**3GPP TSG RAN Meeting #92-e RP-211551**

**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 |

After the initial and intermediate rounds, the following WF was endorsed in the second GTW session:

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| *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). 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 where change in serving cell via a L1/L2-triggered handover scheme are not considered in Rel-17 and may be considered in Rel-18*       * *Further discuss how to clarify the Rel-17 objectives associated with scenario 1 for L1/L2-centric inter-cell beam management (during later round(s))*    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* |

To proceed with the underlined part, the following starting point can be used for discussion (based on some previous comments from Apple and Huawei):

* Scenario 1 implies that only one cell is selected at a time and a UE does not need to communicate with more than one cells simultaneously. The selection is performed by dynamic switching of indirect QCL source for PDCCH/PDSCH of the serving cell among associated cells via L1/L2 signaling

Once the group converges on the objectives, the WID will be revised accordingly.

1. Final round

During the final round, interested companies are encouraged to share their view on the following starting point:

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| The objectives associated with scenario 1 of L1/L2-centric inter-cell beam management for multi-beam enhancement are:   * [RAN1] Specify features for inter-cell beam management where only one cell is selected at a time and a UE does not need to communicate with more than one cells simultaneously.   + The selection is performed by dynamic switching of indirect QCL source for PDCCH/PDSCH of the serving cell among associated cells via L1/L2 signaling * [RAN2] ... |

