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

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

Source: Moderator (OPPO)

Title: Discussions on Issue MT.12

Agenda Item: 7.2.6

Document for: Discussion and Decision

# Introduction

A list of editorial TPs will be discussed in this document.

TP#1

Based on the current UE feature group 16-2b-1b, support of the new DMRS port entry {0, 2, 3} is a UE capability for single-DCI based SDM scheme. Consequently, gNB can indicate UE DMRS port entry {0, 2, 3} only if UE supports the feature group 16-2b-1b. ZTE (R1-2100281) proposed that it is not necessary to reiterate it in physical layer specification, i.e. 38.212 and thus they suggest removing the redundant description in the bracket as shown in the following TP1 for 38.212.

## **Round#1 discussion**

Based on the proposal by ZTE (R1-2100281), here is the initial proposal for TP#1

**Proposal: Adopt the following TP for 38.212.**

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| --- |
| **7.3.1.2.2 Format 1\_1**\*\*\* Unchanged text is omitted \*\*\*- Antenna port(s) – 4, 5, or 6 bits as defined by Tables 7.3.1.2.2-1/2/3/4 and Tables 7.3.1.2.2-1A/2A/3A/4A, where the number of CDM groups without data of values 1, 2, and 3 refers to CDM groups {0}, {0,1}, and {0, 1,2} respectively. The antenna ports  shall be determined according to the ordering of DMRS port(s) given by Tables 7.3.1.2.2-1/2/3/4 or Tables 7.3.1.2.2-1A/2A/3A/4A. When a UE receives an activation command that maps at least one codepoint of DCI field '*Transmission Configuration Indication*' to two TCI states, the UE shall use Table 7.3.1.2.2-1A/2A/3A/4A; otherwise, it shall use Tables 7.3.1.2.2-1/2/3/4. The UE can receive an entry with DMRS ports equals to 1000, 1002, 1003 when two TCI states are indicated in a codepoint of DCI field '*Transmission Configuration Indication*'.\*\*\* Unchanged text is omitted \*\*\* |

If you have comments, please input below

|  |  |
| --- | --- |
| Company | comments |
| QC | Support. |
| OPPO | Support |
| Apple | We think we should remove bracket only instead of the whole text.  |
| LG | Same view with Apple |
| MediaTek | Support |
| Samsung | Support removing bracket only. |
| Huawei, HiSilicon | Support the TP. |
| Nokia, NSB | Support  |
| ZTE | Support |
| Spreadtrum | Support to remove the bracket only |
| vivo | Support |
| Ericsson | Support |
| CATT | Support |

## Round#2 discussion

All the companies support to update the spec but with different method:

* Option 1: remove the bracket and the text inside the backet: QC, OPPO, MTK, HW/HiS, Nokia/NSB, ZTE, vivo, Ericsson
* Option 2: only remove the backet: Apple, LG, Samsung, Spreadtrum,

Option 1 is supported by more companies. So, it is suggested to go with option 1:

**Updated Proposal: Adopt the following TP for 38.212.**

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| --- |
| **7.3.1.2.2 Format 1\_1**\*\*\* Unchanged text is omitted \*\*\*- Antenna port(s) – 4, 5, or 6 bits as defined by Tables 7.3.1.2.2-1/2/3/4 and Tables 7.3.1.2.2-1A/2A/3A/4A, where the number of CDM groups without data of values 1, 2, and 3 refers to CDM groups {0}, {0,1}, and {0, 1,2} respectively. The antenna ports  shall be determined according to the ordering of DMRS port(s) given by Tables 7.3.1.2.2-1/2/3/4 or Tables 7.3.1.2.2-1A/2A/3A/4A. When a UE receives an activation command that maps at least one codepoint of DCI field '*Transmission Configuration Indication*' to two TCI states, the UE shall use Table 7.3.1.2.2-1A/2A/3A/4A; otherwise, it shall use Tables 7.3.1.2.2-1/2/3/4. The UE can receive an entry with DMRS ports equals to 1000, 1002, 1003 when two TCI states are indicated in a codepoint of DCI field '*Transmission Configuration Indication*'.\*\*\* Unchanged text is omitted \*\*\* |

If you have comments, please input below

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| --- | --- |
| Company | comments |
| Samsung | Our understanding is that a UE reporting a UE capability (16-2b-1b: support of new DMRS port entry) can receive an entry with DMRS ports equals to 1000, 1002 and 1003. That’s why we suggest to remove bracket only. If our understanding is wrong, please correct us. |
| Apple | We share same view with Samsung |
| OPPO | We support to only remove the bracket instead of deleting it. |
| CATT | Option 1 is supported.The capability of receiving an activation command that maps at least one codepoint of DCI field '*Transmission Configuration Indication*' to two TCI states is also an optional feature. Should we keep the description of “and subject to UE capability” wherever an optional feature is cited in RAN1 spec? |
| Nokia | Either option is ok with us. Removing does not change the fact that this is only feasible for the UEs supporting the UE feature.  |
| QC | Ok either way. |
| ZTE | Unless some ambiguities caused, RAN1 spec usually does not describe UE capability. That’s why we suggest remove the context of bracket. As Nokia said, even removing the context, it does not change the fact since UE capability has been captured in 38.306. |

TP#2

There is an agreement about default TCI states of PDSCH of mTRP and it is captured in 38.214 g20 version. However, the highlighted part marked in underline as below is missed in 38.214 g40 version.

|  |
| --- |
| **Agreement**The default TCI-states for PDSCH transmission of scheme 3 or scheme 4 are determined as follows:* When the time offset between the DCI and **the 1st PDSCH transmission occasion** is less than the threshold, the two default TCI-states are applied to PDSCH transmission occasions, respectively. The mapping between default TCI states and PDSCH transmission occasions follows the mapping specified for indicated TCI states in Section 5.1.2.1 in TS 38.214.
* The default TCI states are based on the activated TCI states in the slot with the first PDSCH transmission occasion
* Note: Whether to support this feature or not is subject to UE capability FG 16-2b-0.
 |

Thus ZTE (R1-2100281) provided TP to correct that.

