**3GPP TSG RAN WG1 #106-e R1-210xxxx**

**e-Meeting, August 16th – 27th, 2021**

**Agenda item:** 7.2.6

**Source:** Moderator (vivo)

**Title:** Summary of [106-e-NR-eMIMO-08]

**Document for:** Discussion and Decision

# Introduction

This contribution summaries discussion of email thread [106-e-NR-eMIMO-08] MT.5 (default TCI state for AP-CSI-RS when trigger and CSI-RS have different SCSs) triggered by the draft CR in [1].

Based on comments received for the preparation phase, it seems that there are different understanding regarding whether default beam for cross carrier scheduling of PDSCH is specified or not.

During discussion over preparation phase, the following conclusion in previous meeting was mentioned for reference.

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| --- |
| **Conclusion**  **No spec change is needed in Rel-16 for the issue of default TCI states of multi-TRP PDSCH in the case of cross-carrier scheduling** |

 There are also comments that the following specification is not limited to single CC scheduling case, but also applicable for cross carrier scheduling case.

|  |
| --- |
| If a UE is configured with *enableTwoDefaultTCI-States*, and at least one TCI codepoint indicates two TCI states, the UE may assume that the DM-RS ports of PDSCH or PDSCH transmission occasions of a serving cell are quasi co-located with the RS(s) with respect to the QCL parameter(s) associated with the TCI states corresponding to the lowest codepoint among the TCI codepoints containing two different TCI states. When the UE is configured by higher layer parameter *repetitionScheme* set to 'tdmSchemeA' or is configured with higher layer parameter *repetitionNumber*, and the offset between the reception of the DL DCI and the first PDSCH transmission occasion is less than the threshold *timeDurationForQCL,* the mapping of the TCI states to PDSCH transmission occasions is determined according to clause 5.1.2.1 by replacing the indicated TCI states with the TCI states corresponding to the lowest codepoint among the TCI codepoints containing two different TCI states based on the activated TCI states in the slot with the first PDSCH transmission occasion. In this case, if the 'QCL-TypeD' in both of the TCI states corresponding to the lowest codepoint among the TCI codepoints containing two different TCI states is different from that of the PDCCH DM-RS with which they overlap in at least one symbol, the UE is expected to prioritize the reception of PDCCH associated with that CORESET. This also applies to the intra-band CA case (when PDSCH and the CORESET are in different component carriers) |

Based on above views shared, the following understanding can be observed:

* Understanding1: The default TCI state for multi-TRP PDSCH in the case of cross carrier scheduling is unspecified.
* Understanding2: The default TCI state for multi-TRP PDSCH in the case of cross carrier scheduling is specified for single-DCI case, but unspecified for multi-DCI case

It seems that we need to have common understanding on which understanding we hold for multi-TRP PDSCH before we can have further discussion for default TCI state for CSI-RS.

# Question1

Please share your views for case1 in the following table.

Table 1 Question1

|  |  |
| --- | --- |
| Questions for view sharing:   1. Which one of the following understandings do you have for default TCI state of multi-TRP PDSCH in case of cross carrier scheduling? Please clarify and elaborate your rationale.    1. Understanding1: The default TCI state for multi-TRP PDSCH in the case of cross carrier scheduling is unspecified.    2. Understanding2: The default TCI state for multi-TRP PDSCH in the case of cross carrier scheduling is specified for single-DCI case, but unspecified for multi-DCI case.    3. Other understanding, please clarify. | |
| Apple | Our understanding is that default beam is still supported when *enableDefaultBeamForCCS* is enabled. |
| QC | Understanding 2. |
| OPPO | We are not sure whether cross carrier scheduling is supported for m-DCI based m-TRP. As we know, there is no specified UE capability for that. Also, there can be different number of *CORESETPoolindex* in different CCs, which makes m-DCI based m-TRP via CCS very complicated. |
| Lenovo/MotM | Understanding2 |
| Samsung | Our understanding is 2. |
| Nokia/NSB | We have a similar understand as “understanding 2”. Mainly due to that default DCI state for s-DCI m-TRP is not depended on the CORESET TCIs. |
| ZTE | Understanding 1  Based on the current 214, when enableDefaultBeamForCCS is enabled, the UE obtains its QCL assumption from the activated TCI state with the lowest ID. So only single TCI state is used as the default beam for PDSCH. |
| LG | Our understanding is 2. |

# Question2

Please share your views in the following table.

