3GPP TSG-RAN WG4 Meeting #114bis R4-25xxxxx

Wuhan, Hubei, China, 07th – 11th April, 2025

**Title:** Simulation results for SCM

**Source:** Huawei, HiSilicon

**Agenda item:**

**Document for:** Discussion

# Background

In last meeting, WF R4-2419782 [1] related to spatial channel models was approved, this contribution provides our simulation results

1. PDSCH for inter cell interference

According to the email discussion, there are two candidate options for 38.901 based CDL channel model, option A2 and A3, which are captured in appendix. This contribution provides PDSCH performance comparison for such two channel models. The simulation results are captured in Table 2-1:

Table 2-1: Simulation assumptions for CDL channel

|  |  |  |
| --- | --- | --- |
| **Parameter** | | **Value** |
| Duplex mode | | TDD |
| TDD Slot Configuration Pattern | | 7D1S2U |
| FR / Carrier frequency | | FR1,3.5GHz |
| UE speed | | 3km/h |
| Antenna configuration | | Rank4: 4T4R  Rank8: 8T8R |
| Number of layers | | 8,4 |
| PMI | | Single Panel Type I; Randomized precoder selection for every PRB bundle and updated per slot, with equal probability of each applicable i1/i2 combination or codebook |
| Waveform | | CP-OFDM with normal CP |
| Channel Bandwidth/SCS | | 40MHz/30kHz |
| MCS | | 13 (64 QAM table) |
| PDSCH configuration | Mapping type | Type A |
| k0 | 0 |
| Starting symbol (S) | 2 |
| Length (L) | 12 |
| PDSCH aggregation factor | 1 |
| Resource allocation type | Type 0 |
| VRB-to-PRB mapping type | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size | N/A |
| PDSCH DMRS configuration | DMRS Type | Type 1 |
| Number of additional DMRS | 1 |
| Maximum number of OFDM symbols for DL front loaded DMRS | 2 for rank 8  1 for rank 4 |
| Codebook configuration | CodebookType | Single Panel Type I |
| Codebook configuration | For 8Tx  (N1,N2,O1,O2) = (4,1,4,1)  For 4Tx  (N1,N2,O1,O2) = (2,1,4,1) |
| PDSCH DMRS Precoding Configuration | | For Random precoding: for every PRB Bundle (size=2) |
| Number of HARQ Processes | | 8 |
| Maximum HARQ transmissions | | 4 |
| Channel Models | | * For 4T4R: * Option A2 (M,N,P,Ms,Ns) = (1,2,2,1,1) * Option A3 (M,N,P,Ms,Ns) = (1,2,2,1,1) * Option A2 (M,N,P,Ms,Ns) = (8,2,2,8,1) * Option A3 (M,N,P,Ms,Ns) = (8,2,2,8,1) * For 8T8R:   Option A2 (M,N,P,Ms,Ns) = (1,4,2,1,1)  OptionA3 (M,N,P,Ms,Ns) = (1,4,2,1,1)  Option A2 (M,N,P,Ms,Ns) = (8,4,2,8,1)  OptionA3 (M,N,P,Ms,Ns) = (8,4,2,8,1) |
| UE receiver type | | MMSE-IRC |
| Test metric | | SNR(dB) @ 70% of max throughput |
| Channel Geometry (CDL) | 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 simulation results are captured in Figure 2-1:

|  |  |
| --- | --- |
|  |  |
|  |  |

Figure 2-1: Simulation results for CDL model A2 and A3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SNR(dB)@70% of max throughput | Rank4 | | Rank8 | |
| (M,N,P,Ms,Ns) = (1,2,2,1,1) | (M,N,P,Ms,Ns) = (8,2,2,8,1) | (M,N,P,Ms,Ns) = (1,4,2,1,1) | (M,N,P,Ms,Ns) = (8,4,2,8,1) |
| Channel model A2 | 16.5 | 16.4 | 20.1 | 21.0 |
| Channel model A3 | 17.2 | 17.6 | Inf | Inf |

We have following observation:

Observation 1: For Rank4, truncated CDL model (A3) has about 1dB degradation compared to non-truncated channel (A2)

Observation 1: For Rank8, truncated CDL model (A3) has about much degradation compared to non-truncated channel (A2)

1. Conclusion

This contribution provides our simulation results for spatial channel model, the observations are:

Observation 1: For Rank4, truncated CDL model (A3) has about 1dB degradation compared to non-truncated channel (A2)

Observation 1: For Rank8, truncated CDL model (A3) has about much degradation compared to non-truncated channel (A2)