## **Round#1 discussion**

Based on the proposal by ZTE (R1-2100281), here is the initial proposal for TP#2

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

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| **5.1.5 Antenna ports quasi co-location**\*\*\* Unchanged text is omitted \*\*\*Independent of the configuration of *tci-PresentInDCI* and *tci-PresentDCI-1-2* in RRC connected mode, if the offset between the reception of the DL DCI and the first occasion of the corresponding PDSCH is less than the threshold *timeDurationForQCL* and at least one configured TCI state for the serving cell of scheduled PDSCH contains *qcl-Type* set to 'typeD', - the UE may assume that the DM-RS ports of PDSCH of a serving cell are quasi co-located with the RS(s) with respect to the QCL parameter(s) used for PDCCH quasi co-location indication of the CORESET associated with a monitored search space with the lowest *controlResourceSetId* in the latest slot in which one or more CORESETs within the active BWP of the serving cell are monitored by the UE. In this case, if the *qcl-Type* is set to 'typeD' of the PDSCH DM-RS 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). \*\*\* Unchanged text is omitted \*\*\* |

If you have comments, please input below

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| --- | --- |
| Company | comments |
| QC | Is this a Rel. 16 issue? In Rel. 15, we have slot aggregation and the same TP seem to be applicable to that as well. This issue can be discussed as part of Rel. 15 maintenance.  |
| OPPO | We think it is the common understanding for PDSCH repetition with or without the text proposal. We are fine to have it.  |
| Apple | There are different interpretations for this text. One is that this should be determined per transmission occasion. I recall that seems to be the majority understanding in Rel-15. |
| LG | The main sentence is related to schemes other than scheme 3/4 as well. So, it is better to use the original wording captured in g20 version as follows.‘if the offset between the reception of the DL DCI and the corresponding PDSCH or the first PDSCH transmission occasion is less than the threshold *timeDurationForQCL*’ |
| MediaTek | Fine to have the TP |
| Samsung | Support the proposal using expression as “first PDSCH transmission occasion”. |
| Huawei, HiSilicon | It seems to be common understanding since all PDSCH transmission occasions shall be considered as whole, for all schemes. We are neutral.  |
| Nokia, NSB | We do not see a big issue with the text in the spec. “*the offset between the reception of the DL DCI and the corresponding PDSCH*” : Common understanding for offset is that we consider the time between PDCCH and PDSCH (where we do not even mention the first symbol of the PDSCH), so it should be understood that it is the first symbol, which may come in first PDSCH transmission occasion. Also, this is not only the case for Rel-16 as QC mentioned. We suggest no changes to the specs. |
| ZTE | @Nokia, Please note that the above agreement in Rel-16 MTRP. What is the issue to capture the missed agreement?If people think the first PDSCH occasion/symbol should be used, I suggest to make spec clear based on Rel-16 agreement. Regarding whether Rel-15 has the same issue, it can be further discussed in next meeting since I haven’t found the corresponding agreement yet.  |
| Spreadtrum | It is common understanding. Fine with either to capture it or not. |
| vivo | We are OK with LG’s version. |
| Ericsson | Ok with the LG’s version with the following clarification:‘if the offset between the reception of the DL DCI and the corresponding PDSCH or the first PDSCH transmission occasion among multiple PDSCH transmission occasions is less than the threshold *timeDurationForQCL*’ |

## Round#2 discussion

The TP is updated based on the version of LGE and Ericsson. That wording can clearly clarify it is only for scheme 3 and scheme 4.

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

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| **5.1.5 Antenna ports quasi co-location**\*\*\* Unchanged text is omitted \*\*\*Independent of the configuration of *tci-PresentInDCI* and *tci-PresentDCI-1-2* in RRC connected mode, if the offset between the reception of the DL DCI and the corresponding PDSCH or the first PDSCH transmission occasion among multiple PDSCH transmission occasions is less than the threshold *timeDurationForQCL* and at least one configured TCI state for the serving cell of scheduled PDSCH contains *qcl-Type* set to 'typeD', - the UE may assume that the DM-RS ports of PDSCH of a serving cell are quasi co-located with the RS(s) with respect to the QCL parameter(s) used for PDCCH quasi co-location indication of the CORESET associated with a monitored search space with the lowest *controlResourceSetId* in the latest slot in which one or more CORESETs within the active BWP of the serving cell are monitored by the UE. In this case, if the *qcl-Type* is set to 'typeD' of the PDSCH DM-RS 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). \*\*\* Unchanged text is omitted \*\*\* |

