**3GPP TSG-****RAN WG4 Meeting** **#111 R4-2407663
Fukuoka, Japan, 20th – 24th May, 2024**

**Agenda item: 7.10.1**

**Source:** **CAICT**

**Title: Summary of 3GPP Rel-18 FR2 MIMO OTA lab alignment results**

**Document for: Discussion**

# 1 Introduction

The Rel-18 FR2 MIMO OTA lab alignment activity is expected to be concluded at this meeting. Four volunteer labs have submitted their measurement results of the performance alignment devices (PADs) [1]-[4]. Besides, Lab A indicated that their results are 3 dB more optimistic due to the way the power is set at the center of the test zone, and thus their MASC results should be corrected by 3-dB offset [5].

According to the Framework [6], the reference value of each PAD is derived by the linear average (in dB) of the measurement results submitted by labs. The pass/fail limit was specified as 0.75\*preliminary MU.

This contribution presents a summary of the Rel-18 FR2 MIMO OTA lab alignment result. The detailed analysis data is attached in the Excel worksheet of this contribution.

# 2 Discussion

The Rel-18 FR2 MIMO OTA lab alignment measurement results are summarized and analysed, as shown in Table 1 (with Lab A’s original data) and Table 2 (with Lab A’s corrected data with 3-dB offset).

**Table 1. Summary of the Rel-18 FR2 MIMO OTA lab alignment results (with Lab A’s original data)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Device** | **Band** | **MASC70 measurement result [dBm/120kHz]** | **Averageapproach** | **Averagevalue** | **Max-Mindeviation** |
| **Lab A (original results)** | **Lab B** | **Lab C** | **Lab D** | **Lab E** |
| PAD 1 | n261 | -104.97 | -101.79 | -100.64 | Results not available in Rel-18 | NA　 | Linearaverage (in dB) | -102.47 | 4.33 |
| PAD 2 | n261 | -108.56 | -104.92 | -103.87 | -105.41 | -105.69 | 4.69 |
| PAD 3 | n261 | -105.40 | -101.92 | -101.22 | -103.31 | -102.96 | 4.18 |
| PAD 4 | n257 | -108.76 | -105.80 | -104.59 | -106.01 | -106.29 | 4.17 |
| **Device** | **Band** |  **TRMS offset [dBm/120kHz]** | **Pass/fail limit** |
| **Lab A** | **Lab B** | **Lab C** | **Lab D** | **Lab E** |
| PAD 1 | n261 | -2.51 | 0.68 | 1.83 | NA　 | NA　 | ± 0.75\*preliminary MU, i.e., ± 3.79 dB |
| PAD 2 | n261 | -2.87 | 0.77 | 1.82 | NA　 | 0.28 |
| PAD 3 | n261 | -2.44 | 1.04 | 1.74 | NA　 | -0.35 |
| PAD 4 | n257 | -2.47 | 0.49 | 1.70 | NA　 | 0.28 |
| **Lab alignment conclusion**  | **Pass** | **Pass** | **Pass** | **NA** | **Pass** |  |  |  |

**Table 2. Summary of the Rel-18 FR2 MIMO OTA lab alignment results (with Lab A’s corrected data)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Device** | **Band** | **MASC70 measurement result [dBm/120kHz]** | **Averageapproach** | **Averagevalue** | **Max-Mindeviation** |
| **Lab A (with 3dB offset)** | **Lab B** | **Lab C** | **Lab D** | **Lab E** |
| PAD 1 | n261 | -101.97 | -101.79 | -100.64 | Results not available in Rel-18 | NA　 | Linearaverage (in dB) | -101.47 | 1.33 |
| PAD 2 | n261 | -105.56 | -104.92 | -103.87 | -105.41 | -104.94 | 1.69 |
| PAD 3 | n261 | -102.40 | -101.92 | -101.22 | -103.31 | -102.21 | 2.09 |
| PAD 4 | n257 | -105.76 | -105.80 | -104.59 | -106.01 | -105.54 | 1.41 |
| **Device** | **Band** |  **TRMS offset [dBm/120kHz]** | **Pass/fail limit** |
| **Lab A** | **Lab B** | **Lab C** | **Lab D** | **Lab E** |
| PAD 1 | n261 | -0.51 | -0.32 | 0.83 | NA | NA | ± 0.75\*preliminary MU, i.e., ± 3.79 dB |
| PAD 2 | n261 | -0.62 | 0.02 | 1.07 | NA | -0.47 |
| PAD 3 | n261 | -0.19 | 0.29 | 0.99 | NA | -1.10 |
| PAD 4 | n257 | -0.22 | -0.26 | 0.95 | NA | -0.47 |
| **Lab alignment conclusion**  | **Pass** | **Pass** | **Pass** | **NA** | **Pass** |  |  |  |