* 1. Compilation of companies’ inputs

Table 1 Inputs

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| **Company** | **View** |
| Mod V0 | **Please share your views on the objectives associated with scenario 1 of L1/L2-centric inter-cell beam management for multi-beam enhancement:**   * **Please use the above as the starting point (copied below for convenience)**   *The objectives associated with scenario 1 of L1/L2-centric inter-cell beam management for multi-beam enhancement are:*   * *[RAN1] Specify features for inter-cell beam management where only one cell is selected at a time and a UE does not need to communicate with more than one cells simultaneously.*    + *The selection is performed by dynamic switching of indirect QCL source for PDCCH/PDSCH of the serving cell among associated cells via L1/L2 signaling* * *[RAN2] ...* |
| FUTUREWEI | This level of details may take some time for the group to converge. For example, the exact meaning of “at a time” and “communication with more than one cells simultaneously” need clarification and commonly understood by the group. The UE should measure and report for beam management for more than one cells. A suggested wording is “Each L1 channel/signal transmission/reception is to/from a single cell”. The sub-bullet (“The selection …”) seems too detailed as a specific solution which need discussion in WG. Since we may only have time for one round of email discussion, we’d like to suggest updating the WID text based on the agreement so far and leave as much details to WG discussion as possible. |
| vivo | With inter-cell-mTRP-like model (with no serving cell change) it is assumed that UE receives PDCCH/PDSCH from single serving cell no matter whether PDCCH/PDSCH is coming from TRP with different PCI. What is the understanding among the group on PUSCH?  Clarification on “at a time” and “communicate with..” in proposed WID update is required here, I assume it is meant for PDCCH/PDSCH/PUSCH? An UE can perform measurement/reporting simultaneously from multiple cells?  [Mod: Please check the latest version – more general] |
| Samsung | RAN1 scope:   1. Beam measurement/reporting associated with cell(s) with different PCI(s) from the serving cell 2. Beam indication based on Rel-17 unified TCI framework associated with cell(s) with different PCI(s) from the serving cell   We also propose to reword the existing text from the moderator as follows. We agree with Futurewei that the sub-bullet can be too detailed for RAN level. A more detailed scope is given   * *[RAN1] Specify features for inter-cell beam management where a UE can transmit to or receive from only one cell ~~is selected~~ at a time, including beam measurement/reporting and beam indication associated with cell(s) with different Physical Cell ID(s) from the serving cell ~~and a UE does not need to communicate with more than one cells simultaneously.~~ ~~using indirect QCL source~~*   + *~~The selection is performed by dynamic switching of indirect QCL source for PDCCH/PDSCH of the serving cell among associated cells via L1/L2 signaling~~*   RAN2 scope:   1. RRC pre-configurations on the UE-specific channels for cell(s) other than the serving cell 2. L2 signaling for TCI state activation for cell(s) other than the serving cell 3. Depending on the conclusion in RAN1#106 on the synchronization and the timing advance issue, handling of MAC entities at the change of TRP/Cell e.g. timing advance.   [Mod: This could be a good start but I am not sure how to capture this as a part of the objectives. Perhaps RAN2 chairman can comment ☺] |
| Qualcomm | Unsure if the top bullets were meant to be included. We suggest including the following explicit clarifications.   * *[RAN1] Specify features for inter-cell beam management where a UE can transmit to or receive from only one cell ~~is selected~~ at a time, including beam measurement/reporting and beam indication associated with cell(s) with different Physical Cell ID(s) from the serving cell ~~and a UE does not need to communicate with more than one cells simultaneously.~~ ~~using indirect QCL source~~*   + *~~The selection is performed by dynamic switching of indirect QCL source for PDCCH/PDSCH of the serving cell among associated cells via L1/L2 signaling~~*   + *The beam indication is based on unified TCI framework*   + *The same beam measurement/reporting will be reused for inter-cell mTRP* |
| Apple | For RAN1’s work, on topc of the version suggested by Qualcomm, we suggest we change “beam measurement/reporting” into “measurement/reporting”, since not only for beam measurement, but also for CSI measurement or other measurement, UE is not required to measure signals simultaneously from different cells. Another way is to remove the words starting from “including” in the main bullet to make it general. We can also remove the bullet “The beam indication is based on unified TCI framework”, since it has been covered in original WID, but we do not have strong view if other companies are fine to keep it.   * *[RAN1] Specify features for inter-cell beam management where a UE can transmit to or receive from only one cell ~~is selected~~ at a time, including measurement/reporting and beam indication associated with cell(s) with different Physical Cell ID(s) from the serving cell ~~and a UE does not need to communicate with more than one cells simultaneously.~~ ~~using indirect QCL source~~*   + *~~The selection is performed by dynamic switching of indirect QCL source for PDCCH/PDSCH of the serving cell among associated cells via L1/L2 signaling~~*   + *The beam indication is based on unified TCI framework*   + *The same beam measurement/reporting will be reused for inter-cell mTRP*   For RAN2’s work, we think it depends on RAN1’s further work. At current stage, the following sentence in original WID seems to be enough.   * Specify higher layer support of enhancements listed above [RAN2]   [Mod: While this is fine from moderator’s perspective, some other companies, e.g. Nokia, pointed out that the RAN2 scope needs to be hashed out more in relation to scenario 1 – otherwise ambiguity still exists in RAN2] |
