**3GPP TSG-RAN WG4 Meeting #116 R4-251xxxx**

**Bangalore, India, 25th – 29th August 2025**

**Title: TP for 38.753 introduction of spatial channel models for SU-MIMO PMI cases**

**Source: ZTE Corporation, Sanechips**

**Agenda item: 7.12.3**

**Document for: Approval**

**1 Background**

This draft TP captures comparison of PMI performance under SU-MIMO scenario for different spatial channel model parts.

**2 Draft TP**

6 Comparison of Spatial Channel Models

**6.2 SU-MIMO (PMI Aspects)**

This section provides comparison results for different spatial channel modes with simulation assumptions captured in Table 6.2-1.

**Table 6.2-1: Common simulation assumptions for PMI**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | 8Tx |
| Bandwidth | | | MHz | 40 |
| Subcarrier spacing | | | kHz | 30 |
| Duplex Mode | | |  | TDD |
| TDD DL-UL configurations | | |  | 7D1S2U S=6D+4G+4U |
| Antenna configuration | | |  | 8 x 4  (N1,N2) = (4,1) |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic |
| Number of CSI-RS ports (*X*) | |  | 8 |
| CDM Type | |  | CDM4 (FD2, TD2) |
| Density (ρ) | |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1, k2, k3) | |  | Row 8, (4,6) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | Row 8, (5) |
| CSI-RS  interval and offset | | slot | 10, 1 |
|  | |  |  |
| cqi-FormatIndicator | | |  | Wideband |
| pmi-FormatIndicator | | |  | Not configured for eType II  Wideband for Type I |
| Sub-band Size | | | RB | 8 |
| csi-ReportingBand | | |  | 11111111111111 |
| Codebook configuration | Codebook Type | |  | 1. typeII-r16 2. typeI-SP |
| eType II CB config | *paramCombination-r16* |  | 6  (L =4, *pν* =1/2, β=1/2 ) |
| R*(numberOfPMISubbandsPerCQISubband-r16)* |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) | |  | (4,1) |
| (CodebookConfig-O1,CodebookConfig-O2) | |  | (4,1) |
| CodebookSubsetRestriction | |  | 0x FFFF |
| RI Restriction (typeII-RI-Restriction-r16) | |  | Rank 2: 0010  Rank 4: 1000 |
| Physical channel for CSI report | | |  | PUSCH |
| CQI/RI/PMI delay | | | ms | 7 |
| Maximum number of HARQ transmission | | |  | 4 |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | | |  | Type I: Random and Follow PMI.  eType II: Folow PMI |
| Note: Use DM-RS based FOE and compensation. | | | | |

Table 6.2-2: Simulation assumptions for CDL channel

|  |  |  |
| --- | --- | --- |
| **Parameter** | | **Value** |
| FR / Carrier frequency | | FR1,3.5GHz |
| UE speed and movement direction | | 3km/h, () |
| Channel Geometry | LCS UE | α = 180°, β=0°, γ = 0° |
| LCS gNodeB | α = 0°, β=10°, γ = 0° |
| GCS UE | Height = 1.5 m; Azimuth = 0; X Coordinate = 100 m |
| GCS gNodeB | Height = 25 m; Azimuth = 0; X Coordinate = 0 m |
| BS Antenna Polarisation | Cross Polarized antenna elements with +/-45 degrees polarization slant angles |
| BS Radiation Pattern | Defined Table 7.3-1 in TS 38.901 |
| UE Antenna Polarisation | cross-polarized antenna elements with +90/0 degrees polarization slant angles |
| UE Antenna Radiation Pattern | Omnidirectional |
| Antenna Panel Placement | YZ Plane |

The BS antenna configuration for CDL comparison is one antenna element per subarray.

* 8Tx : (M, N, P, Ms, Ns) = (1, 4, 2, 1, 1).

The following comparison test cases are included this chapter:

* FR1 SU-MIMO PMI 8Tx 4Rx 4 layers with Type I (PMI Follow and PMI Random).
* FR1 SU-MIMO PMI 8Tx 4Rx 4 layers with eType II (PMI Follow).
* FR1 SU-MIMO PMI 8Tx 4Rx 2 layers with Type I (PMI Follow and PMI Random).
* FR1 SU-MIMO PMI 8Tx 4Rx 4 layers with eType II (PMI Follow).

**Table 6.2-3: Simulation result summary for FR1 SU-MIMO PMI 8Tx 4Rx with 4 layers**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Source #1** | **Source #2** | **Source #3** | **Source #4** | **Source #5** | **Source #6** | **Average** | **Span** |
| **Gamma** | 1.8 | 1.8 |  |  |  |  |  |  |

**Table 6.2-4: Simulation result summary for FR1 SU-MIMO PMI 8Tx 4Rx with 4 layers**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SNR at Max**  **Throughput [dB]** | | **Source #1** | **Source #2** | **Source #3** | **Source #4** | **Source #5** | **Source #6** | **Average** | **Span** |
| Type I (Follow) | 70% | 9.7 | 9.8 |  |  |  |  |  |  |
| Type I  (Random) | 70% | 17.5 | 18.1 |  |  |  |  |  |  |

**Table 6.2-5: Simulation result summary for FR1 SU-MIMO PMI 8Tx 4Rx with 4 layers**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SNR at Max Throughput [dB]** | | **Source #1** | **Source #2** | **Source #3** | **Source #4** | **Source #5** | **Source #6** | **Average** | **Span** |
| eType II  (Follow) | 70% | 8.5 | 10.8 |  |  |  |  |  |  |

**Table 6.2-6: Simulation result summary for FR1 SU-MIMO PMI 8Tx 4Rx with 2 layers**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Source #1** | **Source #2** | **Source #3** | **Source #4** | **Source #5** | **Source #6** | **Average** | **Span** |
| **Gamma** | 2.6 | 2.3 |  |  |  |  |  |  |

**Table 6.2-7: Simulation result summary for FR1 SU-MIMO PMI 8Tx 4Rx with 2 layers**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SNR at Max**  **Throughput [dB]** | | **Source #1** | **Source #2** | **Source #3** | **Source #4** | **Source #5** | **Source #6** | **Average** | **Span** |
| Type I (Follow | 70% | 2.6 | 0.9 |  |  |  |  |  |  |
| Type I  (Random) | 70% | 8.8 | 9.2 |  |  |  |  |  |  |

**Table 6.2-8: Simulation result summary for FR1 SU-MIMO PMI 8Tx 4Rx with 2 layers**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SNR at Max Throughput [dB]** | | **Source #1** | **Source #2** | **Source #3** | **Source #4** | **Source #5** | **Source #6** | **Average** | **Span** |
| eType II  (Follow) | 70% | -0.5 | 1.3 |  |  |  |  |  |  |

Observation

* 2 companies said that the performance difference between Type I and eType II codebook can be observed in CDL channel model. But the Type I and eType II deployment scenarios are not currently captured in the TR.
* 1 company mentioned that the differences are observed for two different MMSE implementations.
* 1 company said that RAN4 to capture the qualitative observations related to the autocorrelation function of the CDL clusters. In detail, long duration and its high value between I/Q components are observed.
* 1 company said that no consensus on matches deployment observations on advanced receivers in MU adjacent setups.
* 1 company said that using CDL will align RAN4 with RAN1.

**3 Conclusion**

This draft TP captures comparison of PMI performance under SU-MIMO scenario for different spatial channel model part.