3GPP TSG RAN WG1 #105-e R1-210xxxx

e-Meeting, May 10th – 27th, 2021

Source: Moderator (OPPO)

Title: Summary of [105-e-NR-eMIMO-03]

Agenda Item: 7.2.6

Document for: Discussion and Decision

Introduction

This document summarizes the discussion for eMIMO email thread #3:

[105-e-NR-eMIMO-03] Maintenance for Multi-TRP 1: addressing MT.10 (E), MT.2 (H), MT.4 (ND), MT.9 (ND) – Li (OPPO)

* Discussion and decision by May 21st, TPs by May 27th

Discussions

Issue MT.10 (E)

### FL Summary

In R1-2105538, it is noticed that the RRC parameters “enableDefaultTCIStatePerCoresetPoolIndex” and “enableTwoDefaultTCI-States” in 38.214 are not aligned with the RRC parameter name in 38.331, where ‘-’ is missed in the RRC parameter. It is also noticed that the text description in section 5.1.5 has ambiguity for the interpretation on “same *coresetPoolIndex*..”, which actually intend to say **same value of coresetPoolIndex**. Thus the following two changes are proposed for 38.214:

* Correction of RRC names of “enableDefaultTCIStatePerCoresetPoolIndex” as “enableDefaultTCI-StatePerCoresetPoolIndex”, and “enableTwoDefaultTCIStates” as “enableTwoDefaultTCI-States”.
* When referring to PDSCH and PDCCH DMRS, they are associated with same value of coresetPoolIndex, instead of same coresetPoolIndex.