| OPPO | Cell has very specific definition in RAN2. In order to avoid any confusion between RAN1 and RAN2, it is proposed not to mention “cell” but TRP here. Plus we think RAN1 can strive to keep forward compatibility i.e. to reuse Rel17 scheme for scenario2 in Rel18 as much as possible, but it is too early to pin it now. Here is our revision:   * *[RAN1] Specify features for inter-TRP beam management where a UE can transmit to or receive from only one TRP ~~is selected~~ at a time, including beam measurement/reporting and beam indication associated with TRP(s) with different Physical Cell ID(s) ~~and a UE does not need to communicate with more than one cells simultaneously.~~ ~~using indirect QCL source~~*   + *~~The selection is performed by dynamic switching of indirect QCL source for PDCCH/PDSCH of the serving cell among associated cells via L1/L2 signaling~~*   + *The beam indication is based on unified TCI framework*   [Mod: While I see your point, please check DOCOMO’s comment] |
| NTT DOCOMO | Re OPPO’s update, “inter-TRP” is very ambiguous to us. This scope is not be related to multi-TRP. Also, the difference between Rel.17 unified TCI and Rel.15/16 TCI is the beam indication, not beam measurement/reporting. We believe both inter cell mobility and multi TRP inter cell should reuse the same beam measurement/reporting. Hence, we prefer to get back to Apple’s version.   * *[RAN1] Specify features for inter-cell beam management where a UE can transmit to or receive from only one cell ~~is selected~~ at a time, including measurement/reporting and beam indication associated with cell(s) with different Physical Cell ID(s) from the serving cell ~~and a UE does not need to communicate with more than one cells simultaneously.~~ ~~using indirect QCL source~~*   + *~~The selection is performed by dynamic switching of indirect QCL source for PDCCH/PDSCH of the serving cell among associated cells via L1/L2 signaling~~*   + *The beam indication is based on unified TCI framework*   + *The same beam measurement/reporting will be reused for inter-cell mTRP*   [Mod: I tend to agree] |
| FUTUREWEI | There are a few issues of the latest version from NTT DOCOMO. First, the term “at a time” is still ambiguous. As an example, in mTRP a channel (e.g. PDSCH) can be transmitted from 2 TRPs/cells but in a TDM manner. Therefore, is this “only one cell at a time” since only one cell is transmitted to the UE on each OFDM symbol? On the other hand, UE should be allowed to, under this objective, receive different channels/signals from different cells on different symbols/slots. A better wording to capture what the group wants to say may be “Each channel/signal transmission/reception of a UE is to/from a single cell”.  [Mod: I see your point – perhaps this is sufficient for RAN]  Second, about the second sub-bullet about the same beam measurement/reporting, is it meant to say that the design of such mechanism is reused, or the same beam measurement/reporting of the UE is reused for inter-cell mTRP operation of the UE? Either way, further discussion is needed and can be left for RAN1 discussion. Therefore, we suggest to delete it.  [Mod: It was decided in RAN1 that the beam measurement/reporting work from inter-cell mTRP is common with and performed in multi-beam enhancement for L1/L2-centric. So your 1st interpretation is the case and has been discussed and agreed in RAN1 (after 2020/10 all the inter-cell/TRP measurement/reporting work is done in 8.1.1). Therefore, the 1st interpretation requires no further discussion in RAN1. But the 2nd interpretation does. I added “mechanism” below which should address your concern.] |
| Mod V10 | **The latest version from Samsung 🡪 Qualcomm 🡪 Apple/DOCOMO can be used (clean version below, added “Rel-17” to be clear + Futurewei’s comments).**  **Please share your views on the objectives associated with scenario 1 of L1/L2-centric inter-cell beam management for multi-beam enhancement especially the RAN2 part:**  *The objectives associated with scenario 1 of L1/L2-centric inter-cell beam management for multi-beam enhancement are:*   * *[RAN1] Specify features for inter-cell beam management where a UE can transmit to or receive from only a single ~~one~~ cell ~~at a time~~, including measurement/reporting and beam indication associated with cell(s) with different Physical Cell ID(s) from the serving cell*    + *The beam indication is based on Rel-17 unified TCI framework*   + *The same beam measurement/reporting mechanism will be reused for inter-cell mTRP* * *[RAN2] ...* |
| ZTE | From our perspective, in RAN1, we need to further consider inter-cell beam reporting and measurement. Although we already have some progress about basic function of this issue, the details are still FFS: like whether we need to introduce more than 4 beam to be reported in a report instance, flexible activation for inter-cell measurement (e.g., for aperiodic reporting), etc. The above should be at least NW-initialized, and we are open to further consider UE-initialized report. Further, we think the target channel/RS for L1/L2-centric inter-cell beam management should also consider PUSCH/PUCCH, rather than PDCCH/PDSCH-only.  Then, in RAN2, some further identification on potential RAN2 impacts seems to be needed based on Scenario 1, considering that this related discussion was just kicked off in RAN2. Besides, as other items, RAN2 may need to handle RRC and MAC-CE (if any) design for enabling this function based on further RAN1 inputs. The following is our update.  *The objectives associated with scenario 1 of L1/L2-centric inter-cell beam management for multi-beam enhancement are:*   * *[RAN1] Specify features for inter-cell beam management where a UE can transmit to or receive from only a single ~~one~~ cell ~~at a time~~, including measurement/reporting and beam indication associated with cell(s) with different Physical Cell ID(s) from the serving cell*    + *The beam indication is based on Rel-17 unified TCI framework*   + *The same beam measurement/reporting mechanism will be reused for inter-cell mTRP* * *[RAN2]*   + *Further identify potential specification impact corresponding to scenario-1*   + *RRC and MAC-CE (if any) signaling design for enabling this function based on RAN1 input* |
