**3GPP TSG-RAN WG4 Meeting #116 R4-2510714**

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

**Agenda item:** 7.12.2

**Source:** Ericsson

**Title:** TP for TR38.753: Content of chapter 7

**Document for:** Endorsement

# Introduction

In RAN4#115 meeting, alignment simulation parameters were discussed, and preliminary results were delivered based on candidate SCM models. In this contribution, further changes are provided to remove extra SCM model and add potential metrics for 8 layers.

# References

[1] R4-2508776, Way Forward for [115][321] FS\_NR\_demod\_SCM, Nokia

[2] R4-2508621, Summary of alignment simulation for FS\_NR\_demod\_SCM, Apple, Ericsson

[3] R4-2508622, Simulation assumptions for SCM, Huawei, MTK

[4] R4-2510711, Discussion on NR SCM general aspects, Ericsson

**Text Proposal**

7 Alignment of Spatial Channel Models

Simulation results and analysis of different test cases with different channel models are captured in chapter 6 for model comparison. Chapter 7 for alignment is to capture companies’ simulation results on agreed performance metric per channel model and also the span and average value of companies results.

The following alignment test cases are included in this chapter:

* FR1 SU-MIMO PDSCH 4Tx4Rx with 4 layers. The SNR of 30% and 70% maximum throughput are captured. The detailed parameter assumptions can be found in Table 6.2-1 and 6.2-2.
* FR1 SU-MIMO PDSCH 8Tx8Rx with 8 layers. The SNR of 30% and 70% maximum throughput per codeword are captured. The detailed parameter assumptions can be found in Table 6.2-1 and 6.2-2.
* FR1 SU-MIMO PMI 8Tx4Rx with 4 layers and Type-I codebook. The SNR of 70% and 90% maximum throughput are captured. The detailed parameter assumptions can be found in Table 6.1-1 and 6.1-2.
* FR1 SU-MIMO PMI 8Tx4Rx with 4 layers and eType-II codebook. The SNR of 70% and 90% maximum throughput are captured. The detailed parameter assumptions can be found in Table 6.1-1 and 6.1-2.

There are two Spatial Channel Models, one CDL based model, known as [rCDL-C (reduced cluster number CDL-C)] and one TDL based model known as [xTDL-C (extended TDL-C)] which are captured for alignment simulation. Details of these models are in chapters 5.1 and 5.2 respectively.

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

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

The Doppler shift configurations are 3km/h for CDL based model and 10Hz for TDL based model.

## 7.1 [rCDL-C] model results alignment

**Table 7.1-1 Simulation result summary for FR1 SU-MIMO PDSCH 4Tx4Rx with 4 layers**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SNR at Norm. Throughput [dB]** | **Source #1** | **Source #2** | **Source #3** | **Source #4** | **Source #5** | **Source #6** | **Source #7** | **Source #8** | **Average** | **Span** |
| 30% | 8.5 | 6 | 6.4 | 6.6 | 6.4 | 7 | 5.9 | 6.7 | 6.7 | 2.6 |
| 70% | 15.5 | 14.3 | 16.5 | 15.6 | 15.9 | 16.6 | 14.7 | 15.6 | 15.6 | 2.3 |

A screenshot of a graph

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**Observations for [rCDL-C]**

* 7 out of 8 sources could achieve SNR span < 2.5dB at both 30% and 70% normalized throughput.

**Table 7.1-2 Simulation result summary for FR1 SU-MIMO PDSCH 8Tx8Rx with 8 layers**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SNR at Norm. Throughput [dB]** | | **Source #1** | **Source #2** | **Source #3** | **Source #4** | **Source #5** | **Source #6** | **Source #7** | **Average** | **Span** |
| CW1 | 30% | 6.4 | 4.9 | 4.8 | 6.1 | 6.8 | 6.9 | 6.3 | 6.0 | 2.1 |
| 70% | 16.9 | 14.2 | 16.5 | 16.7 | 17.5 | 17.2 | 18.5 | 16.8 | 4.3 |
| CW2 | 30% | 10.1 | 15.7 | 10 | 9.9 | 11.6 | 12.3 | 12.4 | 11.7 | 5.8 |
| 70% | 23.7 | 26 | 24.4 | 24 | 24.7 | 23.4 | 24.4 | 24.4 | 2.6 |

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AI-generated content may be incorrect.

**Observation for [rCDL-C]:**

* 6 out of 7 sources could achieve SNR span <2.5dB for both CW1 and CW2 at both 30% and 70% normalized throughput.