**Here is the TP for 38.214 proposed by R1-2105538:**

***FL proposal***

**Proposal: Adopt the following TP for 38.214 proposed by R1-2105538:**

|  |
| --- |
| < Start of the text proposal > 5.1.5 Antenna ports quasi co-location < Unchanged part 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 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(s) 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).  - If a UE is configured with *enableDefaultTCI-StatePerCoresetPoolIndex* and the UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in different *ControlResourceSets,*  - the UE may assume that the DM-RS ports of PDSCH associated with a value of *coresetPoolIndex* 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* among CORESETs, which are configured with the same value of *coresetPoolIndex* as the PDCCH scheduling that PDSCH, in the latest slot in which one or more CORESETs associated with the same value of *coresetPoolIndex* as the PDCCH scheduling that PDSCH 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 and they are associated with same value of *coresetPoolIndex*, 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).  - If a UE is configured with *enableTwoDefaultTCI-States*, and at least one TCI codepoint 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 containing two different TCI states. When the UE is configured by higher layer parameter *repetitionScheme* set to 'tdmSchemeA' or is configured with higher layer parameter *repetitionNumber*, and the offset between the reception of the DL DCI and the first PDSCH transmission occasion is less than the threshold *timeDurationForQCL,* 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 containing two different TCI states based on the activated TCI states in the slot with the first PDSCH transmission occasion. In this case, if the 'QCL-TypeD' in both of the TCI states corresponding to the lowest codepoint among the TCI codepoints containing two different TCI states 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)  - In all cases above, if none of configured TCI states for the serving cell of scheduled PDSCH is configured with *qcl-Type* set to 'typeD', the UE shall obtain the other QCL assumptions from the indicated TCI states for its scheduled PDSCH irrespective of the time offset between the reception of the DL DCI and the corresponding PDSCH.  < Unchanged part omitted> 5.2.1.5 Triggering/activation of CSI Reports and CSI-RS < Unchanged part omitted>  - If the scheduling offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources in a *NZP-CSI-RS-ResourceSet* configured without higher layer parameter *trs-Info* is smaller than the UE reported threshold *beamSwitchTiming,* as defined in [13, TS 38.306], when the reported value is one of the values of {14, 28, 48} and *enableBeamSwitchTiming* is not provided, or is smaller than 48 when the UE provides *beamSwitchTiming-r16*, *enableBeamSwitchTiming* is provided and the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *repetition* set to 'off' or configured without the higher layer parameter *repetition,* or is smaller than the UE reported threshold *beamSwitchTiming-r16,* when *enableBeamSwitchTiming* is provided and the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *repetition* set to 'on'.  - If a UE is configured with *enableDefaultTCI-StatePerCoresetPoolIndex*and the UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet*  - if there is any other DL signal with an indicated TCI state in the same symbols as the CSI-RS, the UE applies the QCL assumption of the other DL signal also when receiving the aperiodic CSI-RS. The other DL signal refers to PDSCH scheduled by a PDCCH associated with the same *coresetPoolIndex* as the PDCCH triggering the aperiodic CSI-RS and scheduled with offset larger than or equal to the threshold *timeDurationForQCL,* as defined in [13, TS 38.306], aperiodic CSI-RS triggered by a PDCCH associated with the same *coresetPoolIndex* as the PDCCH triggering the aperiodic CSI-RS and scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming* when the reported value is one of the values {14,28,48} and *enableBeamSwitchTiming* is not provided, aperiodic CSI-RS triggered by a PDCCH associated with the same *coresetPoolIndex* as the PDCCH triggering the aperiodic CSI-RS and scheduled with offset larger than or equal to 48 when the reported value of *beamSwitchTiming-r16* is one of the values {224, 336} and *enableBeamSwitchTiming* is provided, periodic CSI-RS, semi-persistent CSI-RS;  - else, the UE applies the QCL parameter(s) of the CORESET associated with a monitored search space with the lowest *controlResourceSetId* among CORESETs, which are configured with the same value of *coresetPoolIndex* as the PDCCH triggering that aperiodic CSI-RS, in the latest slot in which one or more CORESETs are associated with the same value of *coresetPoolIndex* as the PDCCH triggering that aperiodic CSI-RS  - else if a UE is configured with *enableTwoDefaultTCI-States* and at least one TCI codepoint is mapped to two TCI states  - if there is any other DL signal with an indicated TCI state in the same symbols as the CSI-RS, the UE applies the QCL assumption of the other DL signal also when receiving the aperiodic CSI-RS. The other DL signal refers to PDSCH scheduled with offset larger than or equal to the threshold *timeDurationForQCL,* as defined in [13, TS 38.306], aperiodic CSI-RS scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming* when the reported value is one of the values {14,28,48} and *enableBeamSwitchTiming* is not provided, aperiodic CSI-RS scheduled with offset larger than or equal to 48 when the reported value of *beamSwitchTiming-r16* is one of the values {224, 336} and *enableBeamSwitchTiming* is provided, periodic CSI-RS, semi-persistent CSI-RS. If there is a PDSCH indicated with two TCI states in the same symbols as the CSI-RS, the UE applies the first TCI state of the two TCI states when receiving the aperiodic CSI-RS.  < End of the text proposal > |

### First round of comments

Companies are encouraged to provide their view on this TP in the table below:

|  |  |
| --- | --- |
| **Company** | **comments** |
| QC | Support. |
| OPPO | Support |
| Apple | Support |
| Spreadtrum | Fine |
| ZTE | Support |
| vivo | Support |
| Ericsson | Support. |
| Huawei, HiSilicon | Support |
| LG | Support |
| Samsung | Support |
| Nokia | Support |

Issue MT.2(H)

### FL Summary

R1-2104728 noticed that per the current 38.213, when the UE is configured with separate HARQ-ACK feedback in multi-DCI based mTRP system, two PUSCH or PUCCH carrying HARQ-ACK sent to different TRPs could overlap with on uplink transmission (for example CSI report in PUCCH) that is associated with any CORESETPoolindex value. An example is shown here:



In multi-DCI based mTRP system, if a PUCCH with P/SP CSI is simultaneously overlapped with two PUCCHs within a slot with separate HARQ-ACK respectively for two TRPs (which are associated with different values of *CORESETPoolIndex*), as shown in the above Figure, the UE behavior on how to multiplex the CSI with the two HARQ-ACKs is not defined, since no Rel-15 behavior can be followed, and not priority index is defined for PUCCH associated with different *CORESETPoolIndex*. This issue also occurs for other UL signal which is not scheduled by DCI (e.g. PUCCH with SR or type 1 configured grant PUSCH). Similar issue should also be solved for the case that a PUCCH with P/SP CSI/SR is simultaneously overlapped with two PUSCHs associated with different *CORESETPoolIndex*. To resolve the issue, R1-2104728 proposed a TP for 38.213 to specify that the UE does not expect such scenario happens.

