3GPP TSG RAN WG1 #104-e R1-210xxxx

e-Meeting, January 25th – February 5th, 2021

Source: Moderator (OPPO)

Title: Discussions on Issue MT.1

Agenda Item: 7.2.6

Document for: Discussion and Decision

The Issue of MT.1

The UE capability of out-of-order operation of PUSCH/PDCCH in mTRP is specified by the feature group 16-2a-3 in R1-2100113:

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| 16-2a-3 | Out-of-order operation for UL | 1. Support out-of-order operation for PDCCH to PUSCH | 16-2a | Yes | N/A |  | Per band | No | No |  | Note: “Same closed loop index for power control across PUSCHs associated with different CORESETPoolIndex values is not supported by a UE indicating the support of this feature” | Optional with capability signalling |

OPPO (R1-2100113), ZTE (R1-2100281) and Huawei/HiSi (R1-2101256) explained in their tdoc that the Note added here could cause some critical issues.

* The Note would result in that in FR1, the system can not schedule PUSCHs by PDCCH of different CORESETPoolIndex value to a UE supporting the UE capability of 16-2a-3. Because typically in FR1, only one SRS resource is configured for PUSCH transmission and there is no SRI field in DCI. Thus, a same default closed loop index is always applied to all the PUSCH transmissions.
* To make the system work, the Note seems to mandate the gNB to implement two different close loops based on UE capability reporting, no matter whether gNB needs 16-2a-3 functionality.

To resolve that issue, OPPO, ZTE and Huawei/HiSi proposed different solutions or TPs:

* OPPO and ZTE proposed to specify in 38.213 that when the DCI does not have SRI field or when SRI-PUSCH-PowerControl is not provided (i.e., only one default closed-loop index is assumed as specified in current spec), the UE would assume different closed loop index for PUSCHs towards different TRPs.
* ZTE and Huawei/HiSi proposed to capture the scheduling restriction imposed by that Note in the spec even through they proposed different TPs.

## **Round#1 discussion**

Based on the proposals by OPPO/ZTE/HW, here is the initial proposal for MT.1

**Proposal: For issue MT.1:**

* **In Section 7.1.1 of 38.213, for the case when DCI does not have SRI field or SRI-PUSCH-PowerControl is not provided, we clarify that the PUSCHs scheduled by PDCCH of different CORESETPoolindex are associated with different default closed loop index**
* **In section 6.1 of 38.214, we capture the restriction described by the Note of FG 16-2a-3 into the description of PUSCH out-order-operation.**

The TP for 38.213:

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| **7.1.1 UE behaviour**  \*\*\* Unchanged text is omitted \*\*\*  -  if the UE is configured with *twoPUSCH-PC-AdjustmentStates* and  if the UE is not configured with *twoPUSCH-PC-AdjustmentStates* or if the PUSCH transmission is scheduled by a RAR UL grant as described in Clause 8.3  - For a PUSCH (re)transmission configured by *ConfiguredGrantConfig*, the value of  is provided to the UE by *powerControlLoopToUse*  - If the UE is provided *SRI-PUSCH-PowerControl*, the UE obtains a mapping between a set of values for the SRI field in a DCI format scheduling the PUSCH transmission and the  value(s) provided by *sri-PUSCH-ClosedLoopIndex* and determines the  value that is mapped to the SRI field value  - If the PUSCH transmission is scheduled by a DCI format that does not include an SRI field, or if an *SRI-PUSCH-PowerControl* is not provided to the UE, *l*=1 if the PUSCH is scheduled by a PDCCH received in a CORESET which is configured with *CORESETPoolIndex* equal to 1 and othersiwe  - If the UE obtains one TPC command from a DCI format 2\_2 with CRC scrambled by a TPC-PUSCH-RNTI, the  value is provided by the closed loop indicator field in DCI format 2\_2 |

The TP for 38.214:

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| **6.1 UE procedure for transmitting the physical uplink shared channel**  \*\*\* Unchanged text is omitted \*\*\*  If a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *CORESETPoolIndex* in *ControlResourceSet* for the active BWP of a serving cell and PDCCHs that schedule two non-overlapping in time domain PUSCHs are associated to different *ControlResourceSets* having different values of *CORESETPoolIndex,* for any two HARQ process IDs in a given scheduled cell, if the UE is scheduled to start a first PUSCH transmission starting in symbol *j* by a PDCCH associated with a value of *CORESETpoolIndex* ending in symbol *i*, the UE can be scheduled to transmit a PUSCH starting earlier than the end of the first PUSCH by a PDCCH associated with a different value of *CORESETpoolIndex* that ends later than symbol *i* and the UE is expected to be provided with a closed loop index for that PUSCH different from the closed loop index of the first PUSCH.  \*\*\* Unchanged text is omitted \*\*\* |

If you have comments, please input below

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| Company | comments |
| QC | There are two different/ unrelated issues lumped together here.  Issue 1: DCI does not have SRI field.  Issue 2: Restriction imposed by the Note on the network.  Do not support the proposal for Issue 1. The scenario mentioned by OPPO (SRI field not configured) is not just related to closed loop index.  If SRI field is not configured, how does the UE obtain P0, alpha, PL-RS? How does the UE obtain precoding (TPMI for CB-based, SRS resources for NCB-based). This seems to be a big surgery to Rel. 16. If PUSCHs are to be transmitted to different TRPs, SRI field should be always configured and DCI format 0\_1 should be used, which solves all the problems mentioned by OPPO.  Regarding Issue 2, we do not see how the TP alleviates the issue. Is the intention here only to capture the Note in 38.214? We do see why this is critical. The Note is captured already and is part of NR specification. It is not critical to repeat the same in 38.214. We are open to discuss actual solutions to address the issue, but the suggested TP above is not for this purpose. |
| OPPO | Support the proposal.  Regarding the comment from QC, if SRI is not configured in DCI, which is usually the case in FR1, UE can obtain all the power control parameters from RRC according to current 38.213. If only one SRS resource is configured, and no analog beamforming is applied to PUSCH/SRS, why gNB needs to configure multiple SRS resources to UE? Also, even with single SRS resource, precoding(TPMI) can still be calculated separately in each TRP, and different TPMIs can be indicated for PUSCHs targeting different TRP. Hence, I cannot understand the concern that SRI and multiple SRS resources are always needed for M-TRP transmission. Does it mean that FG 2-14 (Supported max number of SRS resource per set) is mandatory to support Rel-16 M-TRP? It is too restrictive to gNB and UE, with unnecessary SRS overhead, especially in FR1. |
| QC | @ OPPO: Are you proposing to use different closed loop index but use the same PL-RS and the same P0 and alpha? Or is the TP above the first TP of a chain of TPs that will follow later to also add a second default PL-RS and a second default P0 and alpha? We just would like to understand the full scope here, and if a need is identified, it should be a complete solution.  Regarding the TPMI, I agree with you. So my comment on precoding issue above is applicable to NCB-based PUSCH only.  Regarding your other comments: I think at this point, we need to distinguish between “if something can cause overhead” or “can be optimized” versus if there is a critical issue. |
| Apple | Support the TPs in principle |
| OPPO | @Qualcomm: On pathloss RS or even PUCCH, we have another TP (please see R1-2100115). It should be good if we can have TRP-specific configuration for all PC parameters when SRI is not indicated. However, it is more like optimization for other PC parameters since the scheduling of M-TRP transmission will not be impacted. For close loop index it is more critical due to the Note of 16-2a-3. For a UE supporting out-of-order operation for uplink, PUSCHs scheduled by different *CORESETPoolIndex* cannot be supported without SRI, since the same default close loop index is defined for different *CORESETPoolIndex*. There is not such restriction for UEs not supporting this FG. Support of 16-2a-3 would become a block to support PUSCH scheduled with different *CORESETPoolIndex* in FR1. |
