**3GPP TSG-RAN WG4 Meeting #104-e R4-2212689**

**Electronic Meeting, August 15 – August 26, 2022**

**Title:** LS on active TCI state list for UL TCI

**Response to:**

**Release:** Rel-17

**Work Item:** NR\_feMIMO-Core

**Source:** RAN WG4

**To:** RAN WG1/WG2

**Cc:**

**Contact Person:**

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**Attachments:**

**1. Overall Description:**

In RAN4 #103-e and RAN4 #104-e meetings, RAN4 has discussed UL TCI state switching delay requirements for unified TCI. The delay requirements are based on whether the pathloss reference RS in the TCI state is maintained or not.

In RAN1 #105, it’s agreed that the UE maintains the PL-RS of the activated UL TCI state or (if applicable) joint TCI state, which is as follows:

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| **Agreement**On path-loss measurement for Rel.17 unified TCI framework, a PL-RS (configured for path-loss calculation) is either included in UL TCI state or (if applicable) joint TCI state or associated with UL TCI state or (if applicable) joint TCI state.* Whether a UE supports “beam misalignment or not” (detailed definition FFS) between the DL source RS in the UL or (if applicable) joint TCI state to provide spatial relation indication and the PL-RS is a UE capability
	+ Note: The term “beam misalignment” is for discussion purpose only
* Whether it is ‘included in’ or ‘associated with’ (including the manner it is performed and the signaling) is up to RAN2
* The UE maintains the PL-RS of the activated UL TCI state or (if applicable) joint TCI state
* The maximum number of activated UL TCI states or (if applicable) joint TCI states per band per cell is a UE capability
* FFS: detailed aspects of PL-RS, e.g. CSI-RS type(s), restriction on configuration
* FFS: For the definition of “beam misalignment or not”, at least consider the case where the periodic DL source RS in the UL or (if applicable) joint TCI state to provide spatial relation indication is configured/associated as the PL-RS
* Note: PL-RS is assumed to be periodic
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RAN1 agreed that UE shall maintain path loss reference RS for up to 4 activated UL (or joint) TCI states, but the number of active UL TCI states can be up to 8 based on UE capability. If the number of UL (or joint) TCI states in active TCI list is larger than 4, the UE behavior for maintaining the pathloss reference RS is unclear. RAN4 notes that there is no UE capability related to maintained pathloss reference RS in TS38.306.

In 38.213 section 7.1, the UE behavior is defined when UE is provided with more than 4 RSs:

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| If the UE is provided a number of RS resources for pathloss estimation for PUSCH/PUCCH/SRS transmissions that is larger than 4, the UE maintains for pathloss estimation RS resources corresponding to RS resource indexes $q\_{d}$ as described in clauses 7.1.1, 7.2.1, and 7.3.1. |

UE will maintain pathloss estimation corresponding to RS resource indexes $q\_{d}$. However, it’s not clear what’s the relationship between $q\_{d}$ and active TCI state list.

RAN4 would like clarification from RAN1/2 on maintained pathloss reference RS.

**Question 1**: What is the relationship between $q\_{d}$ and active UL (or joint) TCI state list? How does network configure the RS resource indexes $q\_{d}$ ?

**Question 2**: Does UE need to track the RSs of TCI state in the active TCI list? Is UE expected to maintain the pathloss RSs of all the pathloss reference RS in the active UL (or joint) TCI list?

**Question 3**: What is the UE behavior when number of active UL (or joint) TCI states is larger than 4 if corresponding pathloss RSs need to be maintained?

**2. Actions:**

**To RAN1 and RAN2:**

RAN4 respectfully asks RAN1/2 to answer the above questions, and take them into consideration for UE behaviors and capability design for unified TCI configuration and indication.

**3. Date of Next TSG-RAN4 Meetings:**

RAN WG4 Meeting #104-bis-e October 10 – October 19 Electronic Meeting

RAN WG4 Meeting #105 November 14 – November 18 Canada, CA