**3GPP TSG RAN WG1 #104b-e R1-2103217**

**e-Meeting, April 12th – 20th, 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

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
	+ *H2:* The proposal can be endorsed without discussion (i.e. unless pointed out otherwise, the moderator will propose to the chair that the proposal be endorsed thereby not counted toward the four-thread quota). It can be merged with any of the assigned threads without any further discussion. This includes TPs associated with previous agreements.
* *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)** | **Companies** | **Initial assessment** | **Company inputs (if any)** |
| MB.1  | RRC parameter misalignment in TS 38.213 and TS 38.214 with regards to *enableDefaultBeamPL-ForPUSCH0-0-r16*FL: needed | CATT, Vivo, Docomo | E | Samsung: We agree with the FL’s assessment. |
| MB.2 | Fixing a typo in clause 7.2.1 of TS 38.213: ‘with with’ 🡪 ‘with’FL: needed | CATT, Docomo | E | Samsung: We agree with the FL’s assessment. |
| MB.3 | Current TS38.213 could be misinterpreted that multi-CC simultaneous TCI update cannot be applied to CORESET#0 (i.e. p=0) because CORESET index p starts from 1 in the same paragraph (either 0<p<12 or 0<p<16). TP proposes to include p=0 for the multi-CC simultaneous TCI update to be aligned with the related MAC-CE description. FL: discussed in pre-phase of last several meetings but not treated. Even though current text in TS38.213 does not explicitly preclude p=0, it is true that it could be implicitly precluded by the value range of p described in the same paragraph.  | Vivo | H | Samsung: We agree with the FL’s assessment. |
| MB.4 | 1. For multi-CC simultaneous TCI update, clarify which BWP’s tci-States-ToAddModList is applied to CORESET#0. 2. If TCI state of active BWP is applied for CORESET #0, conclude that UE does not expect to receive TCI state indication for CORESET #0 when the BWP(s) containing CORESET #0 is inactive.FL: discussed in pre-phase of last meeting. According to TS38.321, it seems clear that the TCI list is from active BWP of the CC. Motivation of the second proposal is unclear. | Vivo | N | Samsung: We agree with the FL’s assessment. It is obviously from active BWP of the CC.vivo: The motivation for the second proposal is as following: if CORESET #0 in CC2 is QCL’ed with a TCI state not in the same BWP, the UE behavior is unclear. We would like to preclude such cases. |
| MB.5 | Paragraph indentation and wording modification (Proposal4 of R1-2102946)FL: Paragraph indentation seems needed while wording modification seems not. | Vivo | E (only paragraph indentation) | Samsung: We agree with the FL’s assessment. Likewise the FL’s assessment, we only agree with aligning the paragraph indentation, but the added wording “that does not include rrc-ConfiguredUplinkGrant” does not need since the following wording “activated, as described in Clause 10.2, by a DCI format that does not include an SRI field” clearly mentioned that this is type 2 configured grant.vivo: Fine with FL proposal. |
| MB.6 | Clarifying PL-RS selection for Type-2 CG-PUSCH based on one of the following interpretations:•Interpretation 1: The PL-RS for Type-2 CG-PUSCH is always based on the one indicated by SRI in activating DCI•Interpretation 2: The PL-RS for Type-2 CG-PUSCH is based on the lasted PL-RS associated with the SRIFL: current spec seems support Interpretation 1 only as the MAC-CE is only for updating ‘mapping’ | Apple | N | Samsung: We agree with the FL’s assessment. Our understanding is Interpretation 1 before UE receives a deactivation DCI. Apple: If all the companies share the same view that current specification is interpretation 1, we can quickly reach a conclusion without potential change to the specification. |
| MB.7 | Clarify that SSB cannot be used for BFD (R1-2102374)FL: This was proposed multiple times and suggest at least a conclusion should be made. | OPPO | H | Docomo: Not support. This should be N.Samsung: We agree that some clarification would be needed. However, if we adopt this CR, the TP has impacts on Rel-15 PCell BFR. Hence if we agree with discussion for this issue, the right place would be Rel-15 maintenance.ZTE: We can fine with some discussion. But, alternatively, we support to explicitly specify that the SSB can be used for BFD.Apple: We think some clarification is preferred since this has been lingering issue for long time. However, the outcome could be that SSB can be used for BFD |
| MB.8 | Clarify SCS for 28 symbols (R1-2102657, TP1/2)FL: Although this was discussed in last meeting without any consensus, it is better to fix this issue with regard to potential ambiguity. | ZTE, Docomo | H | Docomo: Agree with H.Samsung: Our view is interpretation-2. It would be better to clarify this or just a conclusion is also fine. |
| MB.9 | Update CORESETPoolIndex to be 0 after BFR (R1-2102657, TP3)FL: This was proposed multiple times and suggest at least a conclusion should be made. | ZTE | H | Docomo: Not support. This should be N.Samsung: Our view is that this is not essential. We think that rather than reseting CORESETPoolIndex of all CORESETs as 0, restricting monitoring the CORESETs with CORESETPoolIndex = 1 before MAC-CE activation for TCI state of the CORESETs from UE side, or using a single CORESETPoolIndex for a certain time period after beam failure (which is LGE’s last comment) by gNB side is sufficient by implementation.LG: not essential. BFR with two CORESET pools is not of typical case for Rel-16 and is now under working for Rel-17. gNB can configure only one CORESET pool for BFD cell or use one CORESET pool after beam failure by implementation. No need to further optimize this.ZTE: We encourage opponents to clarify the UE behavior when mDCI-mTRP and SCell-BFR are enabled both. |
| MB.10 | Add a condition (when spCell-BFR-CBRA is ‘true’) to apply new beam to PUCCH after CBRA based BFR (R1-2102946)FL: This is based on RAN2’s agreement in last meeting. | vivo | E | Docomo: Not support. This should be N. There is no ambiguity in the current specs.* In TS38.213, PUCCH beam after CBRA-BFR is updated if BFR MAC CE is contained in Msg.3/A.
* In TS38.321, BFR MAC CE is contained in Msg.3/A, **if spCell-BFR-CBRA is set 'true'.**

