**3GPP TSG RAN Meeting #92-e RP-21xxxx**

**Electronic Meeting, June 14-18, 2021**

**Agenda item:** 9.7.1.1

**Source:** Moderator (Samsung)

**Title:** Moderator’s summary for email discussion [92-e-08-feMIMO-Scope]

**Document for:** Discussion and Decision

1. Introduction and background

Per chairman’s instruction, the goal and pertinent contributions for this email discussion is as follows:

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| [92-e-08-feMIMO-Scope] | RP-211035, 1152, 1186, 1190, 1217, 1302, 1359, 1364, 1463, 1187 (feMIMO part) | Eko Onggosanusi, Samsung | 9.7.1.1, 9 |

The following topics have been discussed in the above contributions:

* (1152, 1186/87) Overall progress of Rel-17 NR\_FeMIMO:
  + Even if the overall progress is good, some items experience more challenge in progressing efficiently. Such items include inter-cell mTRP, UL multi-panel, MPE mitigation. For this matter, no RAN intervention was proposed this time as it wasn’t seen necessary. The progress will be reassessed in RAN#93-e.
  + No email discussion is needed on this topic
* (1186, 1364) Overlap between RAN1 AI 8.1.1 (multi-beam) and 8.1.2.2 (inter-cell mTRP) on DPS,
  + Samsung (1186) pointed out that *from WID and workflow perspectives*, there should be no overlap between 8.1.1 and 8.1.2.2: 1) DPS scheme (inter-cell beam management) in 8.1.1 is based on Rel-17 unified TCI while any work in 8.1.2.2 is based on Rel-15/16 TCI; 2) Any work in 8.1.2.2 is targeting mDCI for multi-PDSCH reception (hence simultaneous RX, not DPS) as clearly stated in the WID.
  + But Nokia (1364) pointed out a *de facto* overlap of work between 8.1.1 and 8.1.2.2 on DPS. While DPS is out of scope in 8.1.2.2 according to the WID, at least one alternative (considered for discussion and down-selection) in 8.1.2.2 facilitates DPS. Meanwhile, inter-cell beam management in 8.1.1 comprises DPS.
  + Email discussion is needed on this topic
* (1035, 1152, 1186/90, 1217, 1302, 1359, 1463) Scope of L1/L2-centric inter-cell mobility (L12XCM) in Rel-17. The following sub-topics were discussed:
  + RAN2 scope for Rel-17 L12XCM: scenario 1 (no change in serving cell) vs. scenario 2 (requiring change in serving cell)
    - Samsung (1186/90), affirming the RAN2 response that both scenarios 1 and 2 of R2-2106787 apply to L12XCM *(“RAN2 summarized two expected scenarios and corresponding models (Inter-cell multi-TRP-like model and L1L2 mobility model) with simplified procedures regarding L1/L2 centric inter-cell mobility ...”*), proposes that RAN1 proceed working on inter-cell beam management (including inter-cell beam indication) in parallel to RAN2 work
    - Qualcomm (1302) and CATT (1217) propose to include both scenarios with additional TUs allocated to RAN2. However, if additional TUs are not feasible, CATT proposes to postpone scenario 2 to a later release. On the other hand, MediaTek (1463), OPPO, and Samsung (1190) propose to include only scenario 1 due to the current TU allocation.
  + Other assumptions for Rel-17 L12XCM (given the LS responses from RAN2/3/4):
    - MediaTek (1463), OPPO (1035), and Qualcomm (1302) propose to assume intra-DU (excluding inter-DU) and intra-frequency (excluding inter-frequency)
    - MediaTek (1463) also proposes to assume that “TRP/cell1 and TRP/cell2 are synchronised and timing advance is maintained sufficiently that a RACH would not be required”
    - MediaTek (1463) also proposes that “(p)rotocol stack design for L1/2 centric inter-cell mobility will not target re-use of CA Pcell/Scell concept”
  + Possibility of postponing or de-prioritizing the entire work of L12XCM in Rel-17 to a later release:
    - Vivo (1152) mentioned this as one option among three
    - Huawei (1359) proposes to postpone the entire work to a later release. Huawei maintains that only scenario 2 is relevant for L12XCM (despite the response from RAN2 in R2-2106787) and the workload associated with scenario 2 is excessive.
    - Nokia (1364) proposes to deprioritize the entire work since they observe lack of gain for scenario 2 in their study.
  + Email discussion is needed on each of the above sub-topics

1. Initial round

During the initial round, interested companies are encouraged to share their view on the following:

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| Please review section 1 for background summary.  **Issue 1**: Overlap between RAN1 AI 8.1.1 and 8.1.2.2 pertaining to DPS (dynamic point selection, i.e. one cell/TRP is selected at a time hence corresponding to only one DCI and only one PDSCH reception at a time). The WID is clear about mDCI/multi-PDSCH reception for the objective of 8.1.2.2. Therefore, it is proposed that to ensure scope conformance with the WID and avoid overlap, *RAN affirm that RAN1 AI 8.1.2.2 (inter-cell mTRP) should focus on mDCI/multi-PDSCH reception and refrain from adding the support for DPS*.   * Q1.1: Please comment on the above proposal   **Issue 2**: Scope of L1/L2-centric inter-cell mobility (L12XCM) in Rel-17. Please share your view on the following:   * Q2.1: Assume intra-DU (excluding inter-DU) and intra-frequency (excluding inter-frequency) * Q2.2: Assume that “TRP/cell1 and TRP/cell2 are synchronised and timing advance is maintained sufficiently that a RACH would not be required” * Q2.3: Assume that “(p)rotocol stack design for L1/2 centric inter-cell mobility will not target re-use of CA Pcell/Scell concept” * Q2.4: Affirming the RAN2 response that both scenarios 1 (no change in serving cell) and scenario 2 (requiring change in serving cell) of R2-2106787 apply to L12XCM, RAN1 is to proceed working on inter-cell beam management (including inter-cell beam indication) in parallel to RAN2 work * Q2.5: RAN2 scope *for Rel-17* L12XCM, i.e. scenario 1 (no change in serving cell) and/or scenario 2 (requiring change in serving cell) * Q2.6: Possibility of postponing or de-prioritizing the entire work of L12XCM in Rel-17 to a later release |