Based on comments during preparation phase, we have the following **three options** for resolving this issue:

* **Option 1**: Adopt a TP for 38.213 to clarify that the UE does not expect such overlapping:

|  |
| --- |
| 9.2.5 UE procedure for reporting multiple UCI types  A UE that  - is not provided *CORESETPoolIndex* or is provided *CORESETPoolIndex* with a value of 0 for first CORESETs on active DL BWPs of serving cells, and  - is provided *CORESETPoolIndex* with a value of 1 for second CORESETs on active DL BWPs of the serving cells, and  - is provided *ACKNACKFeedbackMode* = *SeparateFeedback*  does not expect a PUCCH or a PUSCH transmission triggered by a detection of a DCI format in a PDCCH received in a CORESET from the first CORESETs to overlap with a PUCCH or a PUSCH transmission triggered by a detection of a DCI format in a PDCCH received in a CORESET from the second CORESETs, and does not expect a PUCCH or a PUSCH transmission triggered by a detection of a DCI format in a PDCCH received in a CORESET from the first CORESETs and a PUCCH or a PUSCH transmission triggered by a detection of a DCI format in a PDCCH received in a CORESET from the second CORESETs within the same slot to simultaneously overlap with another uplink signal. If there is one or more aperiodic CSI reports multiplexed on PUSCHs in the group of overlapping PUCCHs and PUSCHs and if symbol  is before symbol  that is a next uplink symbol with CP starting after  after the end of the last symbol of  - the last symbol of aperiodic CSI-RS resource for channel measurements, and  - the last symbol of aperiodic CSI-IM used for interference measurements, and  - the last symbol of aperiodic NZP CSI-RS for interference measurements, when aperiodic CSI-RS is used for channel measurement for triggered CSI report  < Unchanged part omitted> |

* **Option 2**: Make the following conclusion:
  + When separate HARQ-ACK feedback is configured in multi-DCI based mTRP system, the UE does not expect that the PUCCHs/PUSCHs scheduled by PDCCHs associated with different CORESETPoolIndex values overlap with another PUCCH/PUSCH simultaneously.
* **Option 3**: Make the following conclusion:
  + When separate HARQ-ACK feedback is configured in multi-DCI based mTRP system, it is up to gNB implementation to avoid that two PUCCHs or PUSCHs scheduled by PDCCHs associated with different CORESETPoolIndex values overlap with another PUCCH/PUSCH simultaneously. If such overlapping happens, it is up to UE implementation.

### First round of comments

Companies are encouraged to provide their view on those three Options in the table below, including your views on the following two questions:

* Which option do you prefer and why?
* If you prefer a TP, what is your comments on the TP?