Samsung: We agree with the FL’s assessment.vivo: This could be editorial.  |
| MB.11 | Define BFD RS selection to avoid ambiguity of BFD RS counting for FG 16-1g (R1-2103084)FL: There is a potential ambiguity for UE FG 16-1g counting if BFD RS selection rule is unclear. | Apple, Docomo | H | Docomo: Agree with H.Samsung: We agree with the FL’s assessment.LG: not positive to open this discussion again at this late stage. This can create NBC issue. Regarding UE capability, we think that one RS difference on counting between UE and gNB would not create critical issue (gNB may assume that UE will use all three RSs for the counting purpose in such case).ZTE: We can fine with some discussion but can NOT support the proposed solution. In our view, the solution should be simplified, e.g., lowest CORESET ID. |
| MB.12 | Add time duration definition for CPU occupation for L1-SINR computation (R1-2103402)FL: It seems the time duration definition for CPU occupation for L1-SINR is missing in current spec. | Huawei/HiSilicon | H | Samsung: We agree with the FL’s assessment.LG: ok to discussZTE: We suggest to mark it as ‘N’. We have no agreement that report quantity = ‘none’ can be applied to L1-SINR measurement.vivo: Support to discuss this issue. Wording update may be necessary.Apple: We do not fully understand the motivation. Why L1-SINR is needed “for a CSI report with higher layer parameter reportQuantity set to 'none' and CSI-RS-ResourceSet with higher layer parameter trs-Info not configured” |
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| MT.1  | R1-2102596 suggested that the title description of Table 5.1.2.1-2 is not proper for URLLC scheme 4 since scheme 4 uses “RepetitionNumber-r16” but the table title uses “*pdsch-AggregationFactor*”. Thus, it suggested to use a separate table for scheme 4.FL: this was discussed in pre-phase in last meeting, some companies commented that the suggested change does not change the spec interpretation.  | CATT | N | Samsung: We agree with the FL’s assessment.vivo: Agree with FL’s assessment. |
| MT.2 | R1-2102596 explained that in current specification, out-of-order operation for PDSCH to HARQ-ACK can be supported only in slot-level granularity. R1-2102596 proposed to update the text to support out-of-order operation for PDSCH to TDMed HARQ-ACK within a slot.FL: this has been proposed multiple times. Suggest to discuss to at least make an conclusion.  | CATT | H | Samsung: We agree with the FL’s assessment.LG: ok to discussZTE: We are OK to discuss thisvivo: We think the current spec is clear since out-of-order operation for PDSCH to HARQ-ACK is supported when separate HARQ-ACK feedback in a slot is configured and there is no restriction of forbidding such a case in the spec.Apple: We do not prefer to discuss it. It already provides NW with enough flexibility for scheduling inter-slot TDM OOO. We already finished the UE FG design.  |
| MT.3 | The issues of default TCI state:* R1-2102658 proposed to extend the default TCI state mapping mechanism specified for TDMSchemeA to all the other single-DCI PDSCH transmission schemes.
* R1-2102947 proposed to specify the mapping between default TCI states and frequency sources of scheme 2a/2b
* R1-2102947 proposes to specify default TCI state for cross-carrier scheduling for mTRP.
* R1-2103218 propose to specify the default TCI state of PDSCH of cross-carrier in S-DCI based mTRP.
* R1-2103673 suggested to discuss the default TCI state of mTRP in cross-carrrier scheduling.