* 1. Compilation of companies’ inputs

Table 1 Inputs

|  |  |
| --- | --- |
| **Company** | **View** |
| Mod V0 | **Please share your views on Q1.1, Q2.1/2.2/2.3/2.4/2.5/2.6** |
| OPPO | **Issue 1**: Overlap between RAN1 AI 8.1.1 and 8.1.2.2 pertaining to DPS. The WID is clear about mDCI/multi-PDSCH reception for the objective of 8.1.2.2. Therefore, it is proposed that to ensure scope conformance with the WID and avoid overlap, *RAN affirm that RAN1 AI 8.1.2.2 (inter-cell mTRP) should focus on mDCI/multi-PDSCH reception and refrain from adding the support for DPS*.   * Q1.1: Please comment on the above proposal   According to the WID, the objective of 8.1.2.2 is for multi-DCI based multi-PDSCH reception. Regarding the DPS, the definition is not clear here since there may be different interpretations of the terminology “DPS” during RAN1 discussion, e.g., transparent, non-transparent. Thus, we prefer to make it clear what “DPS” refers to in this proposal.  [Mod: DPS refers to dynamic point selection, i.e. using single DCI and receiving single PDSCH since only one cell/TRP is selected at a time. Therefore it is clearly not mDCI/multi-PDSCH reception. Thanks for pointing this out. I added this above.] |
| OPPO | **Issue 2**: Scope of L1/L2-centric inter-cell mobility (L12XCM) in Rel-17. Please share your view on the following:   * Q2.1: Assume intra-DU (excluding inter-DU) and intra-frequency (excluding inter-frequency)   Yes, we think this is reasonable way to go   * Q2.2: Assume that “TRP/cell1 and TRP/cell2 are synchronised and timing advance is maintained sufficiently that a RACH would not be required”   Yes, the L12XCM is focusing on FR2 where cell range is small. The cell change is only possible in the overlapping area of FR2 cell hence the timing difference between TRP/cell1 and TRP/cell2 is not significant in practice. Or, if RACH procedure is assumed necessary then the RACH procedure itself will defeat the main intention of the whole feature.   * Q2.3: Assume that “(p)rotocol stack design for L1/2 centric inter-cell mobility will not target re-use of CA Pcell/Scell concept”   Not exactly. In scenario1, it is not entirely clear that TRP/cell2 is a neighboring cell or a serving cell before its relevant TCI state is activated. But once data communication starts it is obviously that TRP/cells is also a serving cell. RAN2 agreed that user plane protocol stacks down to MAC layers are shared between TRP/cell1 and TRP/cell2, so TRP/cells will looks very like a component carrier. The difference is that normal component carriers of CA architecture are inter-frequency carriers while now most likely TRP/cell1 and TRP/cell2 are intra-frequency carriers. Actually another alternative is to take TRP/cell2 as same serving cell of TRP/cell1 with minor variant parameters of e.g. data channel. In this way the model will be simpler. If this alternative can be confirmed then we also agree that CA concept is can’t be reused.  In scenario2, we agree that CA concept is not applicable since TRP/cell2 is actually a neighboring cell i.e. UE is only connected to either TRP/cell1 or TRP/cell2 but not simultaneously. If the TRP/cell1 is PCell, then the outcome of the serving cell change should be same as legacy handover procedure despite that the detail signaling procedure will be totally different.   * Q2.4: Affirming the RAN2 response that both scenarios 1 (no change in serving cell) and scenario 2 (requiring change in serving cell) of R2-2106787 apply to L12XCM, RAN1 is to proceed working on inter-cell beam management (including inter-cell beam indication) in parallel to RAN2 work   Yes   * Q2.5: RAN2 scope *for Rel-17* L12XCM, i.e. scenario 1 (no change in serving cell) and/or scenario 2 (requiring change in serving cell)   Only scenario1, if TU is allowed   * Q2.6: Possibility of postponing or de-prioritizing the entire work of L12XCM in Rel-17 to a later release   No strong opinion. |
| Nokia, Nokia Shanghai Bell | It would be good if there was some structure for the questions without just copy-pasting the proposals from different contributions: The main questions to tackle are very simple: 1) Which parts of the current WI scope are possible to complete in Rel-17? 2) How much time is needed to complete those? How to arrange the topics within AIs is of secondary nature and it can be addressed once the way forward is clarified.  Then Q1.1 just asks whether DPS based on mTRP is possible to be completed and in which AI, whereas Q2.X are about L1 mobility-related aspects (unfortunately in a somehat random order, and since they are coming from different contributions, they are not "apples-to-apples" comparisons, and it is unclear to us how to address those.  For Q1.1, we would note once again that it doesn't matter what is handled in which RAN1 agenda item: Only the WI objectives matter and those are what we should focus on for RAN Plenary discussions. The WI also makes no mention whatsoever about "DPS", nor is it even clear in this context what that would mean. So let's rather focus on questions that help to advance the understanding on the WI scope - we have provided examples of these below.  As discussed in our contribution, the impacts of inter-cell L1 mobility seem major and the existing RAN2/3/4 TUs are not sufficient. Adding more TUs is not feasible either, so L1 mobility should be simply scoped out.  For mTRP objective, RAN2 discussion has currently focused on inter-cell parts (i.e. allowing TRPs to come from different PCIs), which is partly linked with inter-cell L1 mobility. It also seems that what RAN2 discussed is not exactly the same thing that RAN1 discussed, so it's not 100% clear what is even possible in RAN2 with this.  As we discuss in our contribution, it seems that RAN2/4 TUs for this WI were badly underestimated, and RAN3 TUs are simply missing. Hence, considering the already wide scope of Rel-17, RAN should downscope the WI to match the TUs: RAN2/3/4 are already full. This means only matters that have no or minimal RAN3 impacts are allowed, with only limited RAN2/4 impacts (matching the existing TUs). So either the mTRP parts are also taken out, or their scope is clearly limited for **all WGs** (not just RAN1 and not on the AI - level but on objectives).  For mTRP, enhancing the existing Rel-16 mTRP framework should be take as baseline, i.e. no additional "L1-centric" mTRP framework should be created. |
| vivo | Issue1: in our view DPS is one of the possible operations in mTRP scheme, in the case of inter-cell mTRP which is based on Rel-15/16 MDCI MTRP naturally support DPS function.  Issue2: in our view, the main issue is the RAN2 work and TU, scenario seems feasible however it depends on assessment from RAN2 leadership without increasing TU, regular FeMIMO related RAN2 work has to be taken into account as well. |