If you have comments, please input below

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| --- | --- |
| Company | comments |
| Samsung | Support |
| Apple | Do not support this TP. It reverts Rel-15 behavior. |
| OPPO | The TP may also impact the UE behavior when *pdsch-AggregationFactor* is configured, which was supported in Rel-15. However, the agreement only refers to scheme 3/4 for M-TRP. To avoid revert any Rel-15 behavior, we suggest the following wording or no modification to the spec.Independent of the configuration of *tci-PresentInDCI* and *tci-PresentDCI-1-2* in RRC connected mode, if the offset between the reception of the DL DCI and the corresponding PDSCH or the first PDSCH transmission occasion among multiple PDSCH transmission occasions except when *pdsch-AggregationFactor* is configured is less than the threshold *timeDurationForQCL* and at least one configured TCI state for the serving cell of scheduled PDSCH contains *qcl-Type* set to 'typeD' |
| CATT | Support the updated proposal.We fail to understand why slot aggregation is affected with this TP? |
| Nokia | Mentioned before. Do not support.  |
| QC | Do not support. We think it is not needed. With the red part added by OPPO, the question then becomes what happens if pdsch-AggregationFactor is configured, which is an old issue discussed before for Rel. 15 w/o explicitly clarifying in the spec. With the red part, then we have to also explicitly clarify the behaviors for slot aggregation. |
| ZTE | @Apple and Nokia, what is Rel-15 behavior? If people think it is an issue for Rel-15 as well, a CR can be submitted in next meeting. But for Rel-16, we have clear agreement already to use the first occasion. |

I think wenhong’s TP is trying to only implementing the agreement on scheme 3 and scheme 4 but no changing the behavior of PDSCH of rel15 aggregationfactor.

Based on the Wenhong’s input, here is a further update TP.

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

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| --- |
| **5.1.5 Antenna ports quasi co-location**\*\*\* Unchanged text is omitted \*\*\*Independent of the configuration of *tci-PresentInDCI* and *tci-PresentDCI-1-2* in RRC connected mode, if the offset between the reception of the DL DCI and the corresponding PDSCH or the first PDSCH transmission occasion of a PDSCH with multiple PDSCH transmission occasions but with no *pdsch-AggregationFactor* is less than the threshold *timeDurationForQCL* and at least one configured TCI state for the serving cell of scheduled PDSCH contains *qcl-Type* set to 'typeD', - the UE may assume that the DM-RS ports of PDSCH of a serving cell are quasi co-located with the RS(s) with respect to the QCL parameter(s) used for PDCCH quasi co-location indication of the CORESET associated with a monitored search space with the lowest *controlResourceSetId* in the latest slot in which one or more CORESETs within the active BWP of the serving cell are monitored by the UE. In this case, if the *qcl-Type* is set to 'typeD' of the PDSCH DM-RS 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). \*\*\* Unchanged text is omitted \*\*\* |

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| Company | comments |
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TP#3

For scheme 4 of S-DCI mTRP, the RV offset is defined between PDSCH occasions from two TRPs, and one of the candidate values {0, 1, 2, 3} is configured by RRC signaling. ZTE (R1-2100281) proposed that in the title of Table 5.1.2.1-3 in the current 38.214, the condition description of ‘when *sequenceOffsetforRV* is present’ is unnecessary and causes misunderstanding because the RV offset is always configured for scheme 4 as defined in the 38.331. Thus, it is proposed to remove that condition description.

## **Round#1 discussion**

Based on the proposal by ZTE (R1-2100281), here is the initial proposal for TP#3

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

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| **5.1.2.1 Resource allocation in time domain**\*\*\* Unchanged text is omitted \*\*\*The UE may expect that each PDSCH transmission occasion is limited to two transmission layers. For all PDSCH transmission occasions associated with the first TCI state, the redundancy version to be applied is derived according to Table 5.1.2.1-2, where $n$ is counted only considering PDSCH transmission occasions associated with the first TCI state. The redundancy version for PDSCH transmission occasions associated with the second TCI state is derived according to Table 5.1.2.1-3, where additional shifting operation for each redundancy version $rv\_{s} $is configured by higher layer parameter *sequenceOffsetforRV* and $n$ is counted only considering PDSCH transmission occasions associated with the second TCI state. Table 5.1.2.1-3: Applied redundancy version for the second TCI state

|  |  |
| --- | --- |
| *rvid* indicated by the DCI scheduling the PDSCH | *rvid* to be applied to *n*th transmission occasion with second TCI state |
| *n* mod 4 = 0 | *n* mod 4 = 1 | *n* mod 4 = 2 | *n* mod 4 = 3 |
| $$0$$ | $$(0+ rv\_{s}) mod 4$$ | $$(2+ rv\_{s}) mod 4$$ | $$(3+ rv\_{s}) mod 4$$ | $$(1+ rv\_{s}) mod 4$$ |
| $$2$$ | $$(2+ rv\_{s}) mod 4$$ | $$(3+ rv\_{s}) mod 4$$ | $$(1+ rv\_{s}) mod 4$$ | $$(0+ rv\_{s}) mod 4$$ |
| $$3$$ | $$(3+ rv\_{s}) mod 4$$ | $$(1+ rv\_{s}) mod 4$$ | $$(0+ rv\_{s}) mod 4$$ | $$(2+ rv\_{s}) mod 4$$ |
| $$1$$ | $$(1+ rv\_{s}) mod 4$$ | $$(0+ rv\_{s}) mod 4$$ | $$(2+ rv\_{s}) mod 4$$ | $$(3+ rv\_{s}) mod 4$$ |

\*\*\* Unchanged text is omitted \*\*\* |

Please input your comments in table below

|  |  |
| --- | --- |
| Company | comments |
| QC | The current spec is not wrong. |
| OPPO | The RRC parameter “*repetitionSchemeConfig-r16*” which includes “*sequenceOffsetforRV*” is optional. Hence, it is not an issue to say “when *sequenceOffsetforRV* is present”. |
| Apple | Agree with QC and OPPO |
| LG | We are fine to ZTE’s proposal. |
| MediaTek | Agree with QC, OPPO, and Apple |
| Samsung | It seems that current spec is clear. |
| Huawei, HiSilicon | Agree with QC and OPPO |
| Nokia, NSB |  Nothing wrong with the spec.  |
| ZTE | @QC, Samsung, Nokia, OPPO, for scheme 4, please note that *sequenceOffsetforRV* is not optional for TDM scheme 4. Please recheck 38.331.Also, there is no UE behavior description in the current spec if sequenceOffsetforRV is not configured for scheme 4?  |
| Spreadtrum | The spec is clear. Even if the spec captures it, there is no harm. |
| vivo | It seems not a critical issue. |
| Ericsson | The current spec appears to be clear. |

