**3GPP TSG-RAN WG4 Meeting #102- e R4-22XXXXX**

**Electronic Meeting, 21 February – 03 March 2022**

**Agenda item:** 10.1.1

**Source:** vivo, CAICT

**Title:** WF on NR MIMO OTA

**Document for:** Approval

# Introduction

This is the Way Forward on NR MIMO OTA.

# Way Forward on Topic #1: General and Testing

## Sub-topics summary

### Sub-topic 1-1 FR1 channel model validation

**Issue 1-1-1: PDP reference** **for FR1 channel model validation**

Sub-issue 1-1-1-1: PDP reference for FR1 CDL-C UMi channel model validation

Options:

* Option 1: Adopt the FR1 CDL-C UMi reference values in Option 2, and also include clusters 13&14 with power lower than -40dB.
* Option 2: Adopt the FR1 CDL-C UMi reference values in the following Tables:
* **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 |

* **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 |

*Tentative Agreement:*

* + Option 1

Sub-issue 1-1-1-2: PDP reference for FR1 CDL-C UMa channel model validation

* Are the following proposals agreeable?
	+ Proposal 4a: Change the cluster group 3 (clusters 6-8) delay from 235 ns delay to 230 ns for CDL-C UMa for beam 1.
	+ Proposal 4b: Change the cluster group 2 (clusters 2-5) delay from 80 ns delay to 75 ns for CDL-C UMa for beam 2.

*Tentative Agreement:*

* + Keep the PDP reference values unchanged as agreed in the last meeting.

**Issue 1-1-2: PDP pass/fail limits for FR1 channel model validation**

Sub-issue 1-1-2-1: PDP pass/fail limits for FR1 CDL-C UMi channel model validation

* *For FR1 CDL-C UMi channel model validation, which option is agreeable?*
	+ Option 1: Adopt the PDP pass/fail limits in R4-2119093 for FR1 CDL-C UMi channel model validation as below

|  |  |  |
| --- | --- | --- |
|  | **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** | [±10dB] | [±6ns] |

* + Option 2: Adopt the PDP pass/fail limits in R4-2119093 for FR1 CDL-C UMi channel model validation as below (CAICT’s proposal from the 1st round)

|  |  |  |
| --- | --- | --- |
|  | **Power Tolerance** | **Delay Tolerance** |
| **Paths from 0dB to 20dB** | [±2.5dB] | [±6ns] |
| **Paths from 20dB to 30dB** | [±5dB] | [±6ns] |
| **Paths beyond 30dB** | [±10dB] | [±6ns] |

* + Option 3:

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

*Tentative Agreement:*

* + Option 1

Sub-issue 1-1-2-2: PDP pass/fail limits for FR1 CDL-C UMa channel model validation

*options:*

* Option 1: For FR1 CDL-C UMa channel model validation, adopt the following PDP pass/fail limits

|  |  |  |
| --- | --- | --- |
|  | **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** | * +/-10 dB at 290 ns for Beam 1
* +/-7.5 dB for others
 | [±6ns] |

* Option 2: Using the same PDP pass/fail limits for both CDL-C UMi and CDL-C UMa;

*Agreement:*

* + Option 2

**Issue 1-1-3: Spatial Correlation pass/fail limits for FR1 CDL-C UMa channel model validation**

*Agreement:*

* + For CDL-C UMa 3600MHz, the pass/fail limits are formed as bands of ±10% of correlation capped at 100% for the upper limit for target correlation of 65% and above. For target correlations below 65%, the band is widened to ±20% capped at 0%.
	+ For others, the pass/fail limits are formed as bands of ±10% of correlation capped at 100% for the upper limit for target correlation of 35% and above. For target correlations below 35%, the band is widened to ±20% capped at 0%.

# Way Forward on Topic #2: Performance requirements

## Sub-topics summary

### Sub-topic 2-1 FR1 MIMO OTA lab alignment activity

**Issue 2-1-1: Reference value for FR1 MIMO OTA lab alignment**

*Agreements:*

* + Removal of apparent outlier (if identified) should be considered in the average processing to derive reference value.
	+ Define the reference and pass/fail limit of lab alignment together.
	+ FFS the average approach of the measurement results submitted by test labs to derive reference value.
		- Inverse average is the 1st priority
		- linear average
	+ FFS how to identify/treat the “apparent outlier” in the average processing to derive reference value.

