS is not precoded hence gNB should configure 2 SRS resources in time non-overlapping symbols or slots | Apple | N | Apple: This issue also exists in Rel-15 as FL mentioned. But there is a UE capability on number of SRS resources for CB in Rel-15 and usually UE would report 1 for this UE capability. But for uplink full power mode 2, normally more than 1 SRS resources should be supported, then this issue become critical.  Samsung: open to discuss  LG: Agree with FL’s assessment.  ZTE: We agree with FL’s initial assessment that it can be handled by gNB scheduling once this issue occurs in reality, hence we think there is no specification impact.  vivo: agree with FL’s assessment, this CR is not needed.  Qualcomm: Agree with Apple it would be good to clarify this issue in spec. But OK to treat this as low priority, as we also agree with FL this can happen in Rel-15 and gNB suppose to take care of it.  Lenovo/MotM: We agree with FL’s assessment that it can be handled by gNB implementation.  OPPO: our understanding is this is common understanding and there is no ambiguity. So, CR seems not  needed.  Intel: Agree with FL’s assessment. |
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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.1 (Huawei), MT.1 (Ericsson), MU.1 (CATT), and MU.3 (Nokia)
* The following issues can be designated as H (general consensus on the need for some text change, yet still requiring discussion to arrive at exact texts): MB.2 (ZTE) and MB.4 (Apple)
* On the following issues, there is no consensus on the need for discussion (some have been proposed a few times): MB.3, MU.2, and MU.4

The following **conclusion** is made:

* There is no consensus on whether the issues raised in the following contributions need to be addressed in the maintenance on Rel-16 NR\_eMIMO:
  + MB.3: R1-2110967 (ZTE) on SCS determination of 28 symbols for Rel-16 SCell BFR
  + MU.2: R1-2112195 (Qualcomm) on K\_NZ and v relation
  + MU.4: R1-2111713 (Samsung) on Mv and wideband CQI relation
  + UL.1: R1-2111852 (Apple) on SRS transmission for UL full power

The following **proposals** are made:

* RAN1#107-e email thread assignment for the maintenance on Rel-16 NR\_eMIMO:
  + Email thread 1 (Editorial CR for MAC-CE application time) addressing MB.1; moderated by Xi
  + Email thread 2 (Possible text clarification for SCell BFR 1) addressing MB.2; moderated by Bo
  + Email thread 3 (Possible text clarification for SCell BFR 2) addressing MB.4; moderated by Yushu
  + Email thread 4 (Editorial CRs for mTRP ) addressing MT.1; moderated by Siva
  + Email thread 5 (Editorial CRs for mTRP and MU-CSI 1) addressing MU.1; moderated by Qiubin
  + Email thread 6 (Editorial CRs for mTRP and MU-CSI 2) addressing MU.3; moderated by Filippo

# References

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| --- | --- | --- | --- |
| 1 | R1-2110966 | Draft CR on gNB response for SCell-BFR | ZTE |
| 2 | R1-2110967 | Draft CR on SCS determination of 28 symbols for Rel-16 SCell BFR | ZTE |
| 3 | R1-2111219 | Draft CR on MU-CSI enhancement | CATT |
| 4 | R1-2111672 | Clarification on DCI 1\_2 antenna port determination in TS 38.212 | Ericsson |
| 5 | R1-2111851 | CR on SCell Candidate Beam Detection | Apple |
| 6 | R1-2111852 | CR on SRS Transmission for Uplink Full Power | Apple |
| 7 | R1-2112195 | Discussion on UCI issues for eType II CSI | Qualcomm Incorporated |
| 8 | R1-2112355 | Corrections on eType II codebook tables | Nokia |
| 9 | R1-2112399 | Correction on the description of MAC-CE application time in TS 38.214 | Huawei, HiSilicon |
| 10 | R1-2112412 | Correction of UCI mapping for eType II codebook | Huawei, HiSilicon |
| 11 | R1-2111713 | Correction on frequency granularity of CSI based on Rel.16 Type II codebooks | Samsung |
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