FL: That issue has been discussed multiple time in previous meetings but no conclusion. | ZTE, vivo, Samsung, ASUSTEK | N | Samsung: Since the spec already covers the default TCI state of scheme 3 and 4, AP CSI-RS cases, and a part of cross-carrier scheduling, so for the completeness of the spec, it would be good to have the solutions for other issues related to default TCI state.LG: Agree with FL’s assessment (Not essential)ZTE: We have to emphasize the current spec is not complete, the Rel-16 default TCI is only specified for TDM schemes, not yet for SDM and FDM. We encourage opponents to clarify the technical reason.vivo: Propose changing to “H”. As we have made agreement on the default TCI state of scheme 3 and 4, there is no reason to miss the Scheme 2a/2b part. In addition, default TCI state of MTRP for cross-carrier scheduling also needs to be specified. ASUSTeK: Since the concerned cases of default TCI state is covered by existing spec, while incompleteness or conflict has been identified by the proponents, common understanding on the existing spec should be derived to resolve this issue. (Note that the contribution has indeed been there for couples of meetings while concrete discussion has not started yet) |
| MT.4 | R1-2102373 proposes to clarify in 38.214 that the UE does not expect to receive single-DCI mTRP TCI state activation MAC CE when multi-DCI mTRP is configured.FL: it is a good clarification in 214. | OPPO, Docomo, Apple | H | Docomo: Agree with H.Samsung: We don’t think it is needed. It was already captured as a conclusion in RAN1#101-e, that is, Simultaneous reception or dynamic switch of sDCI based mTRP and mDCI based mTRP are not supported. Also, Note 1 in the conclusion also said that this conclusion has no RAN1 specification impact in Rel-16.LG: Ok to discussZTE: This seems non-essential since gNB will not configure SDCI and MDCI based MTRP together.vivo: We don’t have the need to specify anything with the conclusion.Apple: We are fine to discuss this and clarify the specification. |
| MT.5 | For multi-DCI based M-TRP transmission, UE needs to determine whether $\sum\_{μ=0}^{3}\left(N\_{cells,0}^{DL,μ}+γ∙N\_{cells,1}^{DL,μ}\right)$ is larger than $N\_{cells}^{cap}$ or not. But the description in 213 does not align with that. According to the description in current 213, reader would understand that the SCS configuration μ only corresponds to the active DL BWPs of the scheduling cells, and the deactivated cells (without active DL BWP) are not counted for the comparison. Proposal 2 in R1-2102373 provided TP to fix that.FL: this is needed. It looks like the current text description in 213 change the UE behavior wrongly. | OPPO | H | Samsung: We agree with the FL’s assessment and if other companies are okay, then it can be rated E.ZTE: We are OK to discuss thisApple: We are supportive to discuss it |
| MT.6 | R1-2102947 proposes TP to specify the case when PUCCH of CSI/SR/LRR does not overlap with two HARQ-ACK PUCCHs.FL: this issue has been proposed by multiple times. We can discuss and make an conclusion  | Vivo, Apple | H | Docomo: can be N and left to gNB implementation.Samsung: It also can be avoided by gNB implementation.LG: it is not essential and should be low priorityvivo: Agree with FL’s assessment. This restriction is needed to make the gNB avoid such overlapping cases. Otherwise, UE behavior is unspecified when PUCCH of CSI/SR/LRR overlaps with two HARQ-ACK PUCCHs.Apple: We think this is very important for UE implementation. gNB always has scheduling flexibility, but the specification is needed for the expected UE behavior  |
| MT.7 | R1-2102947 proposes to conclude that UE does not expect to be scheduled a PDSCH overlapping with a PDCCH associated to CORESET having different CORESETPoolIndex from the scheduling PDCCHFL: During pre-phase in last meeting, 9 companies thought it is H but 4 companies thought it is N.  | vivo | H | Docomo: can be N.Samsung: It seems not essential and can be rated N.LG: it is not essential and should be low priorityZTE: This should be lower priority since it can be up to implementation. That is, gNB will not configure like that, otherwise, it will be an error case.vivo: To avoid the unclear UE behavior to deal with such overlapping cases, we propose to have the restriction.Apple: We support the discussion |
| MT.8 | The issue of radio link monitoring in mTRP:* Apple (R1-2103085) proposed to enhance the method of UE determining RLM RS in M-DCI mTRP system by adding Lmax = 8.