**Issue 2-1-2: Pass/fail limit for FR1 MIMO OTA lab alignment**

*Agreements:*

The pass/fail limit for lab PAD alignment: the maximum deviation of TRMS between each performance alignment lab and Reference Value

* + Starting point: [+/- 0.75MU], i.e., +/- 2.25 dB for band <3GHz and +/- 2.55 dB for band >3GHz.
	+ Further check is allowed after having some PAD test results next RAN4 meeting.

*[It should be noted that in the framework for NR MIMO OTA requirement, the re-test of a test lab is allowed, if large offset is found from the submitted results.]*

**Issue 2-1-3: Arrangement of PAD test**

*Agreement:*

* + After submitting valid channel model validation results to 3GPP RAN4 #103-e meeting, SGS TW can be arranged to test the Performance Alignment Devices (PADs) in the last labs. (The shipping order for these PADs will be Beijing 🡪 Shanghai 🡪 Cupertino 🡪 New Taipei City)

### Sub-topic 2-2 FR1 MIMO OTA performance test campaign

**Issue 2-2-1: Framework for FR1 MIMO OTA performance test campaign**

*Agreement:*

* + Approve the Framework for FR1 MIMO OTA performance test campaign in R4-2207302.

**Issue 2-2-2: How to avoid the same UE model measured in several labs**

*Option 1: share all the supported band information of each device as a rough approach to avoid same model being measured by many times.*

*Option 2: disclosure all the UE models in 3GPP without any repeated UE models as a precise way*

* *Option 2a: among a small group, i.e. just test labs those join the lab alignment activity and will provide measurement results to define MIMO OTA requirements*
* *Option 2b: among all RAN4 interested companies, i.e. in a public contribution or via RAN4 reflector*

*Option 3: do not consider this aspect when specify FR1 MIMO OTA requirement*

*Pros&Cons:*

*option 1 is simple and* *anonymous but can not directly avoid same UE model;*

*option 2 can potentially address the issue but conflicts with anonymous approach, then mapping results to UE model can be roughly estimated if very few results (e.g. 1~2 devices) submitted from a lab. Besides, option 2 still can not fundamentally force lab to avoid the same UE model testing, if cheating exists.*

*option 3: CDF curve of data pool will be impacted, but FFS the impacts on final requirement, given additional margin will be discussed anyway based on CDF analysis*

*Agreement:*

* + TBA

**Issue 2-2-3: FR1 MIMO OTA TRMS requirements development**

*Agreement:*

* + TBA.

### Sub-topic 2-3 Mechanical mode of FR1 MIMO OTA performance

**Issue 2-3: How to treat the mechanical mode in FR1 MIMO OTA performance requirement**

*Agreement:*

* + The TRMS requirements only apply to the primary mechanical mode for devices having multiple mechanical modes.
	+ The primary mechanical mode for devices having multiple mechanical modes shall be declared by the manufacturers.

### Sub-topic 2-4 FR2 MIMO OTA performance requirements

**Issue 2-4-1: How to calculate the sensitivity values by simulation SNR**

*Agreements:*

* + Simulation results should be aligned firstly before specifying FR2 MIMO OTA requirements.
	+ FFS whether both simulation results and measurement results should be taken into account when defining FR2 MIMO OTA requirements.
	+ FFS the gap between simulation results and measurement results of FR2 UEs.

**Issue 2-4-2: How to evaluate the offset of equivalent SNR due to the non-ideal factors**

*Agreement:*

* + Use “Rel-15 EIS requirements” as the baseline UE assumption for MIMO OTA simulation analysis.

**Issue 2-4-3: FR2 MIMO OTA simulation results for 36 test directions**

*Agreement:*

* + RAN4 to use the limits of FR2 channel model validation for power and delay tolerance, and AoA/ZoA offsets to evaluate the maximum impact on the FR2 MIMO OTA simulation results as a starting point.

### Sub-topic 2-5 MU budget for FR2 MIMO OTA

**Issue 2-5-1: MU budget for FR2 MIMO OTA 3D-MPAC**

*Agreement:*

* + Review and check whether R4-2207301 is agreeable as a starting point for further discussion.

# Reference

*[1] R4-2207424, Email discussion summary for [102-e][334] NR\_MIMO\_OTA, Moderator (CAICT), RAN4#102-e, Feb 2022.*