3GPP TSG-RAN WG4 Meeting # 102-e Revision of R4-2205621

Electronic Meeting, February 21 – March 3, 2022

**Agenda item:** 10.1.3.3

**Source:** Keysight Technologies

**Title:** On FR1 Channel Model Validation

**Document for:** Approval

# Introduction

This contribution addresses various FR1 CM validation aspects.

# PDP Pass/Fail Limits

In the WF on NR MIMO OTA [1], it was agreed to leave pass/fail limits for the FR1 CDL-C- UMa as a TBD for the paths 30 to 40 dB from the peak and make the decision in RAN4#102-e meeting. This document will explain why option 2 should be selected.

The table for the pass/fail limits in the WF on NR MIMO OTA R4-2203063 is the following where Option 2 was added to tighten the limits compared to very loose limits in the Option 1.

|  |  |  |
| --- | --- | --- |
|  | **Power Tolerance** | **Delay Tolerance** |
| **Paths from 0dB to 10dB** | [±1dB] | [±6ns] |
| **Paths from 10dB to 20dB** | [±2.5dB] | [±6ns] |
| **Paths from 20dB to 30dB** | [±5dB] | [±6ns] |
| **Paths from 30dB to 40dB** | TBDOption 1: \_+/-10 dBOption 2: * +/-10 dB at 290 ns for UMa
* +/-5 dB for others
 | [±6ns] |

Several OTA labs measured the PDP and reported their results in the RAN4#101bis-e in R4-2200576 [2], R4-2200832 [3], R4-2201591 [4], R4-2200906 [5] and R4-2203045 [6]. Based on their results, all the labs would pass the tighter limits presented in option 2 in the table above.

**Proposal 1: Adopt the Option 2 for the PDP pass/fail limits of FR1 MIMO OTA UMa CDL-C for the paths from 30 to 40 dB from the peak.**

For FR1 CDL-C UMi, it is proposed to adopt the following pass/fail limits

Table 1: Pass Fail Limits for FR1 CDL-C UMi

|  |  |  |
| --- | --- | --- |
|  | **Power Tolerance** | **Delay Tolerance** |
| **Paths from 0dB to 30dB** | [±2.5dB] | [±6ns] |
| **Paths beyond 30dB** | [±5dB] | [±6ns] |

Proposal 2: Adopt the pass/fail limits for FR1 CDL-C UMi listed in Table 1

# PDP Delay Rounding

In the last WF [1] and subsequently in [7], the delays were merged and rounded to 5 ns delay grid to match with the VNA’s 200 MHz BW setting. The delay at 232.4 was rounded to 235 since it is closer to the average of the delays with clusters 6-8. However, in the actual measurements, the peak power comes for the actual peak at 232.4 ns, not in the averaged delay at 235 ns. Thus, the delay needs to be rounded correctly to 230 ns to have it closer to the original model for beam 1. Similar changes are requested for clusters 2-5 for beam 2.



Proposal 3: Change the cluster group 3 (clusters 6-8) delay from 235 ns delay to 230 ns for CDL-C UMa for beam 1.

Proposal 4: Change the cluster group 2 (clusters 2-5) delay from 80 ns delay to 75 ns for CDL-C UMa for beam 2.

# PDP Reference for CDL-C UMi

The previous WF [1] suggested to finalize the CLC-C UMi PDP reference values this meeting. Below, the proposed reference values are listed for below 2.5 GHz, **Table 2**, and above 2.5 GHz, **Table 3**. It should be noted that the 80 ns (79.4 ns in the original model) tap was merged to 65 ns since even a 100 MHz system cannot distinguish the 80 ns due to the sidelobes of the clusters 6-9.

**Table 2: CDL-C UMi PDP Reference Values at ≤ 2.5 GHz**

|  |  |  |
| --- | --- | --- |
| **Cluster**  | **Delay [ns]** | **Power [dB]**  |
| 1  | 0  | -30.7  |
| 2-5  | 20  | -19.2  |
| 6-10 | 65  | 0  |
| 11-12  | 130  | -31.4  |
| 13  | 215  | -40.8 |
| 14  | 460  | -41.5 |

**Table 3: CDL-C UMi PDP Reference Values at > 2.5 GHz**

|  |  |  |
| --- | --- | --- |
| **Cluster**  | **Delay [ns]** | **Power [dB]**  |
| 1  | 0  | -30.7  |
| 2-5  | 20  | -19.2  |
| 6-10 | 65  | 0  |
| 11-12  | 130  | -31.4  |
| 13  | 215  | -41 |
| 14  | 460  | -41.6 |

Proposal 5: Adopt the FR1 CDL-C UMi reference values in Tables 2 and 3.

# Conclusion

The following proposal was made in this contribution:

**Proposal 1: Adopt the Option 2 for the PDP pass/fail limits of FR1 MIMO OTA UMa CDL-C for the paths from 30 to 40 dB from the peak.**

**Proposal 2: Adopt the pass/fail limits for FR1 CDL-C UMi listed in Table 1**

**Proposal 3: Change the cluster group 3 (clusters 6-8) delay from 235 ns delay to 230 ns for CDL-C UMa for beam 1.**

**Proposal 4: Change the cluster group 2 (clusters 2-5) delay from 80 ns delay to 75 ns for CDL-C UMa for beam 2.**

**Proposal 5: Adopt the FR1 CDL-C UMi reference values in Tables 2 and** 3.

# References

1. R4-2203063, WF on NR MIMO OTA, 3GPP TSG-RAN WG4 Meeting # 101bis-e, Jan. 17-25, 2022
2. R4-2200576, FR1 MIMO OTA channel validation, 3GPP TSG-RAN WG4 Meeting # 101bis-e, Jan. 17-25, 2022
3. R4-2200832, FR1 channel model validation results for CMCC & BUPT joint lab, 3GPP TSG-RAN WG4 Meeting # 101bis-e, Jan. 17-25, 2022
4. R4-2201591, FR1 MIMO OTA channel model validation results and views on PDP pass/fail limits, 3GPP TSG-RAN WG4 Meeting # 101bis-e, Jan. 17-25, 2022
5. R4-2200906, FR1 MIMO OTA Lab Alignment, Channel Model Validation, 3GPP TSG-RAN WG4 Meeting # 101bis-e, Jan. 17-25, 2022
6. R4-2203045, Further results on FR1 MIMO OTA Channel model validation, 3GPP TSG-RAN WG4 Meeting # 101bis-e, Jan. 17-25, 2022
7. TS 38.151, Multiple Input Multiple Output (MIMO) Over-the-Air (OTA) performance requirements, V0.7.0 (2022-01)