| RAN2 Chairman | Comment on the proposed Questions: Avoiding the confusing R1 notations: For RAN2 Mobility enhancements required by this work item, the details should be clarified a) which benefit(s) to achieve, b) some restrictions / assumptions for solution(s) applied. If such focus-enhancing clarifications cannot be done, they will need to be done in R2, and then indeed this will take a lot of time, and feasibility could be questioned (regardless if we could increase the TU somewhat). |
| ZTE | **Issue 1**  Q1.1  We think the scope of 8.1.2.2 can include DPS. This can be left to RAN1 to decide. There is no need to have any RAN guidance for this.  **Issue 2**  In general, we think it is beneficial to give some high-level guidance on scenario 1 or 2 in this plenary considering we only have one meeting in Q4 for RAN2. Thus we prefer to restrict Rel-17 to scenario 1. For other issues, they can be discussed and decided in WGs as the workload is already relieved if we down scope scenario 2.  Q2.1  We think to restrict intra-DU is fine for Rel-17. We are also okay to leave this to RAN2 to decide.  For inter-frequency or not, there is some discussion in RAN1 8.1.2.2. This can be left to RAN1 to decide.  Q2.2  We are fine with this assumption. We are also okay to leave this decision to WGs.  Q2.3  We are okay. We are also okay to leave this to WGs to decide.  Q2.4  We prefer to restrict the Rel-17 work in scenario 1 only in both RAN1 and RAN2. The expected work load of scenario 2 is too high to be completed in Rel-17.  In addition, based on the discussion in RAN2, it seems RRC procedure will be involved anyway for scenario 2, thus the scenario 2 is some kind of L1/L2 triggered L3 mobility instead of L1/L2 centric mobility.  Q2.5  We prefer scenario 1 only.  Q2.6  We think at least scenario 1 can be completed in Rel-17 while scenario 2 can be left to future release. |
| Samsung | **Issue 1:**  The WID is clear. Objective 1, which maps to AI 8.1.1, deals with “Identify and specify features to facilitate more efficient (lower latency and overhead) DL/UL beam management to support higher intra- and L1/L2-centric inter-cell mobility”. While objective 2.b, which maps to AI 8.1.2.2, deals with “Identify and specify QCL/TCI-related enhancements to enable inter-cell multi-TRP operations, assuming multi-DCI based multi-PDSCH reception”  Therefore, we agree that multi-cell mTRP should focus multi-DCI, multi-PDSCH. Dynamic point selection (i.e. receiving from a single TRP at a time) is not within the scope of the objective 2.b.  Question to vivo: Since DPS comprises selecting only one cell/TRP, how is mDCI relevant for DPS which is intended for a UE receiving (simultaneous) multi PDSCH reception?  **Issue 2:**  **Q2.1**: Agree to focus on intra-DU. Having said that, RAN1 design strive to be generic enough to handle inter-DU with no or minimal updates in a future release.  **Q2.2**: Assuming synchronized and small cells seems to be reasonable for Rel-17.  **Q2.3**: The details of the protocol stack design should be left to RAN WG2 to discuss and design. No RAN plenary intervention at this time.  **Q2.4**: Agree that scenario 1 and scenario 2 apply to L12XCM. The RAN1 and RAN2 work can proceed in parallel.  **Q2.5**: Given the TU allocation for this WI for RAN2, and the amount of work RAN2 has discussed and identified for scenarios 1 and 2, it is not possible for RAN2 to complete scenarios 1 and scenarios 2 in Rel-17. Therefore, we agree that in Rel-17 RAN2 focuses on scenario 1.  **Q2.6**: Given that L12XCM has progressed very well so far, the motivation for down-scoping L12XCM from Rel-17 FeMIMO remains unclear especially since the only reason brought forth so far is only related to RAN2 work scope. |
| Huawei, HiSilicon | Q 1.1, we agree that for Rel-17 to focus on inter-cell mTRP for mDCI/multi-PDSCH reception, and we also think this should be according to the Rel15/16 TCI framework. This should be clarified so that no more confusion is raised across WGs in future discussion.  Regarding Q2.1-2.6, we understand they are not same level questions. In our understanding the RAN2 discussion was to clearly separate inter-cell mTRP and L1/L2 mobility as two scenarios to avoid any confusion, it was not the case that both are for L1/L2 mobility. The confusion was due to the original LS from RAN1 with the title of L1/L2 mobility but RAN2’s intention to separate these two scenarios was indeed to decouple these two things. We think at this stage RAN2 TU should be not added for a particular WI anymore, and therefore we prefer to focus on support of inter-cell mTRP in Rel-17, and postpone L1/L2 mobility to Rel-18 considering the impacts and load in RAN1/RAN2. Of course there could be some common parts, but to only prioritize common parts may leave the risks that in Rel-17 none of them can be completed, we think we should prioritize one scenario to be completed and among which, the common parts can be the basis of future discussion for the postponed scenario. Last but not the least, we prefer to use consistent terminology on specific objectives, currently various terms are used by companies and it is difficult to follow whether people are talking exactly the same thing. |
| LG | Q1.1: Fine with proposal.  Q2.1: Agree  Q2.2: Agree  Q2.3: This can left to RAN2 discussion, but we can agree to the moderator’s assumption to make RAN2 discussion simple.  Q2.4: The intention of the question related to affirmation is not clear. Agree with the rest part of the question on inter-cell beam management.  Q2.5: It is simply infeasible for RAN2 to work on both scenarios given the current TU allocation. We think the scenario1 is more in line with RAN1’s understanding, and the scenario2 has been very controversial already in both RAN2 and RAN1. Hence, the only feasible way for progress is to only have scenario1 in scope for Rel-17. We observe that many companies consider the scenario2-like enhancements for Rel-18, from which we see no possibility/urgency of having to support the scenario2 in Rel-17.  Q2.6. See our answer for Q2.5. |
| Telecom Italia | Agree with RAN2 Chair. RAN2 must be involved and the impact is significant without room to discuss the issue.  Therefore agree with Huawei to continue inter-cell mTRP in Rel-17 and to remove L1/L2 mobility from the scope |