Table 2-1 Question2-1

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| --- | --- | --- |
| Questions for view sharing:   1. Do you think current specification in section 5.2.1.5.1 already supports the default TCI state for cross carrier triggered aperiodic CSI-RS when the triggering PDCCH and the CSI-RS have the same numerology?  |  | | --- | | 5.2.1.5.1 Aperiodic CSI Reporting/Aperiodic CSI-RS when the triggering PDCCH and the CSI-RS have the same numerology *<Spec omitted>*  - If a UE is configured with *enableDefaultTCI-StatePerCoresetPoolIndex* and the UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of coresetPoolIndex in ControlResourceSet  - *<Spec omitted>*  - else if a UE is configured with *enableTwoDefaultTCI-States* and at least one TCI codepoint is mapped to two TCI states  - *<Spec omitted>* | | |
| Apple | In our view, the default beam for AP-CSI-RS is as follows as defined in 38.214 section 5.2.1.5.1:  “else if the UE is configured with *enableDefaultBeamForCCS* and when receiving the aperiodic CSI-RS, the UE applies the QCL assumption of the lowest-ID activated TCI state applicable to the PDSCH within the active BWP of the cell in which the CSI-RS is to be received.” |
| QC | Yes. We think “else if a UE is configured with *enableTwoDefaultTCI-States* and at least one TCI codepoint is mapped to two TCI states” is still applicable. |
| OPPO | Yes. |
| Lenovo/MotM | We think the current specification applies to the cross-carrier scheduling at least for the case that the scheduling carrier and the scheduled carrier has the same mTRP configuration.  “If a UE is configured with enableDefaultTCI-StatePerCoresetPoolIndex and the UE is configured by higher layer parameter PDCCH-Config that contains two different values of coresetPoolIndex in ControlResourceSet” applies to the case that mDCI based mTRP is configured for both scheduling carrier and the scheduled carrier.  “else if a UE is configured with enableTwoDefaultTCI-States and at least one TCI codepoint is mapped to two TCI states” applies to the case that sDCI based mTRP is configured for both scheduling carrier and the scheduled carrier. |
| Samsung | Yes. At least “else if a UE is configured with enableTwoDefaultTCI-States and at least one TCI codepoint is mapped to two TCI states” is applicable. |
| Nokia | Agree with QC, SS and Lenovo. |
| ZTE | Yes |
| LG | Yes |

Please share your views in the following table.

Table 2-2 Question 2-2

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| --- | --- |
| Questions for view sharing:   1. If answer to previous question is yes, do you think the default TCI state for cross carrier triggered CSI-RS specified in section 5.2.1.5.1 is applicable for both single DCI case and multi-DCI case?   Note: Single DCI/Multi DCI here refers to the CC where the CSI-RS is transmitted. | |
| QC | No. For multi-DCI case, cross-carrier scheduling is not supported. This is because CORESETPoolIndex does not exist in the scheduled CC since there is no CORESET configured if it is scheduled by another CC. |
| Lenovo/MotM | We think the current specification applies to the cross-carrier triggering at least for the case that the triggering carrier and the triggered carrier has the same mTRP configuration. |
| Samsung | No. |
| Nokia | No. |
| ZTE | No |
| LG | No |

# Question3

Please share your views in the following table.

Table 3 Question3

|  |  |
| --- | --- |
| Questions for view sharing:  Based on previous input, do you think default TCI state for CSI-RS triggered by PDCCH with different numerology should be specified or not? Please clarify your preference and elaborate the rationale.   1. Option1: Yes for both single-DCI case and multi-DCI case 2. Option2: Yes for single-DCI case. No for multi-DCI case. 3. Option3: No for both cases.   Note: Single DCI/Multi DCI here refers to the CC where the CSI-RS is transmitted. | |
| Apple | No. We failed to see spec is broken. |
| QC | Option 3.  For multi-DCI, as explained above, even the basic cross-carrier scheduling is not supported (irrespective of default beam, e.g., even for FR1).  For single-DCI, this (default TCI state for CSI-RS triggered by PDCCH with different numerology) could be supported, but it is not essential at all. |
| OPPO | Option 3. It is not the right stage to support this feature. |
| Lenovo/MotM | We support option 1 at least for the case that the triggering carrier and the triggered carrier has the same mTRP configuration. |
| Samsung | Option 3. |
| Nokia | Option 3. |
| ZTE | Option 3.  We think default TCI for cross-carrier scheduling is not support for PDSCH based on the conclusion in last meeting. The same conclusion can be made for CSI-RS. |
| LG | Option 3. |

# Conclusion

TBD

# References

[1] [R1-2107990](file:///C:\Users\Peng%20SUN\AppData\Local\Docs\R1-2107990.zip) Draft CR on default QCL assumption of AP CSI-RS in MTRP operation when the triggering PDCCH and the CSI-RS have different numerologies vivo