**3GPP TSG RAN Meeting #92-e RP-211536**

**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]: Part 2

**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* |

* 1. Summary and moderator proposals

During the final round, ...

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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 for multi-beam enhancement are:*   * *...* |

1. Extended round

During ...

* 1. Compilation of companies’ inputs

Table 2 Inputs

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| **Company** | **View** |
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* 1. Summary and moderator proposals

# References

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