To summarize the round#1 discussion, The proposed TP is

* Supported: LG, ZTE
* Spec is clear and not supported the TP: QC, OPPO, Apple, MediaTek, Samsung, Huawei, HiSilicon, Nokia, NSB, vivo, Ericsson

Majority companies think the spec is clear and no spec change is needed. **Therefore, no TP is proposed for approval or further discussion.**

TP#4

Both Vivo (R1-2100417) and CATT(R1-2100340) proposed that the text description on HARQ-ACK in one slot in Section 9.2.3 of TS 38.213 does not align with the description in 9.2 and thus it could cause confusing. They suggest to make it clear.

## **Round#1 discussion**

Based on the proposal by Vivo (R1-2100417) and CATT(R1-2100340), here is the initial proposal for TP#4

**Proposal: Adopt the following TP for 38.213.**

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| --- |
| 9.2.3 UE procedure for reporting HARQ-ACKA UE does not expect to transmit more than one PUCCH with HARQ-ACK information in a slot, if the UE is not provided *ackNackFeedbackMode = separate*. \*\*\* Unchanged text is omitted \*\*\* |

If you have comments, please input below

|  |  |
| --- | --- |
| Company | comments |
| QC | Support. Seems to be a necessary clarification. |
| OPPO | Support. |
| Apple | OK |
| LG | Support |
| MediaTek | Support |
| Samsung | Support |
| Huawei, HiSilicon | Fine with the TP. |
| Nokia | Ok  |
| ZTE | Support |
| Spreadtrum | Support |
| vivo | Support |
| Ericsson | Support |
| CATT | Support  |

## Round#2 discussion

All the companies support the TP in the round #1 discussion. So, the TP is copied here for final check and approval:

**Proposal: Adopt the following TP for 38.213.**

|  |
| --- |
| 9.2.3 UE procedure for reporting HARQ-ACKA UE does not expect to transmit more than one PUCCH with HARQ-ACK information in a slot, if the UE is not provided *ackNackFeedbackMode = separate*. \*\*\* Unchanged text is omitted \*\*\* |

TP#5

LGE (R1-2100617) suggested that the current specification does not cover the case of the default TCI state for mTRP PDSCHs when the UE does not support the capability of default QCL assumption per CORESET Pool.

According to the agreement on default TCI state of M-DCI PDSCH, if UE does not support default QCL assumption per CORESET pool, a default beam is determined in the same way as Rel-15 regardless of CORESET pool. In this case, the default beam can be applied to multiple PDSCHs since two PDSCHs scheduled by different TRPs can be overlapped in time domain. For example, if time offset between DCI 1 and PDSCH 1 scheduled by DCI 1 is less than timeDurationForQCL, and PDSCH 1 and PDSCH 2, scheduled by TRP 1 and TRP 2, respectively, are overlapped in time domain, default beam should be applied to not only PDSCH 1 but also PDSCH 2. However, this behavior is unclear in current specification because it does not consider time domain overlapped multiple PDSCHs.

LGE proposed TP to correct that.

## **Round#1 discussion**

Based on the proposal by LGE (R1-2100617), here is the initial proposal for TP#5

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

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| 5.1.5 Antenna ports quasi co-location\*\*\* Unchanged text is omitted \*\*\*Independent of the configuration of *tci-PresentInDCI* and *tci-PresentForDCI-Format1-2-r16* in RRC connected mode, if the offset between the reception of the DL DCI and the corresponding PDSCH is less than the threshold *timeDurationForQCL* and at least one configured TCI state for the serving cell of scheduled PDSCH contains the 'QCL-TypeD', - the UE may assume that the DM-RS ports of PDSCH or fully/partially overlapping PDSCHs in the time domain of a serving cell are quasi co-located with the RS(s) with respect to the QCL parameter(s) used for PDCCH quasi co-location indication of the CORESET associated with a monitored search space with the lowest *controlResourceSetId* in the latest slot in which one or more CORESETs within the active BWP of the serving cell are monitored by the UE. In this case, if the 'QCL-TypeD' of the PDSCH DM-RS 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). \*\*\* Unchanged text is omitted \*\*\* |

