3GPP TSG RAN WG1 #101 R1-200xxxx

e-Meeting, May 20th – June 5th, 2020

Source: Moderator (OPPO)

Title: Discussion on Issue#b-2 in Email Thread 2

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-2 in multi-TRP email thread 2:

* The issue# b-2 to Clarify the relationship between *RepetitionNumber-r16*/*RepSchemeEnabler* and *pdsch-AggregationFactor*, and also clarify the repetitions are in *RepNum16* consecutive slots in Scheme 4.

# Issue#b-2

**Background**:

Companies [4], [12], [17], [18] discuss the issue of relationship between the *RepNumR16* of scheme 4 and the parameter *pdsch-AggregationFactor* that was specified in rel15. They all propose that the *RepNumR16* of scheme 4 and parameter *pdsch-AggregationFactor*  can not be used simultaneously. But their proposal has some difference:

* [4] proposed that *pdsch-AggregationFactor* should be overwritten whenever Rel-16 repetition number *RepetitionNumber-r16* is indicated by DCI.
* [12] proposed that when at least one entry in *pdsch-TimeDomainAllocationList* contains RepNumR16, the UE will ignore the *AggregationFactor*.
* [17] proposed that *pdsch-AggregationFactor* should be overwritten when Rel-16 repetition number *RepetitionNumber-r16* is indicated by DCI.
* [18] proposed that when at least one entry in *pdsch-TimeDomainAllocationList* contains RepNumR16, the UE does not expect to be configured with *AggregationFactor*.

[18] also discussed the issue of simultaneous configuration of scheme 2a/2b/3 and *pdsch-AggregationFactor* and proposed that simultaneous configuration of scheme 2a/2b/3 and *pdsch-AggregationFactor* is not allowed.

[12], [17] and [19] proposed to clarify that in scheme 4, the PDSCH is repeated in in RepNumR16 consecutive slots.

**Proposal 1: Regarding the *RepetitionNumber-r16* of scheme 4 and *AggregationFactor*, down-select from:**

* **Alt1: *pdsch-AggregationFactor* is applied only when the Rel-16 repetition number *RepetitionNumber-r16* is not indicated by a DCI.**
* **Alt2: *AggregationFactor* is applied only when the Rel-16 repetition number *RepetitionNumber-r16* is not included in any entry in *pdsch-TimeDomainAllocationList.***
* **Alt3: When at least one entry in *pdsch-TimeDomainAllocationList* contains *RepetitionNumber-r16*, the UE does not expect to be configured with *AggregationFactor***

**Proposal 2: When a UE is configured by *repetitionSchemeConfig-r16* set to one of '*FDMSchemeA*', '*FDMSchemeB*' and '*TDMSchemeA*', the UE does not expect to be configured with AggregationFactor.**

**Proposal 3: Clarify that in scheme 4, PDSCH is repeated in *RepNumR16* consecutive slots**

Please input your views and comments on these 3 proposals:

|  |  |
| --- | --- |
| Company | Views and comments |
| Apple | Since all the parameters are provided by RRC, gNB should provide the correct parameters. Such “ignore” or “overwritten” are not typical ways we used. It seems Alt3 in proposal 1 and proposal 2 & 3 should be fine. |
| MediaTek | We support Alt 3 in Proposal 1, and also support Proposal 2 and Proposal 3.  |
| OPPO(updated) | For proposal 1, regarding Apple’s comments, I modify the wording since we only need to clarify in 38.214 when to apply *pdsch-AggregationFactor****.*** The application of *RepetitionNumber-r16* has been clearly described in spec. It should be noticed that it is possible that *RepetitionNumber-r16* is configured in *pdsch-TimeDomainAllocationList-ForDCIFormat1\_2* but not in *pdsch-TimeDomainAllocationList* considering it is mainly applied for URLLC. In this case, if DCI format 1\_0 or DCI format 1\_1 is used to schedule PDSCH, it is not reasonable to forbid gNB to use *pdsch-AggregationFactor* for PDSCH (which is actually Rel-15 UE behavior). Hence, **considering a unified design for *pdsch-TimeDomainAllocationList-ForDCIFormat1\_2* and *pdsch-TimeDomainAllocationList*, Alt.1 or Alt.2 is fine to us**. Otherwise, we may need another conclusion to clarify if *pdsch-AggregationFactor* can be configured if *RepetitionNumber-r16* is only configured in *pdsch-TimeDomainAllocationList-ForDCIFormat1\_2.*We also support proposal 2 and 3. |
| ZTE | Support **Proposal 1 with Alt3**, proposal 2 and proposal 3. The reason is that, Alt.1 is not flexible since it doesn’t support repetition number =1 if *pdsch-AggregationFactor* is configured. Alt.2 causes unnecessary configuration, the benefit is unclear. |
| CMCC | Support Proposal 1 with Alt2, proposal 2 and proposal 3.For proposal 1, in 38.214, the number of repetitions *K* for PUSCH has been specified as follows. Similar principle can be reused for PDSCH.For PUSCH repetition Type A, when transmitting PUSCH scheduled by DCI format 0\_1 or 0\_2 in PDCCH with CRC scrambled with C-RNTI, MCS-C-RNTI, or CS-RNTI with NDI=1, the number of repetitions *K* is determined as- if *numberofrepetitions* is present in the resource allocation table, the number of repetitions K is equal to *numberofrepetitions*;- elseif the UE is configured with *pusch-AggregationFactor*, the number of repetitions *K* is equal to *pusch-AggregationFactor*; - otherwise *K=1*. |
| Spreadtrum | Support Alt.3 in Proposal 1 for its flexibility, proposal 2, and proposal 3. |
| vivo | Support Alt.2 in Proposal 1 which works the same way as UL PUSCH in TS 38.214:=============================================For PUSCH repetition Type A, when transmitting PUSCH scheduled by DCI format 0\_1 or 0\_2 in PDCCH with CRC scrambled with C-RNTI, MCS-C-RNTI, or CS-RNTI with NDI=1, the number of repetitions *K* is determined as- if *numberofrepetitions* is present in the resource allocation table, the number of repetitions K is equal to *numberofrepetitions*;- elseif the UE is configured with *pusch-AggregationFactor*, the number of repetitions *K* is equal to *pusch-AggregationFactor*; - otherwise *K=1*.For PUSCH repetition Type A, in case *K>1,* the same symbol allocation is applied across the *K* consecutive slots and the PUSCH is limited to a single transmission layer. The UE shall repeat the TB across the *K* consecutive slots applying the same symbol allocation in each slot. The redundancy version to be applied on the *n*th transmission occasion of the TB, where n = 0, 1, … *K*-1, is determined according to table 6.1.2.1-2. ===============================================For a UE supporting both DCI format 1-1 and 1-2, two TDRA tables are configured, each applies the same rule as Alt.2.We also support Proposal 3. |
| QC | Support Alt3 in Proposal 1, and proposals 2 and 3. Note that for semi-static HARQ-Ack, we agreed on the following in Feb e-Meeting, which means that Alt1 is not allowed. Also, Alt2 is a configuration error case, which should be avoided by the network. For the case of different TDRA tables for DCI formats 1-1 and 1-2 (if this is agreed), still Alt 3 should be followed (if at least one entry of any of the two TDRA tables is configured with RepetitionNumber-r16, AggregationFactor should not be configured/used). Otherwise, Type-1 HARQ-Ack codebook determination requires additional specification efforts. Note that such an impact does not exists for the case of PUSCH in eURLLC (as it does not impact the HARQ-Ack).If the UE is provided *pdsch-AggregationFactor* and no entry in *pdsch-TimeDomainAllocationList* includes *RepNumR16* in *PDSCH-TimeDomainResourceAllocation*, $N\_{PDSCH}^{repeat}$ is a value of *pdsch-AggregationFactor*; otherwise $N\_{PDSCH}^{repeat}=1$. The UE reports HARQ-ACK information for a PDSCH reception- from slot $n-N\_{PDSCH}^{repeat}+1$ to slot $n$, if $N\_{PDSCH}^{repeat}>1$, or - from slot $n-RepNumR16+1$ to slot $n$, if the Time domain resource assignment field in the DCI format scheduling the PDSCH reception indicates an entry in *pdsch-TimeDomainAllocationList* containing *RepNumR16,* or - in slot $n$, otherwise  |
| Ericsson | We have similar comments as QC with regards to Proposal 1. Hence, we support Alt 3 of Proposal 1. We also support Proposals 2 and 3. |
| Huawei | Support Proposal 1 with Alt1 or Alt 3, and slightly prefer Alt 1 due to avoid potential reconfiguration if the NW does not want to use dynamic repetition and prefer that Rel-15 can be sufficient. We are fine with proposal 2, and proposal 3 which shall be aligned with Rel-15 repetition mechanism.  |

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)