**Table 7.1-3 Simulation result summary for FR1 SU-MIMO PMI 8Tx4Rx with 4 layers, follow PMI**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SNR at Norm. Throughput [dB]** | | **Source #1** | **Source #2** | **Source #3** | **Source #4** | **Source #5** | **Source #6** | **Source #7** | **Source #8** | **Source #9** | **Average** | **Span** |
| Type-I | 70% | 12.4 | 11.0 | 10.4 | 10.3 | 10.2 | 9.7 | 9.5 | 10.2 | 9.8 | 10.4 | 2.9 |
| 90% | 14.4 | 13.1 | 12.2 | 12.8 | 12.6 | 12.6 | 12.0 | 12.5 | 12.3 | 12.7 | 2.4 |
| eType-II | 70% | 14.0 | 14.3 | 10.3 | 11.6 | 10.1 | 10.8 | 8.2 | 13.8 | 10.8 | 11.5 | 6.1 |
| 90% | 15.9 | 17.1 | 12.3 | 14.0 | 12.6 | 13.9 | 10.6 | 16.8 | 12.9 | 14.0 | 6.5 |

A screenshot of a computer screen

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**Observation for [rCDL-C]**:

* In type-I codebook case, 8 out of 9 sources could achieve SNR span < 2.5dB at 70% and 90% normalized throughput.

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**Observation for [rCDL-C]:**

* In eType-II codebook case, three clusters of results can be observed:
* Cluster 1: include source #7.
* Cluster 2: include source #3, #4, #5, #6, #9. The span of this cluster < 2.5dB for both 70% and 90% normalized throughput percentiles.
* Cluster 3: include source #1, #2, #8. The span of this cluster < 2.5dB for both 70% and 90% normalized throughput percentiles.

## 7.2 Void











## 7.3 [xTDL-C] model results alignment

**Table 7.3-1 Simulation result summary for FR1 SU-MIMO PDSCH 4Tx4Rx with 4 layers**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SNR at Norm. Throughput [dB]** | **Source #1** | **Source #2** | **Source #3** | **Source #4** | **Source #5** | **Source #6** | **Average** | **Span** |
| 30% | 5.3 | 5.8 | 6 | 6 |  |  | 5.8 | 0.7 |
| 70% | 13.5 | 15.9 | 15.4 | 15.8 |  |  | 15.2 | 2.4 |

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**Observation for [xTDL-C]**:

* 4 out of 4 sources could achieve SNR span < 2.5dB for both 30% and 70% normalized throughput.

**Table 7.3-2 Simulation result summary for FR1 SU-MIMO PDSCH 8Tx8Rx with 8 layers**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SNR at Norm. Throughput [dB]** | | **Source #1** | **Source #2** | **Source #3** | **Source #4** | **Source #5** | **Source #6** | **Average** | **Span** |
| CW1 | 30% | 4 | 2.3 | 5.7 |  |  |  | 4.0 | 3.4 |
| 70% | 14.5 | 11.1 | 14.8 |  |  |  | 13.5 | 3.7 |
| CW2 | 30% | 10.8 | 11 | 11 |  |  |  | 10.9 | 0.2 |
| 70% | 21.2 | 19.7 | 20.4 |  |  |  | 20.4 | 1.5 |

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**Observation for [xTDL-C]**:

* 2 out of 3 sources could achieve SNR span < 2.5dB for CW1 at both 30% and 70% normalized throughput
* 3 out of 3 sources could achieve SNR span < 2.5dB for CW2 at both 30% and 70% normalized throughput.

**Table 7.3-3 Simulation result summary for FR1 SU-MIMO PMI 8Tx4Rx with 4 layers, follow PMI**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SNR at Norm. Throughput [dB]** | | **Source #1** | **Source #2** | **Source #3** | **Source #4** | **Source #5** | **Source #6** | **Average** | **Span** |
| Type-I | 70% | 12.3 | 13.0 | 10.8 |  |  |  | 12.0 | 2.2 |
| 90% | 14.0 | 15.0 | 13.6 |  |  |  | 14.2 | 1.4 |
| eType-II | 70% | 13.5 | 14.7 | 11.6 |  |  |  | 13.3 | 3.1 |
| 90% | 17.0 | 16.8 | 17.3 |  |  |  | 17.0 | 0.5 |

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**Observation for [xTDL-C]:**

* In type-I codebook case, 3 out of 3 sources could achieve SNR span< 2.5dB at both 70% and 90%normalized throughput percentiles.

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AI-generated content may be incorrect.

**Observation for [xTDL-C]:**

* In eType-II codebook case, 2 out of 3 sources could achieve SNR span< 2.5dB at 70% normalized throughput and 3 out of 3 sources could achieve SNR span< 2.5dB at 90%normalized throughput.

## 7.4 Void