If you have comments, please input below

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| --- | --- |
| Company | comments |
| QC | We think this is a valid issue, but is not editorial. If the scheduling offset for both PDSCHs is less than the timeDurationForQCL, then existing spec is clear and enough. The issue is when UE does not support two default QCLs, scheduling offset is smaller than timeDurationForQCL for PDSCH1, but scheduling offset is larger than timeDurationForQCL for PDSCH2. Is this the correct understanding of the issue mentioned by LG?If yes, then we think it should be gNB’s responsibility to indicate the same beam as the default beam for PDSCH2. It can be discussed further whether/ how to capture this in the spec. But first, we would like to confirm that all companies are on the same page about this non-editorial issue. |
| OPPO | We think current specification is clear on this issue. |
| Apple | We failed to see the necessity for this change. Some clarification would be helpful. |
| LG | Response to QC’s question: yes, it is about the case PDSCH 1 is less than threshold but PDSCH 2 is equal or larger than threshold when UE does not support two default beam at the same time. In that case, if PDSCH 1 and 2 are overlapped then UE have no choice but to apply PDSCH 1’s default beam for PDSCH 2 reception as well. However, current specification does not consider overlapped PDSCH 2. |
| MediaTek | Since UEs can report whether supporting simultaneous reception with different Type-D, we fail to see the necessity for the change. If a UE does not support simultaneous reception with different Type-D, then it is gNB’s responsibility. |
| Samsung | Our view is that current specification is clear since gNB does not schedule overlapped PDSCHs to UE which does not support simultaneous reception with different QCL-TypeD. |
| LG2 | @ QC, MediaTek: In non-ideal backhaul, TRP2 does not know whether default beam is applied to PDSCH1 (transmitted by TRP1). Therefore, TRP2 cannot indicate the same beam as the default beam for PDSCH2.@Samsung: In non-ideal backhaul, TRP1 and TRP2 schedules PDSCH independently so PDSCHs from two TRPs can be overlapped or not, opportunistically.   |
| Huawei, HiSilicon | That paragraph belongs to Rel-15 UE behavior and we shall not update spec changes to include possible Rel-16 enhancement. Moreover, the UE cannot determine whether PDSCHs are overlapped or not, in order to determine Type D assumption before scheduling offset.  |
| Nokia, NSB | We do not see the need for the above spec change and agree with the HW’s comment above. Also, if the UE is not reporting the capability of default QCL assumption per CORESET Pool, TRPs can avoid any possible error scenarios, and nothing that needs specification text.  |
| LG3 | @ Huawei: First of all, this is not a new enhancement. We agreed the legacy behavior is reused when UE is not capable of receiving two default beam simultaneously. While legacy default beam behavior is applied to PDSCH1 (from TRP1), PDSCH2 (from TRP2) can be transmitted and offset of PDSCH2 can be equal or larger than *timeDurationForQCL.* ­In this case, based on legacy default beam behavior, UE receives PDSCH2 with PDSCH1’s default beam. But this is not captured in current specification. Secondly, I understand your comment “the UE cannot determine whether PDSCHs are overlapped or not” due to insufficient DCI decoding time for PDSCH1. Alternatively, we can revise current spec as follows considering your concern: “the UE may assume that the DM-RS ports of PDSCH(s) ~~or fully/partially overlapping PDSCHs in the time domain~~ of a serving cell are quasi co-located with the RS(s) with respect to the QCL parameter(s) used for PDCCH quasi co-location indication of the CORESET associated with a monitored search space with the lowest *controlResourceSetId* in the latest slot in which one or more CORESETs within the active BWP of the serving cell are monitored by the UE.”@Nokia: could you clarify how gNB avoid the error scenario in case of large backhaul delay? Each TRP conducts independent dynamic scheduling and one TRP does not know whether other TRP’s scheduling offset is less than threshold.  |
| ZTE | We have the same view with HW that UE may not be able to know how many PDSCHs and whether PDSCHs are overlapped since the DCIs are not decoded before the threshold. So we think the current spec is sufficient. The latest update from LG is also acceptable for us. |
| Spreadtrum | Fine with LG’s revised version. |
| vivo | We also think it is can be solved by network implementation. When the UE reports not supporting the capability of default QCL assumption per CORESET Pool, the scheduling restriction should be applied for TRPs. For non-ideal backhaul, the two TRPs can negotiate first to avoid overlapped PDSCH scheduling with different default QCLs, for example, TRP2 always schedule the PDSCH equal to or larger than the threshold timeDurationForQCL. If TRP2 insists on scheduling the PDSCH less than timeDurationForQCL, it should know the PDSCH is at risk of not receiving by the UE. |
| FL | To summarize the discussion in round#1, the following companies think the spec is clear or do not see the necessarity of this TP: OPPO, MTK, SS, HW, Nokia, Apple, ZTE, vivo. QC think that might not be an editoral change. LG and spreadtrum support the TP. Since majority companies does not support the change, **no TP is proposed for further discussion or approval**.  |
| LG4 | @vivo : even if gNB negotiates to avoid PDSCH overlapping or TRP2 always schedules the PDSCH equal to or larger than the threshold timeDurationForQCL, the same issue still occurs as shown below:During the default beam period for PDSCH1, UE receives PDSCH2, on which TCI state indicated by DCI 2 applies. TRP2 (sending PDSCH2) cannot indicate the same TCI state by DCI 2 as default beam of PDSCH1, because TRP2 does not know whether offset of PDSCH 1 is smaller than threshold or not in non-ideal backhaul. In this case, UE should apply default beam of PDSCH1 for PDSCH2 reception but this is missing in current specification so UE behavior is undefined and there is misalignment in gNB/UE default beam behavior.Considering companies’ input, we proposed the simplest version of TP as follows and would like to get some comment on it if any.“the UE may assume that the DM-RS ports of PDSCH(s) ~~or fully/partially overlapping PDSCHs in the time domain~~ of a serving cell are quasi co-located with the RS(s) with respect to the QCL parameter(s) used for PDCCH quasi co-location indication of the CORESET associated with a monitored search space with the lowest *controlResourceSetId* in the latest slot in which one or more CORESETs within the active BWP of the serving cell are monitored by the UE.” |

To summarize the discussion in round#1, the following companies think the spec is clear or do not see the necessarity of this TP: OPPO, MTK, SS, HW, Nokia, Apple, ZTE, vivo. QC think that might not be an editoral change. LG and spreadtrum support the TP.

Since majority companies does not support the change, **no TP is proposed for further discussion or approval**.

TP#6

CATT (R1-2100340) proposed TP to make the following **three** editorial corrections for TS 38.214.