| FUTUREWEI | **Issue 1**  Q1.1: the more important question in plenary is whether we need to downscope L1/L2-centric inter-cell mobility to only one of the scenarios. We agree with a few other companies that downscoping is needed and inter-cell mTRP like scenario only is supported in Rel-17. Furthermore, for inter-cell mTRP like scenario (AKA scenario 1), clarification is needed. This is not the same exact scenario as that under objective 8.1.2.2 which only covers downlink QCL/TCI work (“Identify and specify QCL/TCI-related enhancements to enable inter-cell multi-TRP operations, assuming multi-DCI based multi-PDSCH reception”). In addition, there were some confusions on which TCI framework (R17 vs. R15/16) should be used for scenario 1 of mobility. Aligning the understanding now will be very beneficial to avoid issues down the road. There was a conclusion in RAN1 under the discussion of 8.1.2.2 (inter-cell mTRP), that “The UE may assume received DL transmission from multiple TRP within a CP in FR1 and FR2. Note: This does not imply that RAN1 intends to ask RAN4 to tighten network synchronization requirements.” This conclusion does not apply to L1/L2 mobility automatically without discussion. Note that assuming same UL TA and RACH-less operation is an even stronger assumption than only downlink RX timing, especially considering the much shorter CP length for FR2. If RAN decides to keep the scope focused and limit the useful cases by not handling multiple TA in Rel-17, there should be no tighter RAN4 requirement for network synchronization.  **Issue 2**  With downscoping to only scenario 1 (with clarifications mentioned above), there is no need to further discuss scenario 2 related issues. For the listed questions, we have the following responses:  Q2.1: Agree.  Q2.2: See our comment for Q1.1  Q2.3: Agree.  Q2.4: Details on beam management is not a RAN level issue. Whether RAN1 and RAN2 works in parallel, it is generally true anyway but if the assumption is that there is no inter-dependence between the RAN1 and RAN2, it is too early to be sure.  Q2.5: Agree for scenario 1 only.  Q2.6: See our comment for Q1.1. |
| vivo2 | Answer to question from Samsung: in mDCI based PDSCH, 2 DCIs schedule two PDSCHs separately, which means they are independent. From gNB perspective, it can schedule one PDSCH by 1 DCI (which maybe coming from any TRPs/cells) or two PDSCHs by 2 DCIs dynamically. In this sense DPS is inherently supported. |
| Apple | **Issue 1**  Q1.1: Agree. We think inter-cell mTRP should focus on QCL related enhancement for mDCI based framework as defined in WID.  **Issue 2**  Q2.1: We do not have strong preference, but we would like to hear more views whether such assumption can reflect the real deployment need.  Q2.2: We think it is premature to preclude RACH related aspects, and it can be decided in RAN1.  Q2.3: We suggest we leave it to WG.  Q2.4: Agree in principle. But we see different understandings on scenario 1 from companies’ contribution. Some think scenario 1 is the same as inter-cell mTRP or it can be called as “unified TCI based inter-cell mTRP”, which requires UE to maintain 2 active TCI states and potentially receive signals from two cells simultaneously, while others think scenario 1 is the same as DPS for both common and dedicated signals, and it can support UE with single active TCI state capability. Scenario 2 is much clearer than scenario 1.  [Mod: Thank you. In my understanding, the second constitutes to scenario 1 (no serving cell change) of L12XCM since only one DCI is so far assumed. This can be further clarified in the next/intermediate round]  Q2.5: Before scenario 1 is clear and confirmed by RAN1, it seems one possible way is that RAN2 can discuss scenario 2 first.  Q2.6: We failed to see the necessity for down-scoping of the entire inter-cell mobility. But we see the progress for inter-cell multi-TRP is slow. |
| Qualcomm | **Issue 1**:   * Q1.1: In principle the proposal seems agreeable.   **Issue 2**: Scope of L1/L2-centric inter-cell mobility (L12XCM) in Rel-17. Please share your view on the following:   * Q2.1: Same DU is ok, limiting to intra-frequency looks also ok but could be also a WG prioritization decision. * Q2.2: Based on prior discussion, assuming synchronization is ok. Although in FR2, our view has been that larger than CP timing difference could be assumed. * Q2.3: At least for capabilities, CA framework needs to be assumed. But for the protocol design, it could be left to a RAN2 decision. * Q2.4: Agree with the proposal. * Q2.5: Both scenario 1 (with necessary clarifications to limit the work) and scenario 2 should be left in scope. * Q2.6: We do not agree with postponing the feature. |
| Spreadtrum | **Issue 1**  Q1.1: Based on our understanding, the only overlap between RAN1 AI 8.1.1 and 8.1.2.2 is the measurement/reporting of non-serving cell RS. Regarding DPS operation, since AI 8.1.1 is based on R17 TCI framework and AI 8.1.2.2 is based on R15/16 TCI framework, there’s no overlap. If DPS is not supported in AI 8.1.2.2, gNB has to always schedule full/partial overlapped PDSCH, which is not desired.  **Issue 2**  Q2.1-2.3: Agree to support a simplified/restricted scenario in R17, further enhancement can be considered in next release.  Q2.4: Support  Q2.5-2.6: We can try to finish Scenario 1 in R17, postponing the entire work of L12XCM is also acceptable to us. |
| MediaTek | **Issue 1:**  We think that this can probably be clarified further by RAN1.  **Issue 2**:  Q2.1: Agree  Q2.2: Agree  Q2.3: Agree, but is possibly mainly relevant in Scenario 2.  Q2.4: Not clear. The benefits for scenario 2 would need further RAN1/2 discussion to understand the real gains. Agree that RAN1 can continue to work on inter-cell beam identification.  Q2.5: Limit work to Scenario 1.We believe that Scenario 2 would require much more cross-WG discussion, and the areas where gains can be obtained would need to be properly clarified first. |
| KDDI | **Issue 2:**  **Q2.1**: Same view as Samsung (i.e. Agree to focus on intra-DU. Having said that, RAN1 design strive to be generic enough to handle inter-DU with no or minimal updates in a future release.)  **Q2.2**: Same view as Samsung (i.e. Assuming synchronized and small cells seems to be reasonable for Rel-17.)  **Q2.3**: The details of the protocol stack design should be discussed in RAN WG2.  **Q2.4**: Agree that scenario 1 and scenario 2 apply to L12XCM.  **Q2.5**: Considering the TU allocation for this WI for RAN2, it is a little bit challenging to complete both two scenarios and we may want to discuss the scope reduction in September or December, but we are fine to include both two scenarios at this moment.  **Q2.6**: As we mention above, we should potentially discuss the scope reduction, it is up to the progress of the RAN2 work. |
