**3GPP TSG-RAN WG4 Meeting #111 R4-24xxxxx**

**Fukuoka, Japan, 20th – 24th May, 2024**

 **4Agenda item:** 7.10.4

**Source:** Moderator (CAICT)

**Title:** Ad-hoc meeting minutes for [111][337] NR\_MIMO\_OTA\_enh

**Document for:** Information

# Introduction

This is the meeting minutes of Ad-hoc discussions for Rel-18 NR\_MIMO\_OTA\_enh WI, chaired by Siting Zhu (CAICT).

# Topic #1: General

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| **[R4-2408907](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408907.zip)** | CAICT | On concluding Performance part of Rel-18 MIMO OTA WI**Proposal 1: RAN4 should finalize the FR1 MIMO OTA performance requirements for bands n1/n5/n28 at this meeting, to conclude the Perf. part of Rel-18 MIMO OTA WI on time.** **Proposal 6: RAN4 should finalize the FR1 MIMO OTA performance requirement for band n261 at this meeting, to conclude the Perf. part of Rel-18 MIMO OTA WI on time.** **Proposal 9: With concluding the MIMO OTA performance requirements, an LS to other OTA groups is needed to ensure industry coordination on this topic.** |
| R4-2408908 (reserved) | CAICT | LS on Rel-18 NR MIMO OTA progress |

## Open issues summary

### Sub-topic 1-1 General views and LS on Rel-18 MIMO OTA performance work

**Issue 1-1-1: Proposals on concluding Rel-18 MIMO OTA performance work**

* Proposals
	+ Proposal 1 (CAICT): RAN4 should finalize the FR1 MIMO OTA performance requirements for bands n1/n5/n28 at this meeting, to conclude the Perf. part of Rel-18 MIMO OTA WI on time.
	+ Proposal 2 (CAICT): RAN4 should finalize the FR2 MIMO OTA performance requirement for band n261 at this meeting, to conclude the Perf. part of Rel-18 MIMO OTA WI on time.
* Recommended WF
	+ Agree to the proposals and conclude the Rel-18 MIMO OTA performance work at this meeting.

Samsung: measurement result for n1 is provided from single lab.

Agreement:

Agree to proposal 1 and proposal 2, conclude the Rel-18 MIMO OTA performance work at this meeting.

**Issue 1-1-2: LS on Rel-18 MIMO OTA progress**

*Moderator’s note: R4-2408908 is reserved for the LS, draft version was uploaded to the draft folder.*

* Proposals
	+ Proposal 1: With concluding the MIMO OTA performance requirements, an LS to other OTA groups is needed to ensure industry coordination on this topic.
* Recommended WF
	+ Agree to the proposal.

Agreement:

Send an LS to other SDOs on MIMO OTA WI progress, detailed content can be updated based on the discussion outcome this week.

