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

e-Meeting, August 10th – 27th, 2021

Source: Moderator (OPPO)

Title: Discussion of [106-e-NR-eMIMO-06]

Agenda Item: 7.2.6

Document for: Discussion and Decision

Introduction

This document summarizes the discussion for eMIMO email thread #6:

[106-e-NR-eMIMO-06] MT.3 (alignment of PDSCH BWP and SCS for mDCI) by August 20 – Li (OPPO)

Discussion

As explained in R1-2107202 [1], the proposed CR is related with one issue in the following text specification in Section 5.1 of 38.214. Specifically, the issue is related with the “non-overlapped PDSCHs” in the highlight sentence.

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| 5.1 UE procedure for receiving the physical downlink shared channel  …  If a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet*, the UE may expect to receive multiple PDCCHs scheduling fully/partially/non-overlapped PDSCHs in time and frequency domain. The UE may expect the reception of full/partially-overlapped PDSCHs in time, only when PDCCHs that schedule two PDSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex*. For a *ControlResourceSet* without *coresetPoolIndex*, the UE may assume that the *ControlResourceSet* is assigned with *coresetPoolIndex* as 0. When the UE is scheduled with full/partially/non-overlapped PDSCHs in time and frequency domain, the full scheduling information for receiving a PDSCH is indicated and carried only by the corresponding PDCCH, the UE is expected to be scheduled with the same active BWP and the same SCS. When the UE is scheduled with full/partially-overlapped PDSCHs in time and frequency domain, the UE can be scheduled with at most two codewords simultaneously. When PDCCHs that schedule two PDSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex,* the following operations are allowed:  … |

Regarding the BWP operation in M-DCI based M-TRP system, the following agreement was made in RAN1#96:

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| **Agreement**  For a UE supporting multiple-PDCCH based multi-TRP/panel transmission and each PDCCH schedules one PDSCH, at least for eMBB with non-ideal backhaul, support following restrictions:   * The UE may be scheduled with fully/partially/non-overlapped PDSCHs at time and frequency domain by multiple PDCCHs with following restrictions:   + …   + The UE is expected to be scheduled with the same active BWP bandwidth and the same SCS if the UE is expected to receive multiple PDSCHs simultaneously at given symbols.   + The number of active BWPs for a UE is 1 per CC   + … |

As pointed in [1], the text in current 38.214 “When the UE is scheduled with.. non-overlapped PDSCHs…, the UE is expected to be scheduled with the same active BWP and the same SCS” seems to suggest that any two non-overlapped PDSCH need to be scheduled in the same active BWP and with same SCS. The consequence is BWP switching for single-TRP transmission is not allowed because non-overlapped PDSCHs in single TRP must be in same active BWP and with same SCS according to this specification.

To assist the discussion, let us consider following two different cases which are illustrated in Figure 1:

* Different PDSCHs are scheduled in single-TRP system or by the same TRP in a m-DCI mTRP system
* Two different PDSCHs are scheduled by two different TRP in m-DCI mTRP system.



**Figure 1: examples of non-overlapped PDSCHs**

Case#1:

**Case #1**: PDSCH 0 and PDSCH 1 in Fig.1 are associated with **same value** of *CORESETPoolindex* (i.e., same TRP in mTRP system) or not associated with any *CORESETPoolindex* (i.e., single-TRP system). As shown in Figure 1, PDSCH 0 and PDSCH 1 are not overlapped, and they are in different BWP.

**Question 1**: Can PDSCH0 and PDSCH1 described in case #1 (i.e., single-TRP or same TRP in m-DCI mTRP system) be scheduled in different BWP?

* If the answer to Question 1 is yes, then the following CR draft proposed in [1] seems to be needed since the current spec seem to not allow that.

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| 5.1 UE procedure for receiving the physical downlink shared channel  <Unchanged parts are omitted>  If a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet*, the UE may expect to receive multiple PDCCHs scheduling fully/partially/non-overlapped PDSCHs in time and frequency domain. The UE may expect the reception of full/partially-overlapped PDSCHs in time, only when PDCCHs that schedule two PDSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex*. For a *ControlResourceSet* without *coresetPoolIndex*, the UE may assume that the *ControlResourceSet* is assigned with *coresetPoolIndex* as 0. When the UE is scheduled with full/partially/non-overlapped PDSCHs in time and frequency domain by PDCCHs associated to different *ControlResourceSets* having different values of *coresetPoolIndex*, the full scheduling information for receiving a PDSCH is indicated and carried only by the corresponding PDCCH, and the UE is expected to be scheduled with the same active BWP and the same SCS. When the UE is scheduled with full/partially-overlapped PDSCHs in time and frequency domain, the UE can be scheduled with at most two codewords simultaneously. When PDCCHs that schedule two PDSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex,* the following operations are allowed:  <Unchanged parts are omitted> |