|  |  |
| --- | --- |
| **Company** | **Comments** |
| QC | We prefer a TP (Option 1) to avoid confusion in the future. However, it would be useful to first list the possible cases that the TP tries to address. In our understanding, the issue is when we have two HARQ-Acks both overlapping with one PUCCH/PUSCH that is not scheduled by a DCI (e.g. CSI on PUCCH, CG-PUSCH).  For example, the case that two HARQ-Acks both overlap with DG-PUSCH is already excluded by the spec for separate HARQ-Ack. The TP does not need to include this.  As another example, the case of two DG-PUSCHs both overlap with a CSI is already addresses by Rel. 15 rule: “If the UE transmits more than one PUSCHs in the slot on the serving cell with the smallest *ServCellIndex* that fulfil the conditions in Clause 9.2.5 for UCI multiplexing, the UE multiplexes the UCI in the earliest PUSCH that the UE transmits in the slot.”. Hence, the TP does not need to restrict this. |
| OPPO | Prefer Option 1 (the wording can be optimized).  For the case of two PUSCHs for different TRPs overlapped with a CSI, we are fine to follow Rel-15 rule to always multiplex CSI in the first PUSCH if companies are fine with it. The wording can be updated as:  Updated TP:  A UE that  - is not provided *CORESETPoolIndex* or is provided *CORESETPoolIndex* with a value of 0 for first CORESETs on active DL BWPs of serving cells, and  - is provided *CORESETPoolIndex* with a value of 1 for second CORESETs on active DL BWPs of the serving cells, and  - is provided *ACKNACKFeedbackMode* = *SeparateFeedback*  does not expect a PUCCH or a PUSCH transmission triggered by a detection of a DCI format in a PDCCH received in a CORESET from the first CORESETs to overlap with a PUCCH or a PUSCH transmission triggered by a detection of a DCI format in a PDCCH received in a CORESET from the second CORESETs, and does not expect a PUCCH transmission triggered by a detection of a DCI format in a PDCCH received in a CORESET from the first CORESETs and a PUCCH transmission triggered by a detection of a DCI format in a PDCCH received in a CORESET from the second CORESETs within the same slot to simultaneously overlap with a PUCCH/PUSCH which is not scheduled by a PDCCH. |
| Apple | We are not sure whether this issue has already been fixed by the following sentence in 38.213. It seems this sentence covers more cases including what we are discussing now.  “A UE does not expect to multiplex in a PUSCH transmission or in a PUCCH transmission HARQ-ACK information that the UE would transmit in different PUCCHs” |
| Spreadtrum | Option1 or option 2 is fine to us. |
| ZTE | The cases seem complicated. We prefer Option 3 for simplicity. |
| vivo | We are fine with Option 1 with minor updating.  and does not expect a PUCCH or a PUSCH transmission triggered by a detection of a DCI format in a PDCCH received in a CORESET from the first CORESETs and a PUCCH or a PUSCH transmission triggered by a detection of a DCI format in a PDCCH received in a CORESET from the second CORESETs within the same slot to simultaneously overlap with another uplink channel or signal |
| Ericsson | We have similar view as ZTE. We prefer Alt 3. |
| Huawei, HiSilicon | Similar with Ericsson and ZTE, it would be quite complicated trying to cover all possible cases of multiplexing, for which some may be covered by existing spec, for example as commented by Apple. We would prefer to leave it to gNB implementation to avoid those cases, as Option 3, so that a conclusion can be sufficient to protect the UE. |
| LG | We have similar view with ZTE, Ericsson and Huawei, and prefer Alt 3. |
| Samsung | Support Option 3. It can be resolved by gNB implementation. |
| Nokia | Support option 3. |

Issue MT.4(ND)

### FL Summary

R1-2104583 and R1-2105469 noticed that the 38.214 only specify the mapping between PDSCH transmission occasions and default TCI states for mTRP URLLC scheme 3 and scheme 4 in single-DCI based mTRP system but such mapping for the scheme 1a, 2a and 2b are specified in 214. They proposed TP to specify such mappings for scheme 1a, 2a and 2b:

|  |  |
| --- | --- |
| TP#1 proposed by R1-2104583 | 5.1.5 Antenna ports quasi co-location  <Unchanged parts are 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 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(s) 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).  - If a UE is configured with *enableDefaultTCIStatePerCoresetPoolIndex* and the UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in different *ControlResourceSets,*  - the UE may assume that the DM-RS ports of PDSCH associated with a value of *coresetPoolIndex* 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* among CORESETs, which are configured with the same value of *coresetPoolIndex* as the PDCCH scheduling that PDSCH, in the latest slot in which one or more CORESETs associated with the same value of *coresetPoolIndex* as the PDCCH scheduling that PDSCH 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 and they are associated with same *coresetPoolIndex*, 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).  - If a UE is configured with *enableTwoDefaultTCI-States*, and at least one TCI codepoint 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 containing two different TCI states. When the UE is indicated with two TCI states‘’, and the offset between the reception of the DL DCI and the first PDSCH transmission occasion is less than the threshold *timeDurationForQCL,* the mapping of the TCI states to PDSCH transmission occasions is determined according to clause 5.1 by replacing the indicated TCI states with the TCI states corresponding to the lowest codepoint among the TCI codepoints containing two different TCI states based on the activated TCI states in the slot with the first PDSCH transmission occasion. In this case, if the ‘QCL-TypeD’ in both of the TCI states corresponding to the lowest codepoint among the TCI codepoints containing two different TCI states 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)  - In all cases above, if none of configured TCI states for the serving cell of scheduled PDSCH is configured with *qcl-Type* set to ‘typeD’, the UE shall obtain the other QCL assumptions from the indicated TCI states for its scheduled PDSCH irrespective of the time offset between the reception of the DL DCI and the corresponding PDSCH.  <Unchanged parts are omitted> |
| TP#2 proposed by R1-2105469 | **5.1.5 Antenna ports quasi co-location**  < Unchanged parts are 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 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).  - If a UE is configured with *enableDefaultTCIStatePerCoresetPoolIndex* and the UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in different *ControlResourceSets,*  - the UE may assume that the DM-RS ports of PDSCH associated with a value of *coresetPoolIndex* 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* among CORESETs, which are configured with the same value of *coresetPoolIndex* as the PDCCH scheduling that PDSCH, in the latest slot in which one or more CORESETs associated with the same value of *coresetPoolIndex* as the PDCCH scheduling that PDSCH 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 and they are associated with same *coresetPoolIndex*, 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).  - If a UE is configured with *enableTwoDefaultTCI-States*, and at least one TCI codepoint 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 containing two different TCI states. When the UE is configured by higher layer parameter *repetitionScheme* set to *‘tdmSchemeA’*, ‘*FDMSchemeA*’, ‘*FDMSchemeB*’ or is configured with higher layer parameter *repetitionNumber* and two TCI states are indicated in a DCI with ‘Transmission Configuration Indication’ field, the mapping of the TCI states to PDSCH transmission occasions is determined according to clause 5.1.2.1 or 5.1.2.3 by replacing the indicated TCI states with the TCI states corresponding to the lowest codepoint among the TCI codepoints containing two different TCI states based on the activated TCI states in the slot with the first PDSCH transmission occasion. In this case, if the ‘QCL-TypeD’ in both of the TCI states corresponding to the lowest codepoint among the TCI codepoints containing two different TCI states 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)  - In all cases above, if none of configured TCI states for the serving cell of scheduled PDSCH is configured with *qcl-Type* set to ‘typeD’, the UE shall obtain the other QCL assumptions from the indicated TCI states for its scheduled PDSCH irrespective of the time offset between the reception of the DL DCI and the corresponding PDSCH. |

As the discussion is to make a conclusion (ND issue), the following possible conclusion is proposed based on the comments from preparation phase. However, I am not sure whether Option 1 is still valid since it is an ND issue.

**Possible conclusion:**

* **Option 1: Adopt one TP for 38.214 to clarify the mapping between default TCI states and PDSCH transmission occasions for scheme 1a, 2a and/or 2b.**
  + **The TP is based on the above TP#1 and TP#2.**
* **Option 2: No Spec change for the issue of mapping between default TCI state and PDSCH transmission occasions for scheme 1a, 2a and 2b in Rel-16.**
* **Option 3: Other (please provide details).**