| Huawei, HiSilicon | We agree with OPPO that TRP is the right term to proceed forward. In our view, the endorsed WF should be clearly reflected in the WI updates. The RAN2 part in our understanding is mainly to support the configuration to enable beam measurement reporting. If there is no serving cell change and Rel-17 only considers intra-DU and intra-freq cases (we think this part should also be clearly reflected in the WID), it should be assumed as synchronized and there should be no impact on RAN2 for RACH and TA (of course pending on RAN1 output).  Could you please also clarify on the current discussed objective, is it to reflect in the WI as below as objective 1c?   1. Enhancement on multi-beam operation, mainly targeting FR2 while also applicable to FR1:    1. Identify and specify features to facilitate more efficient (lower latency and overhead) DL/UL beam management to support higher intracell mobility and/or a larger number of configured TCI states:       1. Common beam for data and control transmission/reception for DL and UL, especially for intra-band CA       2. Unified TCI framework for DL and UL beam indication       3. Enhancement on signaling mechanisms for the above features to improve latency and efficiency with more usage of dynamic control signaling (as opposed to RRC)    2. Identify and specify features to facilitate UL beam selection for UEs equipped with multiple panels, considering UL coverage loss mitigation due to MPE, based on UL beam indication with the unified TCI framework for UL fast panel selection 2. *[RAN1] Specify features for inter-TRP beam management (with no change in serving cell) where a UE can transmit to or receive from only one TRP ~~is selected~~ at a time, including beam measurement/reporting and beam indication associated with TRP(s) with different Physical Cell ID(s) ~~and a UE does not need to communicate with more than one cells simultaneously.~~ ~~using indirect QCL source~~*    1. *~~The selection is performed by dynamic switching of indirect QCL source for PDCCH/PDSCH of the serving cell among associated cells via L1/L2 signaling~~*    2. *The beam indication is based on unified TCI framework*    3. *It applies to intra-DU and intra-frequency cases only* 3. Enhancement on the support for multi-TRP deployment, targeting both FR1 and FR2:    1. Identify and specify features to improve reliability and robustness for channels other than PDSCH (that is, PDCCH, PUSCH, and PUCCH) using multi-TRP and/or multi-panel, with Rel.16 reliability features as the baseline    2. Identify and specify QCL/TCI-related enhancements to enable inter-cell multi-TRP operations, assuming multi-DCI based multi-PDSCH reception based on Rel-15/Rel-16 TCI framework    3. Evaluate and, if needed, specify beam-management-related enhancements for simultaneous multi-TRP transmission with multi-panel reception    4. Enhancement to support HST-SFN deployment scenario:       1. Identify and specify solution(s) on QCL assumption for DMRS, e.g. multiple QCL assumptions for the same DMRS port(s), targeting DL-only transmission       2. Evaluate and, if the benefit over Rel.16 HST enhancement baseline is demonstrated, specify QCL/QCL-like relation (including applicable type(s) and the associated requirement) between DL and UL signal by reusing the unified TCI framework   [Mod: Noted, thanks. We will discuss how to revise the WID in the extended round after we conclude on the objectives. If possible, rather than adding 1c, I’d prefer to work around the text of 1a and 2b] |
| MediaTek | We make a changes below compared to mod V10 proposal on the measurement text. Rationale is that we want to ensure that RAN2 is not requested to specify any L3 measurement handling to handle any measurements defined here, as this would lead to more RAN2 load. We covered this in our input contribution.  *The objectives associated with scenario 1 of L1/L2-centric inter-cell beam management for multi-beam enhancement are:*   * *[RAN1] Specify features for inter-cell beam management where a UE can transmit to or receive from only a single ~~one~~ cell ~~at a time~~, including L1-only measurement/reporting (i.e. no L3 impact) and beam indication associated with cell(s) with different Physical Cell ID(s) from the serving cell*    + *The beam indication is based on Rel-17 unified TCI framework*   *The same beam measurement/reporting mechanism will be reused for inter-cell mTRP*  Also fine with indicating intra-DU and intra-frequency explicitly as proposed above.  On RAN2 impact, regarding Samsung proposal, we appreciate the intention of that compared just saying “work on L2/3 parts”, the reason we are in this situation now is because this was done in the past, so we prefer not to make the same mistake again. I copy it again below:  RAN2 scope:   1. RRC pre-configurations on the UE-specific channels for cell(s) other than the serving cell 2. L2 signaling for TCI state activation for cell(s) other than the serving cell 3. Depending on the conclusion in RAN1#106 on the synchronization and the timing advance issue, handling of MAC entities at the change of TRP/Cell e.g. timing advance.   But regarding:   1. L2 signaling for TCI state activation for cell(s) other than the serving cell   …please could Samsung explain why something specific at MAC layer would be needed just because the beam has a different PCI? Is it not just a generic pointer to a TCI state as pre-configured by RRC?  [Mod: Good point. I believe this should be a general statement (your second understanding)] |
