3GPP TSG RAN WG1 #101 R1-200xxxx

e-Meeting, May 20th – June 5th, 2020

Source: Moderator (OPPO)

Title: Discussion on Issue#b-10 in Email Thread 3

Agenda Item: 7.2.6.2

Document for: Discussion and Decision

1. Introduction

Rel-16 enhancement on MIMO WID includes objectives of enhancing multi-TRP/Panel transmission with ideal and non-ideal backhaul. During the work of rel-16, designs for multiple-PDCCH based and single-PDCCH based multi-TRP/Panel transmission were discussed and specified. This document provides the discussion for Issue #b-10 in multi-TRP email thread 3:

* Issue #b-10 to correct Description on QCL of DMRS ports of M-TRP PDSCH in 38.211

# Issue#b-10: Description on QCL of DMRS ports of M-TRP PDSCH in 38.211

**Reason for changes**:

In current specification TS 38.211, we have the following description on DMRS in Section 7.4.1.1.2:

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| In absence of CSI-RS configuration, and unless otherwise configured, the UE may assume PDSCH DM-RS and SS/PBCH block to be quasi co-located with respect to Doppler shift, Doppler spread, average delay, delay spread, and, when applicable, spatial Rx parameters. The UE may assume that the PDSCH DM-RS within the same CDM group are quasi co-located with respect to Doppler shift, Doppler spread, average delay, delay spread, and spatial Rx. The UE may assume that DMRS ports associated with a PDSCH are QCL with QCL Type A, Type D (when applicable) and average gain. |

That description can only apply to UE when a PDSCH associated with one TCI-state, for instance, single TRP transmission in rel-15. In contrast such restriction in the description does not apply some multi-TRP transmission. Contributions [4] and [12] discussed this issue and proposed TP to correct.

[4] suggests that the QCL assumption of DMRS ports is mainly described in TS 38.214 for both single and multiple TCI states. Thus [4] suggests to remove that sentence in TS 38.211. Furthermore [4] proposes an editorial change that adds the phrase “when applicable”. The TP proposed by [4] is listed as Alt1 below.

[12] suggests also that highlighted description does not apply to single-DCI based multi-TRP transmission when two TCI states are indicated for different DMRS ports in one PDSCH. [12] suggests to add a condition in the description and [12] does not prefer to delete that sentence for backward compatibility to Rel15. The TP proposed by [12] is listed as Alt 2 below.

**Thus, for this issue, we have the following two alternative TPs:**

* **Alt1: TP proposed by [4] for TS 38.211**

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| ---------------------------------------Start of text proposal for 7.4.1.1.2 of TS 38.214 --------------------------------------7.4.1.1.2 Mapping to physical resources<Unchanged parts are omitted>In absence of CSI-RS configuration, and unless otherwise configured, the UE may assume PDSCH DM-RS and SS/PBCH block to be quasi co-located with respect to Doppler shift, Doppler spread, average delay, delay spread, and, when applicable, spatial Rx parameters. The UE may assume that the PDSCH DM-RS within the same CDM group are quasi co-located with respect to Doppler shift, Doppler spread, average delay, delay spread, and spatial Rx(when applicable). The UE may assume that no DM-RS collides with the SS/PBCH block.------------------------------------------------------- End of text proposal ------------------------------------------------------ |

* **Alt2: TP proposed by [12] for TS 38.211:**

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| 7.4.1.1.2 Mapping to physical resources<Unchanged parts are omitted>In absence of CSI-RS configuration, and unless otherwise configured, the UE may assume PDSCH DM-RS and SS/PBCH block to be quasi co-located with respect to Doppler shift, Doppler spread, average delay, delay spread, and, when applicable, spatial Rx parameters. The UE may assume that the PDSCH DM-RS within the same CDM group are quasi co-located with respect to Doppler shift, Doppler spread, average delay, delay spread, and spatial Rx. Except for a PDSCH associated with two TCI states, the UE may assume that DMRS ports associated with a PDSCH are QCL with QCL Type A, Type D (when applicable) and average gain.The UE may assume that no DM-RS collides with the SS/PBCH block. |

 Please input your views and comments on these two alternatives:

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| Company | Views and comments |
| CATT | Regarding the TP proposed in [12], we have the following comments:1. Considering the fact that in scheme 3 and 4, DMRS ports associated with a PDSCH are QCL-ed in each transmission occasion, the newly added condition proposed in [12] is still not precise enough.
2. To address the issue of inaccurate description of QCL in 211, two approaches can be considered.
	1. Alt-1: elaborate all the QCL cases as accurate as possible in 211
	2. Alt-2: for QCL related descriptions in 211, cite corresponding parts in 214

For the above alternatives, alt-2 is preferred. |
| Apple | It looks Alt1 removed Rel-15 spec, but Alt2 fails to define similar behavior for mTRP. We suggest the following change. “The UE may assume that DMRS ports associated with a PDSCH TCI state are QCL with QCL Type A, Type D (when applicable) and average gain.” |
| OPPO | In Rel-15, the DMRS ports associated with a PDSCH may not be configured with any TCI state. Hence, we prefer the following wording to address the comment from CATT (The PDSCH here is actually a PDSCH transmission occasion):“Except for a PDSCH transmission associated with two TCI states, the UE may assume that DMRS ports associated with a PDSCH are QCL with QCL Type A, Type D (when applicable) and average gain” |
| ZTE | Similar view with Apple. Some wording changes are suggested as followsThe UE may assume that DMRS ports associated with a PDSCH and associated with the same TCI state are QCL with QCL Type A, Type D (when applicable) and average gain |
| MediaTek | We prefer a modified Alt1: The UE may assume that the PDSCH DM-RS within the same CDM group are quasi co-located with respect to Doppler shift, Doppler spread, average delay, delay spread, average gain, and spatial Rx (when applicable). Given the current TCI framework specified in Clause 5.1.5 of TS 38.214, the original sentence seems to be redundant except the mention of “average gain”. |
| QC | It seems the suggestions from Apple / ZTE is clearer and more backward compatible.  |
| HW | We prefer Alt 2, with clear enabling conditions of Rel-16 feature. Removing Rel-15 spec is too risky. Adding “a TCI state” or “same TCI state” seems to be same with “*Except for a PDSCH associated with two TCI states*”? We don’t find too much difference among different updates, as long as one of them is used. A PDSCH associated with two TCI states has been clarified in 38.214.  |
| Nokia | We think in the same direction in Alt.1. It would be cleaner not to define different behaviors in 38.211 and 38.214. May be removing unnecessary text from 38.211 is more suitable. However, we do understand the changes of Rel-15 behavior by this. In addition to the above discussion, the text “*The UE may assume that the PDSCH DM-RS within the same CDM group are quasi co-located with respect to Doppler shift, Doppler spread, average delay, delay spread, and spatial Rx”* is not accurate considering Scheme 2b/3/4 as the PDSCH is actually multiple PDSCH transmission occasions, and they are not having same TCI state. However, defining all details are not essential here, as 38.214 discuss this in more details. **Alt.3**In absence of CSI-RS configuration, and unless otherwise configured, the UE may assume PDSCH DM-RS and SS/PBCH block to be quasi co-located with respect to Doppler shift, Doppler spread, average delay, delay spread, and, when applicable, spatial Rx parameters. Unless specified otherwise, t~~T~~he UE may assume that the PDSCH DM-RS within the same CDM group are quasi co-located with respect to Doppler shift, Doppler spread, average delay, delay spread, and spatial Rx (when applicable~~).~~ The UE may assume that DMRS ports associated with a TCI state of PDSCH are QCL with QCL Type A, Type D (when applicable) and average gain. |
| LG | Considering backward compatibility, we do not prefer removing Rel-15 sentence. We support the suggestion from Apple or OPPO, which is clear. |
| NTT DOCOMO | Agree with LG that Rel.15 sentence should be kept and OPPO’s version looks fine to us. |
| Samsung | For Alt1, we agree to add “(when applicable)” after ..spatial Rx. We don’t agree to delete the existing sentence for Rel-15 UEs.For Alt2, behavior for two TCI states has to be specified. As such behavior is already specified in TS 38.214 clause 5.1.6.2 (DMRS reception procedure), we can refer it. The clause also contains association between DMRS ports and PDSCH so that it can be removed from 211.Hence we suggest the following change:

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| The UE may assume that the PDSCH DM-RS within the same CDM group are quasi co-located with respect to Doppler shift, Doppler spread, average delay, delay spread, and spatial Rx (when applicable.) The UE may assume that DMRS ports associated with a TCI state as described in clause 5.1.6.2 of [6, TS 38.214] are QCL with QCL Type A, Type D (when applicable) and average gain. |

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| Ericsson | We also do not prefer to remove the Rel-15 sentence. We support revised version from Oppo:“Except for a PDSCH transmission associated with two TCI states, the UE may assume that DMRS ports associated with a PDSCH are QCL with QCL Type A, Type D (when applicable) and average gain”As pointed out by others above, the behavior for a PDSCH associated with two TCI states is defined in 38.214. So no need to repeat that in 38.211. |
| Lenovo/MOT | We also prefer that the Rel-15 sentence can not be removed and fine with add “(when applicable)”. We support Samsung’s version:The UE may assume that the PDSCH DM-RS within the same CDM group are quasi co-located with respect to Doppler shift, Doppler spread, average delay, delay spread, and spatial Rx (when applicable.) The UE may assume that DMRS ports associated with a TCI state as described in clause 5.1.6.2 of [6, TS 38.214] are QCL with QCL Type A, Type D (when applicable) and average gain. |
| Convida Wireless | Prefer a modified Alt 2, e.g. according to the proposal from ZTE or OPPO. |

1. Updated Proposal

**Proposal: adopt the following TP for TS 38.211**

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| 7.4.1.1.2 Mapping to physical resources<Unchanged parts are omitted>In absence of CSI-RS configuration, and unless otherwise configured, the UE may assume PDSCH DM-RS and SS/PBCH block to be quasi co-located with respect to Doppler shift, Doppler spread, average delay, delay spread, and, when applicable, spatial Rx parameters. Unless specified otherwise, the UE may assume that the PDSCH DM-RS within the same CDM group are quasi co-located with respect to Doppler shift, Doppler spread, average delay, delay spread, and spatial Rx (when applicable). UE may assume that DMRS ports associated with a TCI state as described in clause 5.1.6.2 of [6, TS 38.214]are QCL with QCL Type A, Type D (when applicable) and average gain.The UE may assume that no DM-RS collides with the SS/PBCH block. |

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| Company | Views and comments |
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1. Reference
2. R1-2003397 On remaining issues on M-TRP vivo
3. R1-2003469 Maintenance of multi-TRP enhancements ZTE
4. R1-2003531 Remaining issues on multi-TRP in R16 Huawei, HiSilicon
5. R1-2003627 Discussion on remaining issues of multi-TRP/panel transmission CATT
6. R1-2003660 Remaining issues on multi-TRP transmission MediaTek Inc.
7. R1-2003742 Corrections to multi-TRP Intel Corporation
8. R1-2003819 Remaining issues on multi-TRP/panel transmission Lenovo, Motorola Mobility
9. R1-2003881 On Rel.16 multi-TRP/panel transmission Samsung
10. R1-2003928 Text proposals on enhancements on multi-TRP/panel transmission LG Electronics
11. R1-2003954 Remaining issues on multi-TRP/panel transmission CMCC
12. R1-2003987 Discussion on remaining issues of multi-TRP operation Spreadtrum Communications
13. R1-2004047 Text proposals for enhancements on multi-TRP and panel Transmission OPPO
14. R1-2004229 Remaining issues for Multi-TRP enhancement Apple
15. R1-2004265 Maintenance of Rel-16 Multi-TRP operation Nokia, Nokia Shanghai Bell
16. R1-2004311 Remaining issues on multi-TRP transmission NEC
17. R1-2004395 Remaining issues on multi-TRP/panel transmission NTT DOCOMO, INC
18. R1-2004432 Remaining issues on Multi-TRP/Panel Transmission Ericsson
19. R1-2004463 Multi-TRP Enhancements Qualcomm Incorporated
20. R1-2004592 Clarification on Multi-TRP URLLC Scheme 4 Convida Wireless
21. R1-2004719 FL summary #2 for Multi-TRP/Panel Transmission Moderator(OPPO)