FL: was proposed multiple time and suggest to discuss it at least for a conclusion | Apple, Docomo | H | Docomo: Agree with H.Samsung: It can be discussed but the condition of mDCI mTRP would be included.LG: it is not essential and should be low priorityZTE: We are OK to discuss this. However, we think RLM is only supported for CORESETs with CORESETPoolIndex = 0. |
| MT.9 | The issue of sub-slot HARQ vs m-DCI mTRP transmission.R1-2103085 proposes to make conclusion on the following two issues:* whether UE supports sub-slot based HARQ-ACK PUCCH when UE is configured with Multi-DCI based Multi-TRP operation.
* whether UE supports two HARQ-ACK codebooks with different priorities when UE is configured with Multi-DCI based Multi-TRP operation

R1-2103433 suggests to limit the number of PUCCH transmission for m-DCI based mTRP HARQ when sub-slot PUCCH or two PUCCH configurations are configured with m-DCI mTRP transmission.FL: The issue of m-DCI mTRP HARQ transmission vs sub-slot based HARQ is important. Suggest to discuss and make conclusion on that | Apple, Nokia  | H | Samsung: We agree with the FL’s assessment.ZTE: Not support. From the current specification, it is hard to support both features. Even without further conclusion, we think it is common understanding that both features can not be configured together.vivo: Agree with FL’s assessment. This issue can be discussed to avoid complexity of the mixed configurations.Apple: If companies believe it cannot be configured together, we can have a conclusion. But the current specification suggests that concurrent configuration is supported  |
| MT.10 | R1-2103145 proposes to reset the PDSCH beam to qnew during BFR in single-DCI based mTRP systemFL: This was proposed couple of times. Whether to reset the beam of PDSCH to qnew was discussed a lot in rel15/rel16 PCell and SCell.  | Qualcomm | N | Samsung: We agree with the FL’s assessment.LG: Agree with FL’s assessment (Not essential)vivo: Agree with FL’s assessment. This can be discussed in Rel-17 scope. |
| MT.11 | R1-2103145 proposes to specify the BD/CCE limit when NR-DC and multi-DCI mTRP are configuredFL: This was discussed in pre-phase in a few previous meetings. Some companies commented that it is not essential issue. We might discuss it and make a conclusion on that | Qualcomm | H | Samsung: It seems not essential issue.LG: Not essentialZTE: We are OK to discuss itApple: We are okay to discuss it |
| MT.12 | The issue of SPS PDSCH transmission in mTRP:* R1-2103145 proposed to clarify that the RV sequence used across multiple repetitions in schemes 2b, 3, and 4 is based on setting rvid=0.
* R1-2103218 proposed to Extend the single-DCI M-TRP dynamic grant PDSCH transmission schemes to include SPS PDSCH for enhanced PDSCH reliability for URLLC service types
* R1-2103551 proposed CR to specify the RV values for DL DPSCH SPS in S-DCI mTRP