### First round of comments

Companies are encouraged to provide their view on this issue and the above options:

|  |  |
| --- | --- |
| **Company** | **comments** |
| QC | For SDM scheme or FDM scheme 2a, we do not have PDSCH transmission occasion (=repetition). Hence, the above TPs may require some change if Option 1 is agreed. |
| OPPO | We prefer Option 2. We think applying two default TCI states for scheme 1a, 2a, 2b can be supported by current specification without any further change. |
| Apple | Since this is an ND issue, it looks option 2 is the only choice.  In our view, to use default mapping rule is not the best solution, since the mapping order is fixed. But for larger scheduling offset, gNB can map TCI {0, 1} and {1, 0} in different TCI codepoint to implement different mapping operations for TCI state 0 and 1. |
| Spreadtrum | Option2. The current specification seems not to be broken. |
| ZTE | We support Option 1 to make spec complete. We don’t understand how the current spec is used for scheme 1a, 2a and 2b. The current spec only mentioned scheme 3 and 4 for the default beam mapping.  @Apple, ‘ND’ doesn’t mean it should not be rejected. Otherwise, we don’t need discussion here. |
| vivo | Prefer starting with TP#2 in Option 1.  While TP#1 in Option 1 seems to include scheme 1a, i.e., SDM which is not needed to specify the default beams because the UE uses two beams to receive all resources in time domain and frequency domain simultaneously. |
| Ericsson | The current spec specifically refers to *repetitionScheme* set to ‘tdmSchemeA’ or is configured with higher layer parameter in *repetitionNumber*. The current specification text does not cover ‘*FDMSchemeA*’ and ‘*FDMSchemeB*’ . Hence, we don’t think the current spec supports mapping between default TCI state and PDSCH transmission occasions for scheme 2a and 2b.  We are ok to extend support for this feature. We can start with TP#2. But we have a question regarding “and two TCI states are indicated in a DCI with ‘Transmission Configuration Indication’ field”. Why is this part needed? The default beams, if supported for ‘*FDMSchemeA*’ and ‘*FDMSchemeB*’, should not depend on DCI indicating two TCI states. So we suggest the following modification (shown in green) to TP#2:  “If a UE is configured with *enableTwoDefaultTCI-States*, and at least one TCI codepoint 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 containing two different TCI states. When the UE is configured by higher layer parameter *repetitionScheme* set to *‘tdmSchemeA’*, ‘*FDMSchemeA*’, ‘*FDMSchemeB*’ or is configured with higher layer parameter *repetitionNumber* ~~and two TCI states are indicated in a DCI with ‘Transmission Configuration Indication’ field~~, the mapping of the TCI states to PDSCH transmission occasions is determined according to clause 5.1.2.1 or 5.1.2.3 by replacing the indicated TCI states with the TCI states corresponding to the lowest codepoint among the TCI codepoints containing two different TCI states based on the activated TCI states in the slot with the first PDSCH transmission occasion. In this case, if the ‘QCL-TypeD’ in both of the TCI states corresponding to the lowest codepoint among the TCI codepoints containing two different TCI states 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)” |
| Huawei, HiSilicon | We prefer option 2. It is more understandable that TDM based repetition may have certain default receiving beam at given time. But it is still unclear for us how spec can be broken without correction, for FDM schemes, similar view with Oppo. |
| LG | We prefer option 2. In our perspective, scheme 1a, 2a, and 2b can be supported by current specification as follows.  “If a UE is configured with *enableTwoDefaultTCI-States*, and at least one TCI codepoint 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 containing two different TCI states.” |
| Samsung | Support Option 2 and similar view with OPPO. |
| Nokia | Support Option 1 and share a similar view with E/// |
| Intel | Our view is that current specification supports default PDSCH beam for 1a, 2a, 2b. However, if this is not common understanding, then we should discuss. |
| vivo2 | Re Ericsson, we think the deleting part “and two TCI states are indicated in a DCI with ‘Transmission Configuration Indication’ field” is not needed.  In our understanding, when UE is configured by higher layer parameter repetitionScheme set to ‘tdmSchemeA’, ‘FDMSchemeA’, ‘FDMSchemeB’ or is configured with higher layer parameter repetitionNumber, and the UE is activated at least one TCI codepoint indicates two TCI states, the UE may buffer signals with two default TCI states corresponding to the lowest codepoint among the TCI codepoints containing two different TCI states. However, UE has no idea to use which buffered signal for data decoding at this moment. Only after the DCI is decoded and finding that two TCI states are indicated, the UE is able to identify the it is scheduled by a MTRP scheme, i.e., one of scheme 2a, 2b, 3, 4 according to the higher layer configuration and apply the proper TCI mapping rule from the two buffered signal. Otherwise, when one TCI state is indicated by the DCI, there would be no PDSCH transmission occasions and consequently no TCI state mapping.  Per QC’s comment on the transmission occasion for scheme 2a, 2b, we can update the TP#2 as follows:  - If a UE is configured with *enableTwoDefaultTCI-States*, and at least one TCI codepoint 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 containing two different TCI states. When the UE is configured by higher layer parameter *repetitionScheme* set to *‘tdmSchemeA’*, ‘*FDMSchemeA*’, ‘*FDMSchemeB*’ or is configured with higher layer parameter *repetitionNumber* and two TCI states are indicated in a DCI with ‘Transmission Configuration Indication’ field, the mapping of the TCI states to PDSCH transmission occasions or allocated frequency domain resources for PDSCH is determined according to clause 5.1.2.1 or 5.1.2.3 by replacing the indicated TCI states with the TCI states corresponding to the lowest codepoint among the TCI codepoints containing two different TCI states based on the activated TCI states in the slot with the first PDSCH transmission occasion. In this case, if the ‘QCL-TypeD’ in both of the TCI states corresponding to the lowest codepoint among the TCI codepoints containing two different TCI states 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) |

