**3GPP TSG RAN WG1 #117 R1-24xxxxx R1-24xxxxx**

Fukuoka, Japan, May20th – May 25th, 2024

**Source: Moderator (CATT)**

**Title:** **Summary discussion Draft CR on UL TX spatial filter determination for SRS transmission in unified TCI framework**

**Agenda Item:** **7**

**Release: 17**

**WI code: NR\_FeMIMO-Core**

**Document for:** **Discussion and Decision**

1. **Introduction**

This contribution summarizes companies’view about draft CR on UL TX spatial filter determination for SRS transmission in unified TCI framework.

**Relevant contribution**

R1-2404362 Draft CR on UL TX spatial filter determination for SRS transmission in unified TCI framework CATT

**Reason for the change:**

In Rel-17 unified TCI framework, it was agreed that the UL TX spatial filter for an UL transmission associated with a joint TCI state/UL TCI state is derived from the RS of DL QCL-TypeD for the joint TCI state, or the RS in the UL TCI state. However, how to determine the UL TX spatial filter for the SRS resource(s) configured with a joint TCI state/UL TCI state is not specified in TS38.214.

**Summary of the change:**

Clarify that the UL TX spatial filter for the SRS resource(s) configured with a joint TCI state/UL TCI state is derived from the RS of DL QCL-TypeD for the joint TCI state, or the RS in the UL TCI state.

**The proposed change:**

### 6.2.1 UE sounding procedure

The UE may be configured with one or more Sounding Reference Signal (SRS) resource sets as configured by the higher layer parameter *SRS-ResourceSet* or *SRS-PosResourceSet*. For each SRS resource set configured by *SRS-ResourceSet*, a UE may be configured with SRS resources (higher layer parameter *SRS-Resource*), where the maximum value of K is indicated by UE capability[13, 38.306]. When SRS resource set is configured with the higher layer parameter *SRS-PosResourceSet,* a UE may be configured with *K* ≥1 SRS resources (higher layer parameter *SRS-PosResource*), where the maximum value of K is 16. The SRS resource set applicability is configured by the higher layer parameter *usage* in *SRS-ResourceSet.* When the higher layer parameter *usage* is set to 'beamManagement'*,* only one SRS resource in each of multiple SRS resource sets may be transmitted at a given time instant, but the SRS resources in different SRS resource sets with the same time domain behaviour in the same BWP may be transmitted simultaneously. For a given CC, multiple SRS resources across multiple sets with usage "beamManagement" are not expected to be partially overlapped in time.

For the SRS resource set(s) configured *in srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* set to '*antennaSwitching*' or '*beamManagement*', the UE expects the same SRS resource set(s) with the same *usage* being configured in *srs-ResourceSetToAddModList.*

When the UE is configured *dl-OrJointTCI-StateList* or *ul-TCI-StateList,* the UE can assume that SRS resource(s) in any SRS resource set, except SRS resource set for positioning and an SRS resource set configured with *followUnifiedTCI-StateSRS*, can be configured with *TCI-State* or *TCI-UL-State* or updated as described in clause 6.1.3.59 or 6.1.3.60 of [10, TS 38.321]. If the *TCI-State* or *TCI-UL-State* is configured or updated for an SRS resource, the UE shall perform SRS transmission according to the spatial relation, if applicable, with a reference to the RS for determining UL TX spatial filter. The RS is determined based on an RS configured with *qcl-Type* set to 'typeD' of the indicated *TCI-State* or an RS in the indicated *TCI-UL-State*. The reference RS in the *TCI-State* can be a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition*, or a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info*. The reference RS in the *TCI-UL-State*(s) can be a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition*, a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info*, an SRS resource with the higher layer parameter *usage* set to 'beamManagement', or SS/PBCH block associated with the same or different PCI from the PCI of the serving cell.

If an SRS resource set, except an SRS resource set for positioning, is configured with *followUnifiedTCI-StateSRS*, the UE shall transmit the target SRS resource(s) within the SRS resource set according to the spatial relation, if applicable, with a reference to the RS used for determining UL TX spatial filter. The RS is determined based on an RS configured with *qcl-Type* set to 'typeD' in *QCL-Info* of the indicated *TCI-State* or an RS in the indicated *TCI-UL-State*. The reference RS in the indicated *TCI-State* can be a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition*, or a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info.* The reference RS in the indicated *TCI-UL-State* can be a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition*, a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info,* an SRS resource with the higher layer parameter *usage* set to 'beamManagement', or SS/PBCH block associated with the same or different PCI from the PCI of the serving cell.