Please provide your views on question 1 and any comments for the CR draft in the table below:

|  |  |
| --- | --- |
| **Company** | **comments** |
| Apple | We are fine with the CR. But it seems the possibility of misunderstanding is low, since the whole paragraph is talking about the mDCI operation. |
| QC | The CR is not needed. The answer to the question 1 is yes (through legacy active BWP switching), and this is allowed by specification. In our understanding, this part of the spec is not related to BWP switching. BWP switching is allowed within and across CORESETPoolIndex values as there is no such restriction in 38.213 Section 12. This part of the spec just clarifies that BWP and SCS remains same as Rel. 15 and not changed because of mTRP. Hence, it seems change is not needed.  To be clear, we do not think active BWP switching for multi-DCI is any different than Rel. 15. Active BWP can be switched by a DCI from any CORESETPoolIndex. Network needs to ensure that we do not have more than one active BWP as a result of mTRP (e.g. due to non-ideal backhaul). In the specification text above, it says “UE is expected to be scheduled with the same active BWP” which is correct. |
| OPPO | We have different understanding with QC.  The current spec says: When the UE is scheduled with full/partially/non-overlapped PDSCHs in time and frequency domain, the full scheduling information for receiving a PDSCH is indicated and carried only by the corresponding PDCCH, the UE is expected to be scheduled with the same active BWP and the same SCS.  There is no condition for the value of *CORESETpoolindex*. Also, there is no “simultaneously” restriction for the sentence. For two non-overlapped PDSCHs associated with the same value of *CORESETPoolindex*, the restriction of the same BWP is unnecessary. You can see the next sentence: “When PDCCHs that schedule two PDSCHs are associated to different ControlResourceSets having different values of coresetPoolIndex, the following operations are allowed…”, there is also a condition there.  As another alternative, we can simply delete “non-overlapped” or add “simultaneously” at the end to make the description clear and consistent with previous agreement. |
| Samsung | We are supportive on the proposal which can make the spec. clearer. |
| Nokia/NSB | Not needed.  It seems that concerns are raised on the following reading of the sentence,  “When the UE is scheduled with ~~full/partially/~~non-overlapped PDSCHs in time and frequency domain, the full scheduling information for receiving a PDSCH is indicated and carried only by the corresponding PDCCH, the UE is expected to be scheduled with the same active BWP and the same SCS.”  It is not clear how the above text is related to BWP switching when full paragraph we consider here is about multi-DCI multi-TRP. Also, it is not feasible (as the above text is not sufficient for that) to interpret any BWP switching details.  “If a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet*, the UE may expect to receive multiple PDCCHs scheduling fully/partially/non-overlapped PDSCHs in time and frequency domain. ….. |
| vivo | We understand that some companies have concern that the when a UE is scheduled with non-overlapping PDSCHs, BWP switching is not possible according the text.  As the agreement made in RAN1#96 is   |  | | --- | | • The UE may be scheduled with fully/partially/non-overlapped PDSCHs at time and frequency domain by multiple PDCCHs with following restrictions:  o …  o The UE is expected to be scheduled with the same active BWP bandwidth and the same SCS if the UE is expected to receive multiple PDSCHs simultaneously at given symbols. |   The condition for a UE expecting to be scheduled with the same active BWP and the same SCS is to “receive multiple PDSCHs simultaneously at given symbols”, i.e., scheduled with fully/partially overlapped PDSCHs and non-overlapped PDSCHs is not included.  Therefore, our proposal is to delete “non”:  When the UE is scheduled with full/partially ~~/non-~~overlapped PDSCHs in time and frequency domain, the full scheduling information for receiving a PDSCH is indicated and carried only by the corresponding PDCCH, the UE is expected to be scheduled with the same active BWP and the same SCS. |
| ZTE | We are supportive on the proposal which can make the spec clearer. |
| LG | We are fine with the CR. |
| Lenovo/MotM | We support vivo’s version to delete “non-”. |
| CATT | To align the spec with the agreement in RAN1 #96, we support the revision proposed by vivo. |
| Huawei | We are fine with CR. |

Case#2:

**Case #2**: The UE is configured with m-DCI mTRP transmission. PDSCH0 and PDSCH1 are associated with CORESETPoolindex=0, while PDSCH2 is associated with CORESETPoolindex=1. These three PDSCHs are non-overlapped in time domain. PDSCH0 is in BWP0. But PDSCH1 and PDSCH2 are in BWP1.

**Question 2**: Can the case#2 be supported in m-DCI based mTRP system of rel16?

* If the answer to Question 2 is No, Can we conclude that BWP switching is fully forbidden when different values of CORESETPoolindex are configured for a UE (i.e., m-DCI mTRP is configured)?
* If the answer to Question 2 is YES, we may need to modify the current specification because the current specification does not allow it. What is your suggested change if you think odifying the specification for case#2 is needed?