| Huawei, HiSilicon | We are ok with both TPs in principle. Our original intention is to capture the Note into RAN1 spec since it was agreed by UE cap session to discuss further in RAN1 maintenance session. We are open and agree to discuss default mapping between *CORESETPoolIndex* and the value of *l*, when SRI field or an *SRI-PUSCH-PowerControl* is not provided to the UE, in order to de-coupling conditions of enabling Multi-DCI operation and SRI field. |
| Nokia, NSB | If the concern is understood right, the OOO operations for UL cannot be supported with DCI format 0\_0 due to the Note added in the UE feature 16-2a-3 as use of two close-loop-indexes are not possible with the existing specification. We agree that this may be a restricted use case.  We should try to fix this issue by adjusting the Note. Otherwise, there seems to be a big spec impact to support OOO with DCI format 0\_0. |
| ZTE | We support this TP.  We have the similar view with OPPO, Apple, HW and Nokia. The note in FG 16-2a-3 causes very much restriction for both DCI 0\_0 and 0\_1 without SRI field. Even only for DCI 0\_1, it is too restrictive to mandate UE always support two SRS resources in the resource set. It is noted that support of 2 SRS resources for CB depends another UE capability, see FG 2-14. It is better to consider MTRP deployment even UE only supports 1 SRS resource. |
| Ericsson | We share the concern with Qualcomm, and we do not support the two TPs above.  For the first TP, considering the case with different closed loop indices but the same PL-RS, same P0, and alpha does not seem to make much sense. It would be better to consider a complete solution with different closed loop indices, different PL-RS, different P0, and different alpha. But we are worried that the scope of such a change is too large to be considered in Rel-16 maintainance.  For the second TP, the note is already is UE capability specs, and we do not see the same thing repeated in TS 38.214. |
| vivo | We don’t support the TP.  We have similar views as QC and Ericsson. Actually, different P0, alpha, and PL-RS for UE to determine transmission power towards different TRPs is more critical to ensure a reliable performance for PUSCHs scheduled from different TRPs. It doesn’t make sense to only introduce two closed loop indexes for MTRP PUSCH transmission without taking into account the open loop power control parameters. From our understanding, a straightforward way is to include SRI field in the scheduling DCI to provide two sets of power control parameters for MTRP. Otherwise, PUSCH transmission towards different TRPs cannot be supported properly. For the cases of a UE supporting a single SRS resource and no SRI field present in DCI, optimization for MTRP PUSCH OOO transmission is not needed in Rel-16. |
| LG | We have similar views as QC, vivo and Ericsson. Specification impact seems too large to support per TRP PC without SRI field. It has impact not only on closed loop index but also OL PC parameters and precoder for non-CB. It is not proper to address all this issue in this stage. Also, enhancement only for closed loop does not make it work. |
| CATT | We also think the note in FG16-2a-3 is to restrictive to network implementation. If it’s possible, remove that note would be the most straightforward way of solving this issue.  On the other hand, per TRP power control for Rel-16 should not be considered in such a late stage. What’s more, independent power control for PUSCH and PUCCH cannot be actually supported based on the TPs provided by OPPO and ZTE.  So, if we can touch neither the note in FG16-2a-3 nor independent power control in this stage, the second part of FL proposal seems to be a reasonable approach. |
| Lenovo/MotM | We share similar views with QC, vivo, Ericsson and LG. Only introducing different closed loop indices but with the same open loop power parameters does not make sense for multiTRP operation. Introducing indepdent power control for muit-TRP can give a complete solution for this scenario, however, it will have lager specification impact and it’s too later in the CR stage.  From our understand, DCI format 0\_0 cannot support OoO operation due to the Note. If OoO operation is supported for DCI format 0\_1/0\_2, the UE expects SRI field is present in the scheduling DCI to indicate different power control loop. |