**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. Compilation of companies’ inputs: 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 |

Table 1 Inputs – initial round

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| **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.  [Q2.5/2.6]  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.  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. |
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1. Summary and moderator proposals

During the initial round, based on the collected inputs in section 2, the following **observation** can be made:

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| **Proposed way forward 1 (after the initial round)**:  ... |

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# References

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