| Nokia, Nokia Shanghai Bell | **We think the best way is to try to modify the WI objectives directly: Otherwise there will be misunderstanding between RAN1, RAN2, RAN3 and RAN4 in next meetings when it's not clear what the WI scope is. So we assume these are supposed to be done to the WI objectives?**  [Mod: Please see my comment to Huawei]  **Hence, some comments from our side (in the form of text):**   * **What does "only one cell is selected at a time" mean? We understand this to indicate that UE either uses TRP1 or TRP2 at one time but simultaneously (e.g. DL from TRP1, UL to TRP2 is not supported). But if that's the case, then the remainder of the sentence already covers this so it's best to simplify the text by deleting that text. Additionally, it's better to mention what is included and only indicate what is not included if there is an issue.** * **Similarly, the phrase "dynamic switching" is ambiguous and it is not clear what it means The text already says "L1/L2 signaling", which in itself is ambiguous: this may cover both DCI and/or MAC CE, and while it would be good if we could already agree which of these it is, that seems impossible now (it's more task for RAN1 and RAN2 to handle). Similarly, we think it's best to talk about TCI states rather than QCL sources.**   [Mod: The latest version was given in Mod V10 row which seems to have addressed the above. Please check section 2.2]  **We suggest to clarify the objectives as follows:**  The objectives associated with L1/L2-centric inter-cell beam management for multi-beam enhancement are:   * [RAN1] Specify features for inter-cell beam management where UE may be configured with beams from different cells but only communicates with one cell at a time.   + The inter-cell beam selection is performed by switching of TCI state for PDCCH/PDSCH via L1/L2 signaling * [RAN2] Specify impacts to MAC and RRC concerning inter-cell beam management, including signalling, measurement configuration and TCI state switching.   + There is no impact to serving cell (e.g. serving cell does not change when beam selection is done) when UE is configured with inter-cell beam management. * [RAN1/2] Specify UE capabilities for inter-cell beam management * [RAN3] Specify inter-node signalling between CU and DU to enable inter-cell beam management. * [RAN4] Specify UE requirements for inter-cell beam management * The WI shall only consider intra-DU and intra-frequency scenarios.   [Mod: I have incorporated the comments as much as possible on top of the latest version in Mod V10 row] |
| Ericsson | **RAN1 objective:**  The Huawei formulation seems good as a starting point. But we want to do these small changes to align with terminology used in RAN1 so far and avoid misunderstandings:   1. *[RAN1] Specify features for inter-****cell*** *beam management (with no change in serving cell) where a UE can transmit to or receive from only one* ***cell*** *at a time, including beam measurement/reporting and beam indication associated with* ***cell****(s) with* ***any*** *Physical Cell ID(s)*    1. *The beam indication is based on unified TCI framework*    2. *It applies to intra-DU and intra-frequency cases only*   **RAN2 objective:**  We appreciate Samsung's attempt to capture the RAN2 objective in more detail. But we see the point from Apple too that perhaps the easiest is to use the existing RAN2 bullet but clarify that the scope is Scenario 1, but that we should allow for future extension in to Scenario2. Perhaps this wording could be used:   * Specify higher layer support of enhancements listed above to support Scenario 1, while allowing for extension to support Scenario 2 (see R2-2106787 for description of Scenario 1 and Scenario 2) [RAN2]   [Mod: Given the concern voiced in the previous rounds (e.g. Nokia, RAN2 chairman) that the RAN2 scope needs to be articulated at this point, Nokia’s version seems to be fitting from my perspective. I added the above comment to Nokia’s version] |
| CATT | **For R1 objective we are fine with latest version from Rapporteur.**  **For R2 objective, we are along the same line as Ericsson, i.e., it can be simpler as for other objectives for this WID the R2 part has a quite general bullet. We are not sure if scenario 1 needs to be mentioned in R1 part as there is no other scenario anymore (it should be clear what needs to be support once the R1 objective is agreed)**  [Mod: Please see my comment to Ericsson] |
| Sony | From the discussion and previous RAN1 agreements, we think the terminology “inter-cell beam management” seems more proper than “inter-TRP beam management”.  From our understanding, the inter-cell beam management could be applied to scenario 2 of L1/L2 XCM, too. To save potential duplicated work and time in RAN1, we would check whether the following change for [RAN1] is okay. In addition, our views from RAN2 perspective is added for the group to consider.  [Mod: The latest version in section 2.2 should address your point]  *The objectives associated with scenario 1 of L1/L2-centric inter-cell beam management for multi-beam enhancement are:*   * *[RAN1] Specify features for inter-cell beam management where a UE can transmit to or receive from only a single ~~one~~ cell ~~at a time~~, including measurement/reporting and beam indication associated with cell(s) with different Physical Cell ID(s) from the serving cell*    + *The beam indication is based on Rel-17 unified TCI framework*   + *The same beam measurement/reporting mechanism will be reused for inter-cell mTRP. Study whether it can be applied to scenario 2 as well.* * *[RAN2]*   + *Specify (if needed) RRC pre-configuration and L2 signaling to facilitate scenario 1* |
| Mod V20 | **Revised proposal – see section 2.2. Compared to the version in Mod V10 row**   * **Main sentence: revise dper Huawei’s input** * **[RAN1] Added MediaTek’s inputs** * **Other WGs: Merged Huawei’s (intra-DU intra-F), ZTE’s, Nokia’s, and Ericsson’s inputs** |