<Unrelated parts are omitted>

1. **Discussion**

**Question 1:** Are you fine with the change proposed in [1]? If you have a concern, please explain. Do you have specific comments or revisions to the draft CR in [1]?

Please provide your comments on the proposal to the table below

|  |  |
| --- | --- |
| Company | Comments |
| ZTE | One simplified solution is just to clarify ‘Type-D RS’ in the TS 38.214 Section 5.1.5. Please review the following suggestion:  **5.1.5 Antenna ports quasi co-location**  The UE can be configured with a list of up to *M* *TCI-State* configurations within the higher layer parameter *PDSCH-Config* to decode PDSCH according to a detected PDCCH with DCI intended for the UE and the given serving cell, where M depends on the UE capability *maxNumberConfiguredTCIstatesPerCC*. Each *TCI-State* contains parameters for configuring a quasi co-location relationship between one or two downlink reference signals and the DM-RS ports of the PDSCH, the DM-RS port of PDCCH or the CSI-RS port(s) of a CSI-RS resource. The quasi co-location relationship is configured by the higher layer parameter *qcl-Type1* for the first DL RS, and *qcl-Type2* for the second DL RS(if configured). For the case of two DL RSs, the QCL types shall not be the same, regardless of whether the references are to the same DL RS or different DL RSs. The quasi co-location types corresponding to each DL RS are given by the higher layer parameter *qcl-Type* in *QCL-Info* and may take one of the following values:  - 'typeA': {Doppler shift, Doppler spread, average delay, delay spread}  - 'typeB': {Doppler shift, Doppler spread}  - 'typeC': {Doppler shift, average delay}  - 'typeD': {Spatial Rx parameter}  The UE can be configured with a list of up to *128* *TCI-State* configurations, within the higher layer parameter *dl-OrJointTCI-StateList* in *PDSCH-Config* for providing a reference signal for the quasi co-location for DM-RS of PDSCH and DM-RS of PDCCH in a BWP/CC, for CSI-RS, and to provide a reference signal with *qcl-Type* set to 'typeD', if applicable, for determining UL TX spatial filter for dynamic-grant and configured-grant based PUSCH and PUCCH resource in a BWP/CC, and SRS. |
| Samsung | Fine with ZTE’s TP |
| Moderator | Thanks for ZTE’s input and Samsung’s feedback. Then let’s try the TP proposed by ZTE. |
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1. **Conclusion**

Based on the input, the following TP is proposed for TS 38.214 section 5.1.5:

**5.1.5 Antenna ports quasi co-location**

The UE can be configured with a list of up to *M* *TCI-State* configurations within the higher layer parameter *PDSCH-Config* to decode PDSCH according to a detected PDCCH with DCI intended for the UE and the given serving cell, where M depends on the UE capability *maxNumberConfiguredTCIstatesPerCC*. Each *TCI-State* contains parameters for configuring a quasi co-location relationship between one or two downlink reference signals and the DM-RS ports of the PDSCH, the DM-RS port of PDCCH or the CSI-RS port(s) of a CSI-RS resource. The quasi co-location relationship is configured by the higher layer parameter *qcl-Type1* for the first DL RS, and *qcl-Type2* for the second DL RS(if configured). For the case of two DL RSs, the QCL types shall not be the same, regardless of whether the references are to the same DL RS or different DL RSs. The quasi co-location types corresponding to each DL RS are given by the higher layer parameter *qcl-Type* in *QCL-Info* and may take one of the following values:

- 'typeA': {Doppler shift, Doppler spread, average delay, delay spread}

- 'typeB': {Doppler shift, Doppler spread}

- 'typeC': {Doppler shift, average delay}

- 'typeD': {Spatial Rx parameter}

The UE can be configured with a list of up to *128* *TCI-State* configurations, within the higher layer parameter *dl-OrJointTCI-StateList* in *PDSCH-Config* for providing a reference signal for the quasi co-location for DM-RS of PDSCH and DM-RS of PDCCH in a BWP/CC, for CSI-RS, and to provide a reference signal with *qcl-Type* set to 'typeD', if applicable, for determining UL TX spatial filter for dynamic-grant and configured-grant based PUSCH and PUCCH resource in a BWP/CC, and SRS.

1. **References**
2. R1-2404362 Draft CR on UL TX spatial filter determination for SRS transmission in unified TCI framework CATT