| Ericsson | Q1.1: From the WID, it is clear that 8.1.2.2 relies on the mDCI framework. Anything that is specified that in 8.1.2.2 would require that the UE should be capable in simultaneously receive multiple DCIs. A DPS solution, i.e., a solution that is tailored for reception of a single PDCCH and a single PDSCH is out of scope of 8.1.2.2.  Q2.1: Agree.  Q2.2: Agree.  Q2.3: The question is not crystal clear. We assume that the neighbor cell is handled by the same MAC entity as the serving cell, and the neighbor cell is not an SCell, it is a cell on the same frequency which the UE has been configured to use. Perhaps this means that our answer to the question is "Yes"?  Q2.4: The question is not clear to us, but we assume it asks if RAN1 and RAN2 can work in parallel? If so: Yes, we agree.  [Mod: That’s correct]  Q2.5: We think both scenarios should be included in Rel-17. Plenary can aim to reduce the scope (which we are doing here with the questions above). There are common parts for both features, e.g. configuration of the other cell, L1 measurement configuration, L1/L2 signal (e.g. MAC CE) for enabling (scenario 1) or switching to (scenario 2) the other cell. These common aspects are needed for both scenarios and hence there is no point in down-scoping (at least not at this point in time).  Q2.6: We are not supportive of removing the objective. |
| NTT DOCOMO | **Issue 1:**  We believe the current WID is clear. Agenda of inter cell M-TRP can focus on NCJT. However, dynamic point selection seems be inevitable in M-DCI based M-TRP. For example, NW can schedule PDSCH from one TRP, even if M-DCI based M-TRP. So, we don’t need to explicitly mention this: “*and* *refrain from adding the support for DPS”.*  **Issue 2**:  Q2.1: Agree, considering the Rel.17 workload.  Q2.2: We’d like to discuss in RAN1 whether TA is maintained and PRACH tx is not needed.  Q2.3: We are ok with the proposal as currently we do not see clear benefit to re-use the CA design, but we are open to discuss.  Q2.4: Considering limited RAN2 TU, we support RAN2 to focus on scenario 1 only, and RAN1 proceeds specification work for both L12XCM and inter cell M-TRP, based on scenario 1.  Q2.5: We support both L12XCM and inter cell M-TRP in Rel.17. |
| CATT | **Issue 1:**  we are fine with the proposal  **Issue 2:**  Fine with 2.1-2.4.  Then regarding work scope and R2 TU, we also think that some high level discussions in RP is meaningful, because in the previous R2 discussions it seems not very clear which scenario(s) are more important and giving the most gain. |
| Sony | **Issue 1**  **Q1.1:** In our understanding, DPS operation can be enabled (up to gNB’s scheduling decisions) when mDCI/multi-PDSCH is supported for inter-cell M-TRP. But with respect to the WID, we are fine with the proposal to target the enhancement of mDCI/multi-PDSCH in RAN1 AI 8.1.2.2, rather than intentionally introducing new features dedicated to DPS.  **Issue 2**  **Q2.1:** Agree. It’s better to start from the simplest case.  **Q2.2:** Okay with the assumption of synchronization. If there are any unsynchronized cases/scenarios, we could leave it to next release to handle, if any.  **Q2.3:** we see CA framework has the potential to serve as a starting point for L1/L2 centric inter-cell mobility and inter-cell M-TRP. So, we think whether to restrict CA concept is up to RAN2.  **Q2.4:**  We are fine to carry out RAN1’s work on inter-cell beam management in parallel to RAN2’s work, if they are not mutually dependent.  **Q2.5:** we see companies worrying about limited TU in RAN2 to complete whole scope of Rel.17 L12XCM. We are fine to focus on scenario 1.  **Q2.6:** scenario 2 can be postponed to later release (c.f. our response to Q2.5). |
| Nokia, Nokia Shanghai Bell | **Moderator:** It seems one of our comments was attributed to only Q2.5/2.6. while they are relevant for those, we don't appreciate moderator making such statements without attributing those changes clearly. Therefore, we have removed the part that was not added by us.  **General:** Whatever we discuss, the focus should be on what is possible in Rel-17, and NOT "how much" has been done. It doesn't matter how much work has been done if the remaining work amount is infeasible in Rel-17!  **Questions:** We should not discuss technical details in RAN unless WGs have done it already. Q2.1 was in the LSs from both RAN2 and RAN3, but Q2.2-Q2.4 seem to concern technical details. Hence, there is no technical foundation to decide on these in RAN. Then Q2.5/6 are about the scope which we need to discuss, but these questions need to be discussed separately. Finally, why should RAN even talk about how RAN1 agenda items are organized? That's the job of RAN1 chair, and RAN only needs to care about the WI objectives.  [Mod: Fundamental technical issues are occasionally discussed in RAN. In fact, your earlier comment on # TUs required (to be decided in RAN) would need this info a priori. In this case they (Q2.1-2.3) are pertinent since they dictate the scope as clearly indicated in the LS response from RAN2/3/4. Taking into account that those issues involve multiple WGs, RAN guidance is quite appropriate.]  **Way forward:** To attempt some sort of compromise based on comments, most companies think scenario 2 is a no-go. Therefore, it seems like the simplest way forward is the following:   1. **Remove scenario 2 from the Rel-17 WI (can be considered for Rel-18)** 2. **Clarify what is in scope of "scenario 1" in the WI (as second step, to ensure the remaining Rel-17 workload is reasonable )**   [Mod: In essence this could be a reasonable starting point addressing Q2.5. Thank you.] |
| Intel Corporation | **Issue 1:**  Q1.1: OK  **Issue 2**:  Q2.1: Agree to assume intra-DU and intra-frequency for Rel-17  Q2.2: Given the limited amount of time we are fine to assume sufficient synchronization and discuss more general case in Rel-18  Q2.3: Agree  Q2.4: Ok to continue work in parallel assuming the scope of the work is clear  Q2.5: Both scenarios should be considered  Q2.6: We prefer to continue the discussion on L1/2 mobility |
| Lenovo/Motorola Mobility | **Issue 1**:   * Q1.1: We agree with FL proposal to clarify that inter-cell multi-TRP in R17 feMIMO in 8.1.2.2 only focuses on the enhancement on inter-cell multi-TRP operation based on the R16 multi-DCI based multi-TRP by reusing Rel-16 QCL rule. Furthermore, we think no explicit specification support is needed for DPS PDSCH transmission when inter-cell multi-TRP is supported.   **Issue 2**: Scope of L1/L2-centric inter-cell mobility (L12XCM) in Rel-17.   * Q2.1: OK to assume intra-DU and intra-frequency in Rel-17. Cases for inter-DU and inter-frequency can be considered in later release. RAN2 input is required. * Q2.2: Assuming synchronization for scenario 1 is OK in R18. All asynchronous cases need to be dealt with in R18. * Q2.3: Open to discuss this issue. * Q2.4: Support. * Q2.5: Both scenarios are within R17 scope. * Q2.6: We think at lease scenario 1 can be completed in R17 while scenario 2 can be postponed to R18 depending on the progress and RAN2 TU allocation. |