Issue MT.9(ND)

### FL Summary

R1-2104651 noticed that in the current spec, the BD/CCR limit is not correctly defined for the case when NR-DC and multi-DCI based mTRP are configured at the same time. Specifically, In current spec, when UE is configured with NR-DC and at the same time is configured with multi-DCI based multi-TRP in at least one CC, the conditions for pdcch-BlindDetection for the MCG + pdcch-BlindDetection for the SCG as well as for pdcch-BlindDetectionMCG-UE + pdcch-BlindDetectionSCG-UE are wrong.

Thus, R1-2104651 proposed TP for 38.213 to make change for the NR-DC by following the similar approach as CA:

|  |
| --- |
| ============**TP for 38.213 Section 10**====================================  < Unchanged parts are omitted >  When a UE is configured for NR-DC operation, the UE determines a capability to monitor a maximum number of PDCCH candidates and a maximum number of non-overlapped CCEs per slot that corresponds to  downlink cells for the MCG where  is provided by *pdcch-BlindDetection* for the MCG and determines a capability to monitor a maximum number of PDCCH candidates and a maximum number of non-overlapped CCEs per slot that corresponds to  downlink cells for the SCG where  is provided by *pdcch-BlindDetection* for the SCG. When the UE is configured for carrier aggregation operation over more than 4 cells, or for a cell group when the UE is configured for NR-DC operation, the UE does not expect to monitor per slot a number of PDCCH candidates or a number of non-overlapped CCEs that is larger than the maximum number as derived from the corresponding value of .  When a UE is configured for NR-DC operation with a total of downlink cells on both the MCG and the SCG, where is the total number of configured downlink serving cells of the first set on both MCG and SCG and is the total number of configured downlink serving cells of the second set on both MCG and SCG, the UE expects to be provided *pdcch-BlindDetection* for the MCG and *pdcch-BlindDetection* for the SCG with values that satisfy  - *pdcch-BlindDetection* for the MCG + *pdcch-BlindDetection* for the SCG <= *pdcch-BlindDetectionCA*, if the UE reports *pdcch-BlindDetectionCA*, or  - *pdcch-BlindDetection* for the MCG + *pdcch-BlindDetection* for the SCG <= , if the UE does not report *pdcch-BlindDetectionCA*.  For NR-DC operation, the UE may indicate, through *pdcch-BlindDetectionMCG-UE* and *pdcch-BlindDetectionSCG-UE*, respective maximum values for *pdcch-BlindDetection* for the MCG and *pdcch-BlindDetection* for the SCG.  If the UE reports *pdcch-BlindDetectionCA*,  - the value range of *pdcch-BlindDetectionMCG-UE* or of *pdcch-BlindDetectionSCG-UE* is [1, …, *pdcch-BlindDetectionCA*-1], and  - *pdcch-BlindDetectionMCG-UE* + *pdcch-BlindDetectionSCG-UE* >= *pdcch-BlindDetectionCA*.  Otherwise, if  is a maximum value of that the UE can be configured on both the MCG and the SCG as described in [10, TS 38.133],  - the value range of *pdcch-BlindDetectionMCG-UE* or of *pdcch-BlindDetectionSCG-UE* is [1, 2, 3],  - *pdcch-BlindDetectionMCG-UE* + *pdcch-BlindDetectionSCG-UE* >= .  < Unchanged parts are omitted > |

