3GPP TSG RAN WG1 #103-e R1-200xxxx

e-Meeting, October 26th – November 13th, 2020

Source: OPPO

Title: Discussions for MT.2

Agenda Item: 7.2.6

Document for: Discussion and Decision

The Issue of PDCCH and PDSCH colliding

In multi-TRP system (either multi-DCI based or single-DCI based), one PDSCH and one PDCCH could overlap in one or more symbols. ZTE (R1-2007750), Apple (R1-2008436) and vivo (R1-2008675) proposed specification change or conclusion to clarify the UE behavior when PDCCH and PDSCH overlap in time domain in multi-TRP systems:

* ZTE (R1-2007750) proposed that:
  1. In multi-DCI based system, PDCCH is prioritized when PDSCH and PDCCH of same CORESETPoolIndex value collide in time domain with different QCL-typeDs
  2. In single-DCI based system, PDCCH is prioritized when PDSCH and PDCCH collide in time domain with different QCL-TypeDs.
  3. ZTE also proposed Text proposal for that.
* Apple (R1-2008436) also proposed in multi-DCI system, PDCCH is prioritized when PDSCH and PDCCH of same CORESETPoolIndex collides in time domain with different QCL-TypeDs. Apple provided Text proposal for that.
* vivo (R1-2008675) proposed to conclude that the UE does not expect to be scheduled with a PDSCH overlapping with a PDCCH associated to CORESET having different CORESETPoolIndex from the scheduling PDCCH.

Based on the proposals and discussions provided in those tdocs, the following proposal is made:

**Draft Proposal 1: In multi-TRP system:**

* **It is concluded that the UE does not expect to be scheduled with a PDSCH overlapping with a PDCCH that are associated with different CORESETPoolIndex values.**
* **Adopt the following TPs for the case when PDSCH and PDCCH collides with different QCL-TypeD in multi-TRP system:**

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| **TS 38.214 V16.3.0** 5.1.5 Antenna ports quasi co-location <Unchanged parts are 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 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).  - If a UE is configured with *enableDefaultTCIStatePerCoresetPoolIndex-r16* 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 *enableTwoDefaultTCIStates-r16*, 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-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 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 contains 'QCL-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> |

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PDCCH monitoring in multi-TRP

Companies (ZTE, Intel, Spreadtrum, Qualcomm and Nokia) discussed the issue of that PDCCHs collides with different QCL-TypeDs in multi-DCI based multi-TRP systems. They made the same proposal to specify the UE to monitor PDCCH with QCL-TypeD priority within each TRP.

* ZTE(R1-2007750) proposed to clarify PDCCH monitoring with a QCL-TypeD for a respective TRP in the case PDCCH candidates overlap in time domain;
* Intel (R1-2007938) provided TP to clarify that PDCCH prioritization is based on QCL Type D properties within one TRP in multi-DCI multi-TRP operation;
* Spreadtrum (R1-2008093) proposed to clarify that priority rule of monitoring PDCCHs in Rel-15 is applied separately for each TRP when UE capable of simultaneous reception with different QCL Type-D RSs.
* Qaulcomm (R1-2008610) proposed to clarify that Rel. 15 procedures on PDCCH for QCL prioritization is done per CORESETPoolIndex
* Nokia (R1-2008723) proposed to specify that For a UE capable of simultaneous reception with different QCL-TypeD, the PDCCH monitoring priority rule based on QCL-TypeD is applied within CORESETs of the same coresetPoolIndex.

We have the following UE feature for receiving different QCL-TypeD in multi-TRP system:

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| 16-2c | Simultaneous reception with different Type-D | Supports simultaneous reception with different QCL Type-D RSs. | Per band | FR2 only | Optional with capability signalling |

Thus, based on the proposals/TP proposed by the companies, the following proposal is made:

**Draft Proposal 2: For the UE capable of FG16-2c, the UE applies the priority rule of monitoring PDCCHs of Rel-15 with respect to QCL-TypeD within PDCCHs associated with the same CORESETPoolIndex value and adopt the following TP:**

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| **TS 38.213:** 10.1 UE procedure for determining physical downlink control channel assignment <Unchanged parts are omitted>  If a UE   * is not provided *CORESETPoolIndex* for first CORESETs, or is provided *CORESETPoolIndex* with value 0 for first CORESETs on active DL BWPs of serving cells, and * is provided *CORESETPoolIndex* with value 1 for second CORESETs on active DL BWPs of serving cells, and * is capable of simultaneous reception with different QCL Type-D RSs   the following procedure is applied separately for the first CORESETs and the second CORESETs.  If a UE  - is configured for single cell operation or for operation with carrier aggregation in a same frequency band, and  - monitors PDCCH candidates in overlapping PDCCH monitoring occasions in multiple CORESETs that have same or different QCL-TypeD properties on active DL BWP(s) of one or more cells  the UE monitors PDCCHs only in a CORESET, and in any other CORESET from the multiple CORESETs having same QCL-TypeD properties as the CORESET, on the active DL BWP of a cell from the one or more cells  - the CORESET corresponds to the CSS set with the lowest index in the cell with the lowest index containing CSS, if any; otherwise, to the USS set with the lowest index in the cell with lowest index  - the lowest USS set index is determined over all USS sets with at least one PDCCH candidate in overlapping PDCCH monitoring occasions  - for the purpose of determining the CORESET, a SS/PBCH block is considered to have different QCL-TypeD properties than a CSI-RS  - for the purpose of determining the CORESET, a first CSI-RS associated with a SS/PBCH block in a first cell and a second CSI-RS in a second cell that is also associated with the SS/PBCH block are assumed to have same QCL-TypeD properties  - the allocation of non-overlapping CCEs and of PDCCH candidates for PDCCH monitoring is according to all search space sets associated with the multiple CORESETs on the active DL BWP(s) of the one or more cells  - the number of active TCI states is determined from the multiple CORESETs  If a UE  - is configured for single cell operation or for operation with carrier aggregation in a same frequency band, and  - monitors PDCCH candidates in overlapping PDCCH monitoring occasions in multiple CORESETs where none of the CORESETs has TCI-states with 'QCL-TypeD',  the UE is required to monitor PDCCH candidates in overlapping PDCCH monitoring occasions for search space sets associated with different CORESETs.  <Unchanged parts are omitted> |

If you have comments, please input below

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