# Topic #2: FR1 MIMO OTA

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| **[R4-2407062](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407062.zip)** | Apple | On band n1 CDL-C UMa Channel Model Validation |
| **[R4-2408907](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408907.zip)** | CAICT | On concluding Performance part of Rel-18 MIMO OTA WI**Observation 1: Additional criteria of FR1 MIMO OTA for bands < 1GHz are still under discussion, which affects the scope of data pool for specifying performance requirements.** **Proposal 2: For FR1 MIMO OTA for bands < 1GHz, RAN4 should make decision on the additional criteria and the scope of data pool at this meeting.** **Observation 2: According to our measurement results, four of five “failed” UEs can pass the test when PRS-EPRE-MAX increased to -78 dBm/15kHz.****Observation 3: All the “failed” UEs in our device pool were produced in 2021~2022 and for regional market, some of these UEs only support band n28A rather than the full n28 band.** **Observation 4: It is possible that UEs equipped with 4Rx antennas are included in the device pool, and the algorithm of these UEs on selecting/combining antennas does not work properly** **during 2x2 MIMO OTA testing. This is a possible reason for the poor measured TP.** **Proposal 3: RAN4 should carefully check the UE samples and exclude any abnormal measurement results, to avoid any misleading decisions on the test method/addition criteria.** **Proposal 4: The maximum downlink power can be increased to -78 dBm/15kHz for bands < 1GHz, if system integrators/test labs can confirm this value is feasible. Not to relax the minimum number of orientations that are required to reach 90%/70% TP.** **Proposal 5: For the band n28/n5 data pool, include those devices that only fail the 90% criteria (but pass 70%), but exclude those that fail the 70% criteria (Option 2).** |
| **[R4-2408900](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408900.zip)** | OPPO | On initial DL Power of MIMO OTA for low bands***Observation 1: For some devices, -80 dBm/15kHz initial DL power is not enough to get 90% theoretical throughput in several measurement orientations.******Observation 2: Increasing the initial DL power will achieve the goal of making the UE achieving 90% theoretical throughput.******Proposal 1: It is proposed to increase the initial DL power to -74 dBm/15kHz.******Proposal 2: If the initial DL power is set lower than -74 dBm/15kHz, the number of azimuthal orientations that fail to reach 90% theoretical throughput should be relaxed accordingly.*** |
| **[R4-2407063](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407063.zip)** | Apple | [Measurement campaign] On FR1 MIMO OTA measurement resultsProposal 1: The RAN4 NR MIMO OTA rapporteur exceptionally accepts Apple’s late submission of FR1 MIMO OTA data points, including the data in the performance requirement pool. |
| **[R4-2407660](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407660.zip)** | CAICT | [Measurement campaign] FR1 MIMO OTA measurement campaign data submission |
| **[R4-2407810](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407810.zip)** | Xiaomi | [Measurement campaign] Test result for FR1 performance requirement for band n5 |
| **[R4-2408226](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408226.zip)** | CMCC | [Measurement campaign] Measurement data for Rel-18 FR1 MIMO OTA performance requirements |
| **[R4-2408903](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408903.zip)** | OPPO | [Measurement campaign] 3GPP Rel-18 FR1 MIMO OTA Measurement Campaign-OPPO |
| R4-2407661 | CAICT | Analysis of FR1 MIMO OTA measurement campaign and Proposals on performance requirements**Proposal 1: Adopt the values at 85% percentile of the CDF curves as starting point for requirements discussion.*** **For band n28, define the performance requirement in the range of -87.0 to -84.7 dBm/15kHz.**
* **For band n5, define the performance requirement in the range of -88.0 to -88.6 dBm/15kHz.**
* **For band n1, define the performance requirement as -97.6 dBm/30kHz.**
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## Open issues summary

### Sub-topic 2-1 Additional criteria for bands <1GHz

**Issue 2-1-1: General views on additional criteria and UE pool**

* Proposals
	+ Proposal 1: For FR1 MIMO OTA for bands < 1GHz, RAN4 should make decision on the additional criteria and the scope of data pool at this meeting.
	+ Proposal 2: RAN4 should carefully check the UE samples and exclude any abnormal measurement results, to avoid any misleading decisions on the test method/addition criteria.
* Recommended WF
	+ Agree to Proposal 1 and Proposal 2.

**Issue 2-1-2: Additional criteria for bands <1GHz**

*Moderator’s note: In the WF of the last meeting:*

|  |
| --- |
| **Issue 1-2-1: Additional criteria of FR1 MIMO OTA for bands < 1GHz****Agreement:*** Reconsider the additional criteria of FR1 MIMO OTA for bands < 1GHz. The following options should be considered:
	+ Option 1: Increase the maximum downlink power condition (i.e. PRS-EPRE-MAX) for bands < 1GHz, e.g., increase PRS-EPRE-MAX from -80dBm/15kHz to -74~-77 dBm/15kHz.
	+ Option 2: Relax the additional criteria on 90%TP without increasing PRS-EPRE-MAX.
	+ Combinations of Options 1 and 2.
* For Option 1, further check the maximum PRS-EPRE-MAX that test systems can support. Feedback from test labs/system integrators is needed.
* Make decision based on more analysis and more measurement results. Encourage more labs to share detailed measurement results before a check point prior to RAN4#111 Tdoc submission deadline via 3GPP\_TSG\_RAN\_WG4\_NR-MIMO-OTA reflector.
 |

*Several labs have provided more measurement results and UE information to help with making decision on this issue, as captured in R4-2407661 (Analysis file of FR1 measurement campaign). Some Observations are provided in R4-2408907 (CAICT) and R4-2408900 (OPPO).*