Please provide your views on the question 2 in the table below:

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| --- | --- |
| **Company** | **comments** |
| Apple | We failed to see why this question is relevant to the CR. But in our view, BWP switching is allowed, but gNB should make sure the PDSCHs scheduled by different CORESETPoolIndex should be with the same BWP, as specified. So it seems no spec change is needed. |
| QC | Why current specification does not allow Case 2? Where in the specification differentiation between Case 1 and Case 2 is explained? We are confused about this question. |
| OPPO | Please see our comment for Case 1.  For non-overlapped PDSCHs, the UE should be able to be scheduled with different active BWPs and different SCSs.  As an alternative, we can simply delete “non-overlapped” or add “simultaneously” at the end to make the description clear and consistent with previous agreement. |
| Samsung | Our answer is Yes, but we cannot understand why this case is not supported without revising specification. |
| Nokia/NSB | Not fully sure that question is relevant to the CR as the CR text is not discussing BWP switching. |
| ZTE | It is better to revise the spec to make it clearer. |
| LG | Same view with Samsung. |
| Lenovo/MotM | Our answer is Yes and it will be more clear by delete “non-”  When the UE is scheduled with full/partially ~~/non-~~overlapped PDSCHs in time and frequency domain, the full scheduling information for receiving a PDSCH is indicated and carried only by the corresponding PDCCH, the UE is expected to be scheduled with the same active BWP and the same SCS. |
| CATT | Same view as Lenovo/MotM. |
| Huawei | Not sure how this question of Case 2 is related to this CR and why current specification will disable Case 2. |

2nd round discussion

In the first round discussion, we have the following comments and inputs:

* Samsung, Apple, OPPO, ZTE, LG and Huawei support the CR proposed in [1] to make the spec clearer. The argument is the text in current spec does not include the condition of different CORESETPoolIndex value and it does not include the restriction of “simulatenously”, which were in our orginal agreement.
* However, QC,Nokia/NSB do not support the CR proposed in [1]. Their argument is that text is not related with BWP switching and the current text does not imply that the BWP switching is changed for M-DCI.
* Vivo pointed out that the reason for why some companies have concerns on the current spec is because that the condition of “receive multiple PDSCHs simultaneously at given symbols” in original RAN1 agreement is not captured in the current Spec text. For that, vivo propose a new TP to delete “the non-”. Lenovo/MotM, CATT and OPPO is ok with the TP proposed by vivo.

Based on the comments from companies, my understanding is that no one thinks the BWP operation is different for M-DCI mTRP and we all have the same understanding on that RAN1 agreement. The reasons for concerns by some companies is that some conditions in the RAN1 agreement was not captured in the spec. The RAN1 agreement made in RAN1#96 does state that:

|  |
| --- |
| **Agreement**  For a UE supporting multiple-PDCCH based multi-TRP/panel transmission and each PDCCH schedules one PDSCH, at least for eMBB with non-ideal backhaul, support following restrictions:   * The UE may be scheduled with fully/partially/non-overlapped PDSCHs at time and frequency domain by multiple PDCCHs with following restrictions:   + …   + The UE is expected to be scheduled with the same active BWP bandwidth and the same SCS if the UE is expected to receive multiple PDSCHs simultaneously at given symbols.   + The number of active BWPs for a UE is 1 per CC   + … |

But the condition of “**if the UE is expected to receive multiple PDSCHs simultaneously at given symbols**” in the RAN1 agreement was not captured in the spec, which cause confusion to some companies. Therefore, I would like to propose to capture this missing condition in the spec to make it clear that the UE expects same active BWP when the UE is expected to receive overlapped PDSCHs.

Here is the updated proposal:

**Proposal: Adopt the following TP for 38.214:**

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| 5.1 UE procedure for receiving the physical downlink shared channel  <Unchanged parts are omitted>  If a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet*, the UE may expect to receive multiple PDCCHs scheduling fully/partially/non-overlapped PDSCHs in time and frequency domain. The UE may expect the reception of full/partially-overlapped PDSCHs in time, only when PDCCHs that schedule two PDSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex*. For a *ControlResourceSet* without *coresetPoolIndex*, the UE may assume that the *ControlResourceSet* is assigned with *coresetPoolIndex* as 0. When the UE is scheduled with full/partially/non-overlapped PDSCHs in time and frequency domain, the full scheduling information for receiving a PDSCH is indicated and carried only by the corresponding PDCCH, and the UE is expected to be scheduled with the same active BWP and the same SCS when receiving multiple PDSCHs simultaneously at given symbols. When the UE is scheduled with full/partially-overlapped PDSCHs in time and frequency domain, the UE can be scheduled with at most two codewords simultaneously. When PDCCHs that schedule two PDSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex,* the following operations are allowed:  <Unchanged parts are omitted> |

Please provide your comments on this TP proposal in the table below:

|  |  |
| --- | --- |
| **Company** | **comments** |
| Apple | We think previous version is better. The definition of “multiple PDSCHs” and “at given symbols” are not quite clear. |
| QC | Would it be enough to have a conclusion? Our preference is no spec change as there is no risk of confusion.  For the TP above, “when receiving multiple PDSCHs simultaneously at given symbols” is not a clear specification language (even though it is used in the agreement) |
| LG | Support the TP |
| vivo | Perhaps deleting ‘non-’ is the simplest way. |

Conclusion

…

References

1. R1-2107202 Draft CR for M-DCI based M-TRP transmission OPPO