* 1. Summary and moderator proposals

During the initial round, based on the collected inputs in section 2.1, the following **observation** can be made:

* On inter-cell mTRP (AI 8.1.2.2 in RAN1):
  + Q1.1: Almost all companies sharing their inputs have opined that the wording in the WID (#2b) implies that any scheme tailored for reception of a single PDCCH and/or a single PDSCH (such as DPS) is out of scope. The *de facto* overlap pointed out in Nokia’s RP-211364 can be addressed with proposed WF-1 below (without explicitly mentioning DPS per, e.g. NTT Docomo’s and Nokia’s comments).
* On L1/l2-centric inter-cell mobility (L12XCM):
  + Q2.1: All companies sharing their inputs are fine to assume intra-DU only in Rel-17.
  + Q2.2: While many companies sharing their inputs are fine, some opined that this needs more discussion in RAN1 and it is too premature to agree on inter-cell synchronization assumption (as well as not needing TA and RACH).
    - From moderator’s perspective, given that only 3 RAN1 meetings are left, it is beneficial if this issue can be concluded as soon as possible.
  + Q2.3: While many companies sharing their inputs seem to be fine, it was pointed out that this issue is mainly relevant for scenario 2 of L12XCM (requiring serving cell change) and would need more RAN2 discussion.
    - From moderator’s perspective, this can be discussed in RAN2 after scenario 1 vs scenario 2 discussion is more settled.
  + Q2.4: Almost all companies sharing their inputs have opined that the works in RAN1 and RAN2 can proceed in parallel. In particular, the work on inter-cell beam indication in RAN1 can carry on.
  + Q2.5: The majority of companies opined (due to TU allocation) that only scenario 1 (assuming no change in serving cell) is feasible in Rel-17 for L12XCM and that scenario 2 (assuming change in serving cell, hence a potentially new L1/L2-triggered hand-over scheme) can be considered in Rel-18
    - In addition, Nokia proposed to further clarify the scope associated with scenario 1 to ensure no ambiguity and reasonable workload for Rel-17 (also relevant to Apple’s comment)
  + Q2.6: Almost all companies sharing their inputs do not agree to the possibility of down-scoping the entire work of L12XCM.

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| **Proposed way forward (WF) 1 (after the initial round)**:  *On the scope of Rel-17 NR\_FeMIMO:*   1. *RAN affirms that AI 8.1.2.2 in RAN1 (inter-cell mTRP) should focus on multi-DCI and multi-PDSCH reception (per WI objective) and refrain from adding the support for any scheme tailored for reception of a single PDCCH and/or a single PDSCH.* 2. *Regarding scope and workflow of L1/L2-centric inter-cell mobility in Rel-17:*    1. *Assume only intra-DU and intra-frequency (excluding inter-DU or inter-frequency)*    2. *In RAN1#105-e, conclude whether the following is assumed or not: two cells are synchronised so that timing advance is sufficiently maintained and a RACH would not be required*    3. *RAN1 and RAN2 works can proceed in parallel, e.g. RAN1 can proceed the work on inter-cell beam indication*    4. *Assume only scenario 1 (assuming no change in serving cell).*        * *Scenario 2 (assuming change in serving cell aided by a L1/L2-triggered handover scheme) can be considered Rel-18*       * *Further discuss the scope associated with scenario 1 (intermediate round)* |

1. Intermediate round

During the intermediate round, interested companies are encouraged to share their view on the following:

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| **Please share your inputs on the following**:   * Proposed way forward 1 in section 2.2 (content, wording) * If proposed WF 1-2d (on scenario 1 focus) is agreeable, what is the scope of RAN1 and RAN2 work for L1/L2-centric inter-cell mobility assuming scenario 1 (no change in serving cell)   + Note: Being mindful of the workload and TU allocation especially in RAN2 |