FL: it was discussed in pre-phase in previous meeting and some companies thought that is it is not essential to rel16 and maybe for later release. In last meeting, 4 companies support it as H but 5 companies suggested this is N | Qualcomm, Samsung, Ericsson | N | Samsung: SPS is supported already in S-DCI based M-TRP. There’s no reason to exclude SPS for M-DCI based M-TRP only. Also overlapping issue should be resolved and without resolving this issue, overlapping SPS PDSCHs may not be received by the UE even though UE may have declared a capability to receive overlapping DG PDSCHs.vivo: Agree with FL’s assessment. |
| MT.13 | R1-2103218 proposes to Introduce a parameter X which can be corresponding to or can include a DCI decoding delay time for default TCI states of the single-DCI multi-TRP PDSCH repetition. UE applies the first TCI state to a receive symbols before decoding DCI. The value of X can be specified by one of the following candidatesFL: the threshold *timeDurationForQCL* already consider the DCI decoding latency.  | Samsung | N | Samsung: We think that it can be rated as H. For the case of tdmSchemeA based on default beam, if the second PDSCH occasion starts before finishing the PDCCH decoding, the UE cannot know an appropriate timing for applying the second default TCI. Hence, some clarification would be needed for this case.LG: Current specification is enough. |
| MT.14 | The issue of PT-RS in NC-JT:R1-2103552 suggested that the current PT-RS power allocation for NC-JT does not take the muted RE into account when 2 PT-RS ports are configured. Thus, R1-2103552 proposes to update PT-RS power allocation in Table 4.1-2 of 38.214 v16.4.0 to reflect additional power boosting for NC-JT when 2 PT-RS ports are configured and also proposed a new table for 38.214.FL: suggest to discuss it | Ericsson, Docomo | H | Docomo: Agree with H.Samsung: We agree with the FL’s assessment.LG: Ok to discussZTE: OK to discuss this |
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| UL.1 | ***ul-FullPwrMode2-TPMIGroup-r16***Indicates the UE supported TPMI group(s) which delivers full power. The capability signalling comprises the following values:- *twoPorts-r16* indicates a 2-bit bitmap- *fourPortsNonCoherent-r16* indicates one of the TPMI groups {~~G~~g0-3}- *fourPortsPartialCoherent-r16* indicates one of the TPMI groups (~~G~~g0-6)UE indicates support of this feature shall also indicate support of *ul-FullPwrMode2-MaxSRS-ResInSet.*NOTE 1: When a full coherent UE operates in mode 2, it reports TPMIs the same as a partial-coherent UE.NOTE 2: For 4 port partial-coherent or full-coherent UE, UE can only report: 2-port {2-bit bitmap} or/and one of 4-port non-coherent {G0~G3} or/and one of 4-port partial-coherent {G0~G6}For 4 port non-coherent UE, UE can only report: 2-port {2-bit bitmap} or/and one of 4-port non-coherent {G0~G3}For 2 port UE, UE can report: 2-port {2-bit bitmap}}NOTE 3: A UE that supports this feature must report at least one of the values.FL: TP for 38.306, should be discussed in RAN2 and make necessary correction according the previous LS from RAN1 | Samsung | E (RAN2) | Samsung: For clarification of label “E(RAN2)” which one is the right interpretation? 1) Do we agree on this CR and send an LS to RAN2?2) Should this issue be discussed in RAN2?LG: Ok to discuss for clarification.ZTE: We support to discuss thisFL: if RAN1 can agree on proposed correction, RAN1 can send LS to RAN2. My original thinking was it can discussed directly in RAN2.  |

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):
* The following issues can be handled as H2 (editorial TPs that can be agreed without further email discussion, including capturing previous agreements)
* The following issues can be designated as H (requiring discussion and additional agreements/conclusions):

In light of the above observations, the moderator makes the following **proposals**:

* Continue discussion on 4 threads:
	+ Thread 1 (moderator ...) Maintenance and TPs for Multi-beam 1: addressing
	+ Thread 2 (moderator ...) Maintenance for Multi-TRP 1: addressing

# References

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| --- | --- | --- | --- |
| 1 | R1-2102373 | Text proposals for M-TRP transmission | OPPO |
| 2 | R1-2102374 | Corrections for SCell BFR | OPPO |
| 3 | R1-2102595 | Maintenance of Multi-beam enhancement operation | CATT |
| 4 | R1-2102596 | Maintenance of Multi-TRP transmission | CATT |
| 5 | [R1-2102657](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2102657.zip) | Maintenance of multi-beam operation | ZTE |
| 6 | [R1-2102658](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2102658.zip) | Maintenance of Multi-TRP enhancements | ZTE |
| 7 | [R1-2102946](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2102946.zip) | Maintenance on multi beam related issues | vivo |
| 8 | [R1-2102947](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2102947.zip) | Maintenance on multi TRP | vivo |
| 9 | [R1-2103084](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2103084.zip) | Remaining issues on Rel-16 beam management enhancement | Apple |
| 10 | [R1-2103085](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2103085.zip) | Remaining issues on Rel-16 Multi-TRP enhancement | Apple |
| 11 | R1-2103145 | Remaining Issues on Multi-TRP Enhancements | Qualcomm Incorporated |
| 12 | R1-2103218 | On Rel.16 multi-TRP/panel transmission | Samsung |
| 13 | [R1-2103219](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2103219.zip) | On UL full power transmission and multi-beam | Samsung |
| 14 | [R1-2103395](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2103395.zip) | Corrections on the precoding for PUSCH | Huawei, HiSilicon |
| 15 | [R1-2103402](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2103402.zip) | Correction on CPU occupation rules for L1-SINR reporting | Huawei, HiSilicon |
| 16 | [R1-2103433](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104b-e/Docs/R1-2103433.zip) | Maintenance of Rel-16 Multi-TRP operation  | Nokia, Nokia Shanghai Bell |
| 17 | R1-2103551 | Draft CR on DL SPS based PDSCH repetitions | Ericsson |
| 18 | R1-2103552 | Maintenance for single-DCI based multi-TRP in Rel-16 | Ericsson |
| 19 | R1-2103673 | Interoperation between cross-carrier scheduling and multiple TRPs | ASUSTEK COMPUTER (SHANGHAI) |