As the discussion is to make a conclusion (ND issue), the following possible conclusion is proposed based on the comments from preparation phase. However, I am not sure whether Option 1 is still valid since it is an ND issue.

**Possible conclusion:**

* **Option 1: Adopt one TP for 38.213 to specify the BD/CCE limit for the case when both NR-DC and multi-DCI multi-TRP.**
  + **Endorse the TP in R1-2104651.**
* **Option 2: Rel-16 does not support concurrent configuration of NR-DC and multi-DCI based multi-TRP**
  + **No spec changes**
* **Option 3: Other (please provide details).**

### First round of comments

Companies are encouraged to provide their view on this issue and those options:

|  |  |
| --- | --- |
| **Company** | **Comments** |
| QC | We prefer Option 1 as the intention has never been to exclude the combination of NR-DC and multi-DCI (same way as combination of CA or two PUCCH groups and multi-DCI is not excluded). The changes are same as the case of CA in current spec. |
| OPPO | Prefer Option 1.  If Option 2 is agreed by majority, we prefer to have a clear conclusion for it. |
| Apple | Since this is an ND issue, it looks option 2 is the only choice. |
| Spreadtrum | Option2. It is too late to introduce this feature. It could be discussed in future Release. |
| ZTE | The same view as OPPO |
| vivo | Prefer Option2. |
| Huawei, HiSilicon | We have the same view with Vivo/ZTE for Option 2, to protect the UE. |
| LG | System is not broken based on current specification and we prefer Option2. |
| Samsung | Support Option 2. |
| Nokia | Support option 1. |

Conclusion

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References

1. R1-2104407 Maintenance on multi-TRP transmission Lenovo, Motorola Mobility
2. R1-2104482 Correction on power control for PUSCH CATT
3. R1-2104582 Maintenance of multi-beam operation ZTE
4. R1-2104583 Maintenance of Multi-TRP enhancements ZTE
5. R1-2104651 Remaining Issues on Multi-TRP Enhancements Qualcomm Incorporated
6. R1-2104728 Text proposals for overlapping between PUSCH/HARQ and CSI OPPO
7. R1-2104729 Text proposals for TCI state activation OPPO
8. R1-2105085 Remaining issues on Rel-16 Multi-TRP enhancement Apple
9. R1-2105287 Summary for Rel.16 NR eMIMO maintenance Moderator (Samsung)
10. R1-2105288 On Rel.16 multi-TRP/panel transmission Samsung
11. R1-2105289 On Rel-16 multi-beam maintenance Samsung
12. R1-2105351 Discussion on DRX interaction with CPU occupancy Nokia
13. R1-2105352 DRX interaction with CPU occupancy Nokia
14. R1-2105468 Maintenance on number of SRS resource set(s) for DCI format 0\_1 and DCI format 0\_2 vivo
15. R1-2105469 Maintenance on beam related issues vivo
16. R1-2105537 Correction on enabling configuration of time restriction over L1-SINR measurement Huawei, HiSilicon
17. R1-2105538 Corrections on RRC names and interpretation for Multi-TRP Huawei, HiSilicon
18. R1-2105809 Draft CR on DL SPS based PDSCH repetitions Ericsson
19. R1-2105810 Maintenance for single-DCI based multi-TRP in Rel-16 Ericsson
20. R1-2105842 Interoperation between cross-carrier scheduling and multiple TRPs ASUSTeK