1. Reference

[1] R4-2502378 Way Forward for [113][320] NR\_SCM. Nokia

1. Appendix

* Option A3:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Cluster #** | **Cluster delay (ns)** | **Power in [dB]** | **AOD in [°]** | **AOA in [°]** | **ZOD in [°]** | **ZOA in [°]** |
| 1 | 0 | -4.4 | -38.2 | -96.9 | 96.8 | 98.1 |
| 2 | 77 | -1.2 | -21.8 | 118.9 | 98.5 | 71.1 |
| 3 | 81 | -3.5 | -21.8 | 118.9 | 98.5 | 71.1 |
| 4 | 85 | -5.2 | -21.8 | 118.9 | 98.5 | 71.1 |
| 5 | 79 | -2.5 | -34.2 | -124.4 | 100.9 | 67.6 |
| 6 | 232 | 0 | -5.9 | 171.2 | 99.2 | 76.6 |
| 7 | 235 | -2.2 | -5.9 | 171.2 | 99.2 | 76.6 |
| 8 | 239 | -3.9 | -5.9 | 171.2 | 99.2 | 76.6 |
| 9 | 240 | -7.4 | 44.2 | 51.9 | 106.4 | 62.8 |
| 10 | 290 | -7.1 | -50.6 | 63.4 | 94.5 | 56.6 |
| 11 | 300 | -10.7 | 49.1 | -42.1 | 107.5 | 69.8 |
| 12 | 341 | -11.1 | -73.0 | 43.1 | 92.3 | 50.8 |
| 13 | 448 | -5.1 | -44.2 | 65.1 | 104.6 | 103.4 |
| 14 | 478 | -6.8 | -50.4 | -63.4 | 105.2 | 50.1 |
| 15 | 792 | -8.7 | -60.2 | 79.0 | 91.7 | 51.7 |
| 16 | 989 | -13.2 | 64.6 | 26.3 | 105.2 | 121.0 |
| 17 | 1554 | -13.9 | 62.2 | -22.6 | 94.0 | 53.9 |
| 18 | 1679 | -13.9 | 55.0 | -1.6 | 91.8 | 61.6 |
| 19 | 2004 | -15.8 | -76.3 | -19.8 | 90.7 | 37.5 |
| 20 | 2047 | -17.1 | 57.4 | 4.5 | 108.2 | 53.1 |
| 21 | 2302 | -16 | 58.1 | 0.2 | 91.7 | 35.8 |
| 22 | 2423 | -15.7 | 67.3 | -4.9 | 91.6 | 52.9 |
| 23 | 2571 | -21.6 | 76.2 | -28.3 | 106.4 | 46.4 |
| 24 | 3158 | -22.8 | -91.4 | 29.3 | 109.5 | 44.7 |
| **Per-Cluster Parameters** | | | | | | |
| *Parameter* | | *c*ASD in [°] | *c*ASA in [°] | *c*ZSD in [°] | *c*ZSA in [°] | XPR in [dB] |
| *Value* | | 1.4 | 15.6 | 3.6 | 12.2 | 7 |

* Option A2:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Cluster #** | **Cluster delay (ns)** | **Power in [dB]** | **AOD in [°]** | **AOA in [°]** | **ZOD in [°]** | **ZOA in [°]** |
| 1 | 0 | -4.4 | -38.2 | -96.9 | 96.8 | 98.1 |
| 2 | 226 | -1.2 | -21.8 | 118.9 | 98.5 | 71.1 |
| 3 | 238 | -3.5 | -21.8 | 118.9 | 98.5 | 71.1 |
| 4 | 250 | -5.2 | -21.8 | 118.9 | 98.5 | 71.1 |
| 5 | 232 | -2.5 | -34.2 | -124.4 | 100.9 | 67.6 |
| 6 | 682 | 0 | -5.9 | 171.2 | 99.2 | 76.6 |
| 7 | 691 | -2.2 | -5.9 | 171.2 | 99.2 | 76.6 |
| 8 | 702 | -3.9 | -5.9 | 171.2 | 99.2 | 76.6 |
| 9 | 705 | -7.4 | 44.2 | 51.9 | 106.4 | 62.8 |
| 10 | 852 | -7.1 | -50.6 | 63.4 | 94.5 | 56.6 |
| 11 | 1317 | -5.1 | -44.2 | 65.1 | 104.6 | 103.4 |
| 12 | 1405 | -6.8 | -50.4 | -63.4 | 105.2 | 50.1 |
| **Per-Cluster Parameters** | | | | | | |
| *Parameter* | | *c*ASD in [°] | *c*ASA in [°] | *c*ZSD in [°] | *c*ZSA in [°] | XPR in [dB] |
| *Value* | | 1.4 | 15.6 | 3.6 | 12.2 | 7 |