1. **The first correction** is to align terminology in the description of Scheme 4: in current spec, both “transmission occasion” and “transmission” are used to term the repetition in scheme 4. It is suggested to align the terminology to “transmission occasion”.
2. **The second correction** is to clarify understanding on text description in section 5.1 of 38.214 to avoid confusion. As discussed in R1-2100340, Regarding the UE procedure for receiving multiple PDCCHs scheduling fully/partially/non-overlapped PDSCHs in time and frequency domain, the following description can be found in clause 5.1 of 38.214:

|  |
| --- |
| 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: |

The highlighted sentence seems to have the following two different interpretation:

* Interpretation 1: 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*.
* Interpretation 2:The UE may expect the reception of full/partially-overlapped PDSCHs in timeonly**,** when PDCCHs that schedule two PDSCHs are associated to different *ControlResourceSets* having different values of *CORESETPoolIndex*.

Apparently, Interpretation 1 is our common understanding and thus CATT proposed to update the text to eliminate the potential confusion and wrong interpretation.

1. **The third suggested correction** is regarding the table of RV values applied to the PDSCH of URLLC scheme 4. In current spec, for scheme 4, the redundancy version applied to multiple transmission occasions associated with the first TCI state is derived from the table 5.1.2.1-2, which was defined for slot aggregation transmission in Rel-15 when using the higher layer parameter pdsch\_AggregationFatcor to indicate the repetition number of PDSCH. However, the description of the table is not appropriate for URLLC scheme 4 since the title of that table is “Table 5.1.2.1-2: Applied redundancy version when pdsch-AggregationFactor is present”. That may lead to a misunderstanding on repetition number indication. Therefore, CATT suggested to use a separate table for the illustration for scheme 4 to avoid the confusion.

## **Round#1 discussion**

Based on the proposal by CATT (R1-2100340), here is the initial proposal for TP#6

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5.1 UE procedure for receiving the physical downlink 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*, 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: \*\*\* Unchanged text is omitted \*\*\*5.1.2.1 Resource allocation in time domain\*\*\* Unchanged text is omitted \*\*\*When a UE configured by the higher layer parameter *PDSCH-config* that indicates at least one entry contains *repetitionNumber* in *PDSCH-TimeDomainResourceAllocation*, - If two TCI states are indicated by the DCI field 'Transmission Configuration Indication' together with the DCI field 'Time domain resource assignment' indicating an entry which contains *repetitionNumber* in *PDSCH-TimeDomainResourceAllocation* and DM-RS port(s) within one CDM group in the DCI field 'Antenna Port(s)', the same SLIV is applied for all PDSCH transmission occasions across the *repetitionNumber* consecutive slots, the first TCI state is applied to the first PDSCH transmission occasion and resource allocation in time domain for the first PDSCH transmission occasion follows Clause 5.1.2.1.  When the value indicated by *repetitionNumber* in *PDSCH-TimeDomainResourceAllocation* equals to two, the second TCI state is applied to the second PDSCH transmission occasion. When the value indicated by *repetitionNumber* in *PDSCH-TimeDomainResourceAllocation* is larger than two, the UE may be further configured to enable *cyclicMapping* or *sequenticalMapping* in *tciMapping*. - When *cyclicMapping* is enabled, the first and second TCI states are applied to the first and second PDSCH transmission occasions, respectively, and the same TCI mapping pattern continues to the remaining PDSCH transmission occasions. - When *sequenticalMapping* is enabled, first TCI state is applied to the first and second PDSCH transmission occasions, and the second TCI state is applied to the third and fourth PDSCH transmission occasions, and the same TCI mapping pattern continues to the remaining PDSCH transmission occasions. The UE may expect that each PDSCH transmission occasion is limited to two transmission layers. For all PDSCH transmission occasions associated with the first TCI state, the redundancy version to be applied is derived according to Table 5.1.2.1-3, where $n$ is counted only considering PDSCH transmission occasions associated with the first TCI state. The redundancy version for PDSCH transmission occasions associated with the second TCI state is derived according to Table 5.1.2.1-4, where additional shifting operation for each redundancy version $rv\_{s} $is configured by higher layer parameter *sequenceOffsetforRV-r16* and $n$ is counted only considering PDSCH transmission occasions associated with the second TCI state. Table 5.1.2.1-3: Applied redundancy version when *RepetitionNumber-r16* is present

|  |  |
| --- | --- |
| *rvid* indicated by the DCI scheduling the PDSCH | *rvid* to be applied to *n*th transmission occasion with first TCI state |
| *n* mod 4 = 0 | *n* mod 4 = 1 | *n* mod 4 = 2 | *n* mod 4 = 3 |
| 0 | 0 | 2 | 3 | 1 |
| 2 | 2 | 3 | 1 | 0 |
| 3 | 3 | 1 | 0 | 2 |
| 1 | 1 | 0 | 2 | 3 |

Table 5.1.2.1-4: Applied redundancy version for the second TCI state when *sequenceOffsetforRV-r16* is present

|  |  |
| --- | --- |
| *rvid* indicated by the DCI scheduling the PDSCH | *rvid* to be applied to *n*th transmission occasion with second TCI state |
| *n* mod 4 = 0 | *n* mod 4 = 1 | *n* mod 4 = 2 | *n* mod 4 = 3 |
| $$0$$ | $$(0+ rv\_{s}) mod 4$$ | $$(2+ rv\_{s}) mod 4$$ | $$(3+ rv\_{s}) mod 4$$ | $$(1+ rv\_{s}) mod 4$$ |
| $$2$$ | $$(2+ rv\_{s}) mod 4$$ | $$(3+ rv\_{s}) mod 4$$ | $$(1+ rv\_{s}) mod 4$$ | $$(0+ rv\_{s}) mod 4$$ |
| $$3$$ | $$(3+ rv\_{s}) mod 4$$ | $$(1+ rv\_{s}) mod 4$$ | $$(0+ rv\_{s}) mod 4$$ | $$(2+ rv\_{s}) mod 4$$ |
| $$1$$ | $$(1+ rv\_{s}) mod 4$$ | $$(0+ rv\_{s}) mod 4$$ | $$(2+ rv\_{s}) mod 4$$ | $$(3+ rv\_{s}) mod 4$$ |