Figure 2 presents the MASC measurement results, and Figure 3 visualizes the deviations between each MASC measurement results and average values.

**(a) with Lab A’s original data**

**(b) with Lab A’s corrected data**

**Figure 2. The Rel-18 FR2 MIMO OTA lab alignment measurement results**

**(a) with Lab A’s original data**

**(b) with Lab A’s corrected data**

**Figure 3. Deviation between each measurement result and the average value**

**Observation 1: Four volunteer labs provided their measurement results for FR2 MIMO OTA lab alignment in Rel-18 MIMO OTA lab alignment activity. With Lab A’s corrected data, the maximum deviation between different labs is 2.09 dB, which is within 0.5 preliminary MU. No outlier value is observed.**

**Observation 2: The performance rankings of the PADs are consistent across different labs.**

**Observation 3: With Lab A’s corrected data, the maximum deviation between measurement results and average values is -1.10 dB, which is about 0.22\*preliminary MU.**

**Observation 4: The maximum deviation between measurement results and reference values is within the agreed pass/fail limit, +/- 0.75\*preliminary MU (3.79 dB). The four labs can be confirmed as aligned.**

To provide a comprehensive overview of the measurement results, the measured sensitivity values @ 70% TP at each of test points are illustrated in Annex.

# 3 Conclusion

This contribution presents a summary of the Rel-18 FR2 MIMO OTA lab alignment result.

**Observation 1: Four volunteer labs provided their measurement results for FR2 MIMO OTA lab alignment in Rel-18 MIMO OTA lab alignment activity. With Lab A’s corrected data, the maximum deviation between different labs is 2.09 dB, which is within 0.5 preliminary MU. No outlier value is observed.**

**Observation 2: The performance rankings of the PADs are consistent across different labs.**

**Observation 3: With Lab A’s corrected data, the maximum deviation between measurement results and average values is -1.10 dB, which is about 0.22\*preliminary MU.**

**Observation 4: The maximum deviation between measurement results and reference values is within the agreed pass/fail limit, +/- 0.75\*preliminary MU (3.79 dB). The four labs can be confirmed as aligned.**

# Annex: Measurement results at each test point

To provide a comprehensive overview of the measurement results, the measured sensitivity values @ 70% TP at each of test points are shown in Fig. A-1 (with Lab A’s original data).

(a) PAD 1

(b) PAD 2

(c) PAD 3

(d) PAD 4

Figure A-1. Measured sensitivity values at each test point (with Lab A’s original data)

# References

1. R4-2400194, On FR2 MIMO OTA Lab Alignment PADs measurement results, Apple, 3GPP RAN4#110, Feb. 2024.
2. R4-2405463, Measurement results for 3GPP FR2 MIMO OTA Lab Alignment Activity, CAICT, 3GPP RAN4#110bis, Apr. 2024.
3. R4-2405312, Measurement results for 3GPP FR2 MIMO OTA Lab Alignment Activity, CMCC, 3GPP RAN4#110bis, Apr. 2024.
4. R4-2406133, Measurement results for 3GPP FR2 MIMO OTA Lab Alignment Activity, Huawei, HiSilicon, RAN4#110bis, Apr. 2024.
5. R4-2407064, On FR2 MIMO OTA measurement results, Apple, 3GPP RAN4#111, May 2024.
6. R4-2407662, Updated Framework and time plan for FR2 MIMO OTA performance requirements development (May 2024), CAICT, 3GPP RAN4#111, May 2024.