* 1. Compilation of companies’ inputs

Table 2 Inputs

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| **Company** | **View** |
| Mod V24 | **Please share your inputs on the following**:   * Proposed way forward 1 in section 2.2 (content, wording) * If proposed WF 1-2d (on scenario 1 focus) is agreeable, what is the scope of RAN1 and RAN2 work for L1/L2-centric inter-cell mobility assuming scenario 1 (no change in serving cell)   + Note: Being mindful of the workload and TU allocation especially in RAN2 |
| Samsung | Proposal 1: Support  Proposals 2a, 2c: Support  Proposal 2b: We think there is a typo should be RAN1#106-e. Support  Proposal 2d: We are fine to defer scenario 2 to Rel-18. But we want to confirm that scenario 1 applies to L1/L2 centric inter-cell mobility as well as inter-cell mTRP. This should be part of the proposal.  [Mod: Done] |
| FUTUREWEI | Proposal 1: suggest to clarify that AI 8.1.2.2 is based on R15/16 TCI framework and AI 8.1.1 is based on R17 TCI framework.  Proposal 2a: agree.  Proposal 2b: It should be 106-e RAN1 meeting. Instead of a yes or no question, suggest making it more general: *In RAN1#106-e, conclude on the synchronization and timing advance assumption between the cells*  Proposal 2c: we do not see the need of this proposal.  Proposal 2d: agree to only support scenario 1 (assuming no change of serving cell) in Rel-17  [Mod: Done. I still keep proposal 2c for now to see what other companies think.] |
| Mod V27 | Revised WF proposal 1 per comments above (from Samsung and Futurewei). |
| vivo | We are generally fine with the proposals.  We also think proposal 2c may not be needed.  On proposal 2d, it is fine to consider scenario 1 in Rel-17 as discussed in RAN2, related work in RAN1, RAN2 should be clarified assuming no adjustment to current TU allocation. |
| Lenovo/Motorola Mobility | Proposal 1: support  Proposal 2a: support  Proposal 2b: we prefer to only consider synchronous cases in Rel-17 and asynchronous cases can be supported in Rel-18, but fine to conclude in RAN1#106-e.  Proposal 2c: we also think it is not needed.  Proposal 2d: agree to only support scenario 1 in Rel-17 and support scenario 2 in Rel-18. |
| Qualcomm | Proposal 1: Support  Proposal 2a: Support  Proposal 2b: Do not support assuming synchronization for FR2 L1/L2-centric inter-cell mobility. Ok to assume synchronization for mTRP.  Proposal 2c: Support  Proposal 2d: Do not support. Both Scenario 1 and Scenario 2 should be kept in scope.  [Mod: Given the majority view (with TU allocation in mind) and the compromise effort from, e.g. Nokia and Huawei, from moderator’s perspective, assuming only scenario 1 for Rel-17 is a good middle ground (RAN plenary style ☺)] |
| Huawei, HiSilicon | We are fine with Proposal 1, but in general we’d like to have a clear text on what aspect is according to which TCI framework, instead of referencing the RAN1 agenda item. The agenda items can be adjusted from time to time and we should use the exact content corresponding to that AI instead.  [Mod: Good point]  Regarding proposal 2, we are not convinced why inter-cell mTRP applies to L1/L2 centric cell mobility as in our understanding cell mobility always indicates the serving cell is changed. We think 2d is the overall pre-requisite of the others, and thus we think the order should be modified as below. We agree with others that 2c does not help, it is unclear what kind of work can be done in parallel and we’d like to remove this bullet. We’d also like to be clearer on what scenario 1 and 2 are to avoid any repeated discussion in the future.   1. *Regarding scope and workflow of L1/L2-centric inter-cell multi-TRP in Rel-17:*    1. *Assume only scenario 1 Inter-cell multi-TRP-like model as defined in RAN2 in Rel-17.*        * *Scenario 2 L1L2 mobility model as defined in RAN2 (assuming change in serving cell aided by a L1/L2-triggered handover scheme) can be considered in Rel-18*    2. *Assume only intra-DU and intra-frequency (excluding inter-DU or inter-frequency)*    3. *In RAN1#106-e, conclude on the synchronization and the timing advance assumptions between the cells*   [Mod: I understand. Reworded “L1/L2-centric inter-cell mobility” to “L1/L2-centric inter-cell beam management”. Your proposed term “L1/L2-centric inter-cell mTRP” will result in confusion with the inter-cell mTRP item #2b in the WID – the intention of proposal 2 is for item #1 in the WID, i.e. multi-beam enhancement]  We then also agree with Nokia that it should be clarified Rel-17 scope in RAN1 and RAN2 to support scenario 1. In our view, it is dynamic switch of indirect QCL source for PDCCH/PDSCH of the serving cell among associated cells via L1/L2 signaling, which is specific to Scenario 1.  [Mod: Noted – merged with Apple’s comment/bullet] |
| Apple | 1a: We do not support this new sub-bullet. Since the WID for inter-cell mTRP is only about QCL/TCI enhancement, if it is only based on R16 TCI, it cannot work since nothing on UL related enhancement is in the scope.  [Mod: Clarified that this is only for DL beam indication – per WID]  2a/2b/2c: OK.  2d: Do not support. The same comments as initial round. Scenario 1 and 2 were based on RAN2’s response from higher layer point of view, but we need to see whether both are reasonable from RAN1 point of view. We think this can be revisited in September.  [Mod: Please see comment for Qualcomm. I hope a middle ground can be agreed.]  In addition, is it possible that we add a bullet to clarify scenario 1?   * In scenario 1, only one cell is selected at a time and UE does not need to communicate with more than 1 cells simultaneously   [Mod: Done, merged with Huawei’s comment] |
| OPPO | 1a is fine for us  2a is fine for us  2b, we would like to conclude in the plenary that synchronization between cells is assumed. If we can’t, then to conclude in RAN1 is also acceptable for us  2c is not necessary  2d, we are fine to assume only scenario 1 and postpone scenario 2 into Rel18. We also have concern on the last sentence. In RAN2 scenario 1 is called inter-cell mTRP since it could misunderstood that it is for L1.L2-centric inter-cell mobility due to the fact that no serving cell is changed. Can we simply change it to be “Further discuss the Rel-17 scope associated with scenario1 (during the intermediate round)”? thanks  [Mod: Done] |
| ZTE | We are generally fine with 1, 2a, 2b, 2d as in the proposed WF from the moderator. We have concern on the revised version from Huawei. If we want to down scope scenario 2 in Rel-17, it should be excluded from both inter-cell MTRP (8.1.2.2) and L1/L2 centric mobility (8.1). The revised wording from Huawei seems implying scenario 2 is only excluded from 8.1.2.2 but still can be considered in 8.1 in Rel-17.  [Mod: From my reading, the wording from Huawei doesn’t imply as such because 8.1.2.2 is by default based on scenario 1 (no change in serving cell). Also 8.1.2.2 is only addressed in proposal 1 while proposal 2 is for L1/L2-centric inter-cell beam management. Perhaps some rewording of the revised proposal can be proposed?]  We also agree with other companies that 2c does not contain useful information, which should be removed. Alternatively, it should clarify better on what to do in RAN1 and RAN2. For example, RAN1 should consider beam measurement and report as well in addition to beam indication, i.e., “*RAN1 can proceed the work on inter-cell beam measurement/report/indication.*” It is better to clarify the RAN2 work as well, e.g., RRC/MAC-CE signaling design. |
| Mod V35 | Revised WF proposal 1 to address inputs. Since a number of companies opined that the original proposal 2c is not needed, it is now removed.  Now the clean version of WF proposal 1 looks like this:  **Proposed way forward (WF) 1 (after the initial round)**:  *On the scope of Rel-17 NR\_FeMIMO:*   1. *RAN affirms that inter-cell mTRP in RAN1 should focus on multi-DCI and multi-PDSCH reception (per WI objective) and refrain from adding the support for any scheme tailored for reception of a single PDCCH and/or a single PDSCH.*    1. *Note: The DL beam indication (TCI state update) for inter-cell mTRP in is based on Rel-15/16 QCL/TCI framework while L1/L2-centric inter-cell beam management for multi-beam enhancement is based on Rel-17 unified TCI framework* 2. *Regarding scope and workflow of L1/L2-centric inter-cell beam management for multi-beam enhancement, for Rel-17:*    1. *Assume only scenario 1 (inter-cell-mTRP-like model as defined in RAN2, assuming no change in serving cell).*        * *In scenario 1, only one cell is selected at a time and UE does not need to communicate with more than one cells simultaneously wherein the selection is performed by dynamic switch of indirect QCL source for PDCCH/PDSCH of the serving cell among associated cells via L1/L2 signaling*       * *Scenario 2 (L1/L2-triggered mobility as defined in RAN2, assuming change in serving cell aided by a L1/L2-triggered handover scheme) can be considered in Rel-18*       * *If needed, further discuss the Rel-17 scope associated with scenario 1 for L1/L2-centric inter-cell beam management (during the final round)*    2. *Assume only intra-DU and intra-frequency (excluding inter-DU or inter-frequency)*    3. *In RAN1#106-e, conclude on the synchronization and the timing advance assumptions between the cells* |
| Nokia, Nokia Shanghai Bell | **Organizational:** It's really difficult to follow and comment the WF from initial round when it keeps getting modifued during the intermediate round. If we want to have the WF as "living" version considered for intermediate round, we should copy that for discussion in intermediate round so the history is visible and it's transparent to all companies where the changes come from. We did this now by copying the table (retaining the original track changes) to below.  **Proposal 1:** We (mostly) agree with the basic intent but this is not acceptable wording: There's no point for RAN to micro-manage how one working group chair (RAN1) assigns agenda items, especially up to the numbering of AIs. The way forward must be valid for all WGs that are affected by these decisions. What's relevant is that RAN indicates what the work on inter-cell mTRP shall consist on, and what shall not be considered.  Then on the TCI framework, this was NOT even discussed in the first round so that part has to be removed: If it has been agreed in RAN1, then it's automatically taken into account int he work, and if it hasn't, RAN or RAN1 should first discuss the topic before jumping to conclusions. Now the text is simply coming from the moderator without any initial round discussion.  **Proposal 2 (general):** Probably the meaning is the same but let's stop using these "assume" and "refrain" when making decisions: Those do not create real decisions but simply "deprioritize" certain aspects. At this point, we really should make decisions and use clear language to make sure guidance is correctly understood in WGs. We have provided several proposals for that kind of wording below.  Also, let's not use the "scenario 1/2" terminology here since that is going to be exceedingly hard to trace back later on: We should clearly indicate the scenarios, so we provided wording that makes this clear (i.e. scenario 1 = no serving cell change, scenario 2 = serving cell change).  **Proposal 2c:** This is not a meaningful proposal until 2d has been decided. We really should be making clear what the work on "multi-beam indication" means, and until 2d (in one form or another) has been progresses, there is no foundation for this proposal. Hence, we can only discuss this in the final round and provided wording to make this clear. Let's try to focus on 2d first.  **Proposal 2d:** It's a bit unclear how we should discuss the scope: Is it intended that the companies provide the proposed WI objective change, or does the moderator do that? |
| Ericsson | If RAN plenary would drop the whole objective of L1/L2-centric inter-cell mobility in Rel-17, time would be saved. However, based on the discussion so far, that is not a preferred or likely outcome.  We think is a good exercise that was started in the initial round of this discussion, i.e. to do some simplification of which deployments/etc. can be assumed. Those simplifications will make the discussions in the WGs more focused.  Regarding dropping Scenario 2: There are several aspects which are common for Scenario 1 and Scenario 2, such as: configuration of the neighbour cell, measurements, trigger messages (in Scenario 1 an  addition of the neighbour is triggered, and in Scenario 2 it is a switch). Regardless if Scenario 2 is down-scoped in this plenary meeting, RAN2 will anyway need to discuss these aspects in the August meeting. Down-scoping will not help the August meeting whatsoever. We can revisit the discussion in September to see if dropping Scenario 2 would help.  What we can do in this plenary is to agree on the simplifications discussed in the Initial phase, and then task the WGs to work on the common aspects of Scenario 1 and Scenario 2 until September, where plenary again can check the status. |
| vivo | **General comment**: inter-cell-mTRP-like model, it was discussed in RAN2, what is relevant to RAN1 work need some clarification.  **On the first bullet point below**, the second sentence “support for any scheme tailored for reception of a sing PDCCH and/or a single PDSCH is not supported in Rel-17 mTRP” is not clear. Is the proposal about “additional spec change” is not supported? As we and other companies commented above, in multi-DCI based PDSCH reception single-DCI based PDSCH reception is by default supported.  **On the bullet point 2 c) below**, the discussion point on synchronization and time advance is related to PDCCH/DPSCH reception, is it correct understanding? |