\*\*\* Unchanged text is omitted \*\*\* |

If you have comments, please input below

|  |  |
| --- | --- |
| Company | comments |
| QC | Support the TP for the first and second issues. For the last issue (RV table), we think there is no ambiguity (even though the suggestion can make things more clear, it is not critical)  |
| OPPO | The TPs are not essential issues since even without the TPs, the understanding on the wordings is clear. We are fine with the first two TPs, and the 3rd seems a little redundant.  |
| Apple | The first and second change should be fine. |
| LG | We are fine to CATT’s proposal.  |
| MediaTek | Support the TP |
| Samsung | Support the first and second TPs. |
| Huawei, HiSilicon | We are fine to the first and second corrections only. |
| Noki/NSB | Ok with first two TPs. Not the last one. There is nothing wrong with the spec reading.  |
| ZTE | We are fine with the TPs |
| Spreadtrum | Fine with the TPs. |
| vivo | OK with the first two TPs. The third TP is not necessary. |
| Ericsson | Support the first two TPs. |

## Round#2 discussion

To summarize the round#1 discussion,

* All the companies support the first and second TP
* But the third TP are not supported by: QC, OPPO, Nokia/NSB and vivo. They suggest that the third one is not necessary.

Therefore, a updated proposal with only the first and second TP is proposed for approval:

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

|  |
| --- |
| 5.1 UE procedure for receiving the physical downlink 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*, 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: \*\*\* Unchanged text is omitted \*\*\*5.1.2.1 Resource allocation in time domain\*\*\* Unchanged text is omitted \*\*\*When a UE configured by the higher layer parameter *PDSCH-config* that indicates at least one entry contains *repetitionNumber* in *PDSCH-TimeDomainResourceAllocation*, - If two TCI states are indicated by the DCI field 'Transmission Configuration Indication' together with the DCI field 'Time domain resource assignment' indicating an entry which contains *repetitionNumber* in *PDSCH-TimeDomainResourceAllocation* and DM-RS port(s) within one CDM group in the DCI field 'Antenna Port(s)', the same SLIV is applied for all PDSCH transmission occasions across the *repetitionNumber* consecutive slots, the first TCI state is applied to the first PDSCH transmission occasion and resource allocation in time domain for the first PDSCH transmission occasion follows Clause 5.1.2.1.  When the value indicated by *repetitionNumber* in *PDSCH-TimeDomainResourceAllocation* equals to two, the second TCI state is applied to the second PDSCH transmission occasion. When the value indicated by *repetitionNumber* in *PDSCH-TimeDomainResourceAllocation* is larger than two, the UE may be further configured to enable *cyclicMapping* or *sequenticalMapping* in *tciMapping*. - When *cyclicMapping* is enabled, the first and second TCI states are applied to the first and second PDSCH transmission occasions, respectively, and the same TCI mapping pattern continues to the remaining PDSCH transmission occasions. - When *sequenticalMapping* is enabled, first TCI state is applied to the first and second PDSCH transmission occasions, and the second TCI state is applied to the third and fourth PDSCH transmission occasions, and the same TCI mapping pattern continues to the remaining PDSCH transmission occasions. \*\*\* Unchanged text is omitted \*\*\* |

If you have comments, please input below

|  |  |
| --- | --- |
| Company | comments |
| Samsung | Support |
| Apple | Support |
| CATT | Support  |
| ZTE | Support |

TP#7

Ericsson (R1-2101691) suggested that there exists ambiguity in the text description (Section 5.1.5 of 38.214) of conditions for the UE to apply default TCI state for single-DCI based mTRP PDSCH. The ambiguity is whether the TCI codepoint refers to the TCI codepoint mapped to TCI field in one DCI or the TCI codepoints activated by MAC CE activation command. Particularly, that could cause problem due to DCI format 1\_2 because only the first S activated codepoints are applied to DCI format 1\_2.

It is proposed to change the wording to clarify that the “TCI codepoint” in the condition of “at least one TCI codepoint indicates two TCI states” means the TCI codepoint activated by the MAC CE activation command and remove the ambiguity.

## **Round#1 discussion**

Based on the proposal by Ericsson (R1-2101691), here is the initial proposal for TP#7

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

|  |
| --- |
| 5.1.5 Antenna ports quasi co-location\*\*\* Unchanged text is omitted \*\*\*- If a UE is configured with *enableTwoDefaultTCIStates-r16*, and at least one TCI codepoint activated by the activation command in 6.1.3.24 of [10, TS38.321] 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 activated by the activation command in 6.1.3.24 of [10, TS38.321] containing two different TCI states. When the UE is configured by higher layer parameter *repetitionScheme-r16* set to '*TDMSchemeA*' or is configured with higher layer parameter *repetitionNumber-r16*, 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 activated by the activation command in 6.1.3.24 of [10, TS38.321] containing two different TCI states based on the activated TCI states in the slot with the first PDSCH transmission occasion.\*\*\* Unchanged text is omitted \*\*\* |