* 1. Summary and moderator proposals

Changes relative to version in Mod V10 row of Table 1 are indicated in red

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| **Proposed way forward (WF) (after the final round)**:  *For Rel-17 NR\_FeMIMO, the objectives associated with scenario 1 of L1/L2-centric inter-cell beam management (with no change in serving cell) for multi-beam enhancement are:*   * *[RAN1] Specify features for inter-cell beam management where a UE can transmit to or receive from only a single cell, including L1-only measurement/reporting (i.e. no L3 impact) and beam indication associated with cell(s) with any ~~different~~ Physical Cell ID(s) ~~from the serving cell~~*    + *The beam indication is based on Rel-17 unified TCI framework*   + *The same beam measurement/reporting mechanism will be reused for inter-cell mTRP* * *[RAN2] Specify impacts to MAC (if any) and RRC concerning inter-cell beam management (including signaling, measurement configuration and TCI state switching) for scenario 1 while allowing possible future extension for scenario 2.*   + *There is no impact to serving cell (e.g. serving cell does not change when beam selection is done) when UE is configured with inter-cell beam management.* * *[RAN1/2] Specify UE capabilities for inter-cell beam management* * *[RAN3] Specify inter-node signaling between CU and DU to enable inter-cell beam management.* * *[RAN4] Specify UE requirements for inter-cell beam management* * *This work shall only consider intra-DU and intra-frequency cases* * *Note: See R2-2106787 for description of scenario 1 and scenario 2* |

Clean version for potential endorsement

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| **Proposed way forward (WF) (after the final round)**:  *For Rel-17 NR\_FeMIMO, the objectives associated with scenario 1 of L1/L2-centric inter-cell beam management (with no change in serving cell) for multi-beam enhancement are:*   * *[RAN1] Specify features for inter-cell beam management where a UE can transmit to or receive from only a single cell, including L1-only measurement/reporting (i.e. no L3 impact) and beam indication associated with cell(s) with any Physical Cell ID(s)*    + *The beam indication is based on Rel-17 unified TCI framework*   + *The same beam measurement/reporting mechanism will be reused for inter-cell mTRP* * *[RAN2] Specify impacts to MAC (if any) and RRC concerning inter-cell beam management (including signaling, measurement configuration and TCI state switching) for scenario 1 while allowing possible future extension for scenario 2.*   + *There is no impact to serving cell (e.g. serving cell does not change when beam selection is done) when UE is configured with inter-cell beam management.* * *[RAN1/2] Specify UE capabilities for inter-cell beam management* * *[RAN3] Specify inter-node signaling between CU and DU to enable inter-cell beam management.* * *[RAN4] Specify UE requirements for inter-cell beam management* * *This work shall only consider intra-DU and intra-frequency cases* * *Note: See R2-2106787 for description of scenario 1 and scenario 2* |

1. Extended round

The following conclusion was endorsed after the final round:

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| **Conclusion:**  For Rel-17 NR\_FeMIMO, the objectives associated with scenario 1 of L1/L2-centric inter-cell beam management (with no change in serving cell) for multi-beam enhancement are:   * [RAN1] Specify features for inter-cell beam management where a UE can transmit to or receive from only a single cell, including L1-only measurement/reporting (i.e. no L3 impact) and beam indication associated with cell(s) with any Physical Cell ID(s)   + The beam indication is based on Rel-17 unified TCI framework   + The same beam measurement/reporting mechanism will be reused for inter-cell mTRP * [RAN2] Specify impacts to MAC (if any) and RRC concerning inter-cell beam management (including signaling, measurement configuration and TCI state switching) only for scenario 1 (allowing extensions in future releases, e.g., for scenario 2).   + There is no impact to serving cell (i.e. serving cell does not change when beam selection is done) when UE is configured with inter-cell beam management. * [RAN1/2] Specify UE capabilities for inter-cell beam management * [RAN3] Specify inter-node signaling between CU and DU to enable inter-cell beam management if any. * [RAN4] Specify UE requirements for inter-cell beam management * This work shall only consider intra-DU and intra-frequency cases * Note: See R2-2106787 for description of scenario 1 and scenario 2 |

Based on the above endorsed conclusion, the following **revision of the WID objective (section 4.1 of RP-202024) is proposed** (revision is indicated in red):

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| ------------ Start objective ----------  The work item aims to specify the further enhancements identified for NR MIMO. The detailed objectives are as follows:   * Extend specification support in the following areas [RAN1]  1. Enhancement on multi-beam operation, mainly targeting FR2 while also applicable to FR1:    1. Identify and specify features to facilitate more efficient (lower latency and overhead) DL/UL beam management for intra-cell and inter-cell scenarios to support higher ~~intra- and L1/L2-centric inter-cell mobility~~ UE speed and/or a larger number of configured TCI states:       1. Common beam for data and control transmission/reception for DL and UL, especially for intra-band CA       2. Unified TCI framework for DL and UL beam indication       3. Enhancement on signaling mechanisms for the above features to improve latency and efficiency with more usage of dynamic control signaling (as opposed to RRC)       4. For inter-cell beam management, a UE can transmit to or receive from only a single cell. This includes L1-only measurement/reporting (i.e. no L3 impact) and beam indication associated with cell(s) with any Physical Cell ID(s)          1. The beam indication is based on Rel-17 unified TCI framework          2. The same beam measurement/reporting mechanism will be reused for inter-cell mTRP    2. Identify and specify features to facilitate UL beam selection for UEs equipped with multiple panels, considering UL coverage loss mitigation due to MPE, based on UL beam indication with the unified TCI framework for UL fast panel selection 2. Enhancement on the support for multi-TRP deployment, targeting both FR1 and FR2:    1. Identify and specify features to improve reliability and robustness for channels other than PDSCH (that is, PDCCH, PUSCH, and PUCCH) using multi-TRP and/or multi-panel, with Rel.16 reliability features as the baseline    2. Identify and specify QCL/TCI-related enhancements to enable inter-cell multi-TRP operations, assuming multi-DCI based multi-PDSCH reception based on Rel-15/16 framework   …. (skipped)  …. (skipped)   * Specify higher layer support of enhancements listed above [RAN2]   + Specify MAC (if any) and RRC enhancements concerning inter-cell beam management (including signaling, measurement configuration and TCI state switching) assuming no impact to serving cell (i.e. serving cell does not change when beam selection is done) when UE is configured with inter-cell beam management.   + Specify UE capabilities for inter-cell beam management (also [RAN1]) * Specify inter-node signaling between CU and DU to enable inter-cell beam management if any [RAN3] * Specify core requirements associated with the items specified by RAN1 [RAN4], including   + Specify UE requirements for inter-cell beam management   ------------ End objective ---------- |

* 1. Compilation of companies’ inputs

Table 2 Inputs

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| **Company** | **View** |
| Mod V21 | **Please share your inputs, if any, on the proposed WID revision. The revision is based on the endorsed conclusion with the following notes:**   * **The terms ‘scenario 1’ and ‘scenario 2’ are not used to ensure that the WID is as self-contained as possible** * **Some suggestion from Huawei during the final round is included for #2b** * **‘higher ... mobility’ is replaced by ‘higher UE speed’ to avoid confusion** |
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* 1. Summary and moderator proposals

# References

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