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| **Proposed way forward (WF) 1 (discussed during the intermediate round)**:  *On the scope of Rel-17 NR\_FeMIMO:*   1. *RAN confirms that inter-cell mTRP in RAN1 work only considers multi-DCI and multi-PDSCH reception (per WI objective). Support for any scheme tailored for reception of a single PDCCH and/or a single PDSCH is not supported in Rel-17 mTRP.* 2. *Regarding scope and workflow of L1/L2-centric inter-cell beam management for multi-beam enhancement, for Rel-17:*    1. *Only scenario for inter-cell-mTRP-like model ( with no change in serving cell will be considered in Rel-17.*        * *Scenarios wherechange in serving cell via a L1/L2-triggered handover scheme are removed from Rel-17 WI and may be considered for Rel-18*       * *Further discuss how to clarify the Rel-17 objectives associated with scenario 1 for L1/L2-centric inter-cell beam management (during the fine-tuning or final round)*    2. *Only intra-DU and intra-frequency scenarios will be considered in Rel-17 (excluding inter-DU or inter-frequency scenarios)*    3. *In RAN1#106-e, conclude on the synchronization and the timing advance assumptions between the cells* |

* 1. Summary and moderator proposals

# References

1. RP-202024 Revised WID: Further enhancements on MIMO for NR Samsung