If you have comments, please input below

|  |  |
| --- | --- |
| Company | comments |
| QC | We do not see the need since when one codepoint contains / indicates two TCI states, only the one MAC-CE could have been used irrespective of the DCI. No ambiguity. |
| OPPO | We don’t think it is needed. |
| Apple | We failed to see the necessity. Some clarification would be helpful. |
| LG | The current specification looks clear. |
| MediaTek | The TP is not needed. |
| Samsung | Current spec is clear. |
| Huawei, HiSilicon | The TP is not needed. |
| Nokia, NSB | Nothing wrong with the spec.  |
| ZTE | The issue raised by E/// may exist from our view since DCI 1\_1 and 1\_2 share the same MACCE, but TCI codpoints of DCI 1\_2 may be fewer than DCI 1\_1.So, it is better to make spec clear.  |
| Spreadtrum | The spec is clear. |
| vivo | The TP is not needed. The current spec is clear that “at least one TCI codepoint indicates two TCI states” or “the lowest codepoint among the TCI codepoints” do refer to the activated DCI codepoints by MAC CE regardless of DCI format. |
| Ericsson | As explained by ZTE above, the MAC CE may activate 8 codepoints but in the case of DCI format 1\_2 only the first S (e.g., S=2) codepoints may be mapped to the TCI field. Hence, it should be clarified which codepoints we refer to when defining the lowest codepoint with two TCI states. |

To summarize the round#1 discussion, we have the following comments on this TP:

* Not needed: QC, OPPO, Apple, LG, MTK, Samsung, HW, Nokia, Spreadtrum, vivo
* Supported: ZTE, Ericsson

Given majority companies think no need to change the Spec, so **no TP is proposed for further discussion or approval**.

TP#8

Intel (R1-2100634) proposed CR for Section 5.1.2.3 of 38.214 to clarify that when counting even or odd PRGs for scheme FDMSchemeA or FDMSchemeB, the PRGs are numbered continuously in increasing order with the first PRG index equal to 0. For ‘fdmSchemeA’ and ‘fdmSchemeB’, the PRGs are assigned to TCI states depending on even or odd index of PRG. However, the indexing of PRGs including index of the first PRG is not defined in TS 38.214. Therefore, Intel proposed to clarify that PRGs are numbered continuously in increasing order with the first PRG index equal to 0, similar to subband indexing defined in Section 5.2.3 of TS 38.214.

## **Round#1 discussion**

Based on the proposal by Ericsson (R1-2101691), here is the initial proposal for TP#7

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

|  |
| --- |
| 5.1.2.3 Physical resource block (PRB) bundling\*\*\* Unchanged text is omitted \*\*\*For a UE configured by the higher layer parameter *RepetitionScheme-r16* set to ‘*FDMSchemeA’ or* ‘*FDMSchemeB’, and* when the UE is indicated with two TCI states in a codepoint of the DCI field *‘Transmission Configuration Indication* and DM-RS port(s) within one CDM group in the DCI field “*Antenna Port(s)*”, - If  is determined as “wideband”, the first $\left⌈\frac{n\_{PRB}}{2}\right⌉$ PRBs are assigned to the first TCI state and the remaining $\left⌊\frac{n\_{PRB}}{2}\right⌋$ PRBs are assigned to the second TCI state, where $n\_{PRB} $is the total number of allocated PRBs for the UE. - If  is determined as one of the values among {2, 4}, even PRGs within the allocated frequency domain resources are assigned to the first TCI state and odd PRGs within the allocated frequency domain resources are assigned to the second TCI state, wherein the PRGs are numbered continuously in increasing order with the first PRG index equal to 0. - The UE is not expected to receive more than two PDSCH transmission layers for each PDSCH transmission occasion.\*\*\* Unchanged text is omitted \*\*\* |

If you have comments, please input below

|  |  |
| --- | --- |
| Company | comments |
| QC | Support. We think this is a good clarification. |
| OPPO | Support. |
| Apple | Support |
| LG | We are fine to Intel’s proposal.  |
| MediaTek | Support |
| Samsung | Support |
| Huawei, HiSilicon | Support |
| Nokia, NSB | OK |
| ZTE | OK |
| Spreadtrum | Fine |
| vivo | Fine with the TP. |
| Ericsson | Support. |
| CATT | Support  |

## Round#2 discussion

All the companies support the TP in round#1 discussion. So the TP is copied here for final check:

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

|  |
| --- |
| 5.1.2.3 Physical resource block (PRB) bundling\*\*\* Unchanged text is omitted \*\*\*For a UE configured by the higher layer parameter *RepetitionScheme-r16* set to ‘*FDMSchemeA’ or* ‘*FDMSchemeB’, and* when the UE is indicated with two TCI states in a codepoint of the DCI field *‘Transmission Configuration Indication* and DM-RS port(s) within one CDM group in the DCI field “*Antenna Port(s)*”, - If  is determined as “wideband”, the first $\left⌈\frac{n\_{PRB}}{2}\right⌉$ PRBs are assigned to the first TCI state and the remaining $\left⌊\frac{n\_{PRB}}{2}\right⌋$ PRBs are assigned to the second TCI state, where $n\_{PRB} $is the total number of allocated PRBs for the UE. - If  is determined as one of the values among {2, 4}, even PRGs within the allocated frequency domain resources are assigned to the first TCI state and odd PRGs within the allocated frequency domain resources are assigned to the second TCI state, wherein the PRGs are numbered continuously in increasing order with the first PRG index equal to 0. - The UE is not expected to receive more than two PDSCH transmission layers for each PDSCH transmission occasion.\*\*\* Unchanged text is omitted \*\*\* |