*Some test labs/system integrators (MVG/Apple, CAICT, CMCC, MediaTek, Xiaomi, OPPO) have confirmed that their test system can support -78dBm/15kHz.*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | *Lab 1* | *Lab 2* | *Lab 3* | *Lab 4* | *Lab 5* | *Lab 6* |
| *Max RS EPRE (dBm/15kHz)* | *-78 is OK**-77 is not sure* | *-75* | *-77* | *-77* | *-76* | *-72* |

* Options
	+ Option 1: Increase the maximum downlink power condition (i.e. PRS-EPRE-MAX) for bands < 1GHz without relaxing the number of orientations.
		- Option 1a: -78 dBm/15kHz
		- Option 1b: -74 dBm/15kHz *(not feasible for some test systems)*
	+ Option 2: Relax the number of orientations without increasing the max. downlink power.
	+ Option 3: Combinations of Options 1 and 2.
		- Option 3a: option 1a + option 2
		- Option 3b: option 1b + option 2
* Recommended WF
	+ Firstly, confirm the max. downlink power condition for bands <1GH; then, decide the number of orientations that required to reach 90% TP.
	+ Abnormal UE/data samples should not be used to draw the conclusion.

Discussion:

Apple: support option 1a

Samsung: related with LTE. All the LTE spec is smaller than -90dBm. The gap between the max RS-EPRE and the requirement should be large enough. Support average value of option 1a and 1b.

Xiaomi: Option 1a is not appropriate.

QC: Option 2 is complicated. Option 1 is a easy approach and should be 1st priority.

OPPO: support option 3a.

Samsung: support oppo’s view.

MVG: Support 1a or option 2. Not sure if we can go with the average of option 1a and 1b.

Moderator: can we go with option 3a? PRS-EPRE-MAX=-78, relax the minimum number from 10 to [8] out of 12 at 90%TP outage.

MVG: Provide feedback from another system integrator that they cannot achieve option 1b.

Xiaomi: OK with option 3a.

Samsung: We need further check the additional criteria at 70%TP.

Agreement:

For <1GHz, PRS-EPRE-MAX=-78dBm/15kHz, the additional criteria at 90%TP is relaxed to 8 out of 12 orientation.

### Sub-topic 2-2 FR1 MIMO OTA performance requirements

**Issue 2-2-1: Measurement data submission deadline for the data pool**

*Moderator’s note: As no more data points have been submitted at this meeting, the data pool can be frozen.*

* Proposals
	+ Proposal 1 (Apple): The RAN4 NR MIMO OTA rapporteur exceptionally accepts Apple’s late submission of FR1 MIMO OTA data points, including the data in the performance requirement pool.
* Recommended WF
	+ Freeze the data pool before the start of RAN4 #111.

Agreement: The data pool is frozen before the start of RAN4 #111.

**Issue 2-2-2: Scope of the performance data pool for bands <1GHz**

*Moderator’s note: There are three options as listed in the WF of the last meeting:*

|  |
| --- |
| **Issue 1-2-2: Whether the measurement data from the “failed” DUTs can be included****Options:** * Option 1: Include all measurements irrespective of whether they failed the test.
* Option 2: Include those devices that only fail the 90% criteria (but pass 70%), but exclude those that fail the 70% criteria.
* Option 3: Exclude all measurements that fail either 70% or 90% TP.

**Agreement:*** FFS the options and make decision at the next meeting.
 |

*CDF analysis based on the three options are presented in R4-2407661 (Analysis file of FR1 measurement campaign).*

* Proposals
	+ Proposal 1 (CAICT): For the band n28/n5 data pool, include those devices that only fail the 90% criteria (but pass 70%), but exclude those that fail the 70% criteria (Option 2).
* Recommended WF
	+ To be discussed

Discussion:

Apple: support option 1.

Samsung: support option 1.

Xiaomi: support option 1.

MVG: support option 1.

OPPO: support option 1.

Agreement:

Include all measurements irrespective of whether they failed the test for <1GHz based on the original criteria.

**Issue 2-2-3: FR1 MIMO OTA performance requirements (n1/n5/n28)**

*Moderator’s note: Based on the different options in Issue 2-2-2, the CDF analysis is presented in R4-2407661.*

Table 2. Summary of CDF analysis results [dBm/15]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Options** | **Percentile (pass rate)** | **n28 TRMS70** | **n5 TRMS70** | **n1 TRMS70** |
| **Option 1** | **80%-tile** | -85.45  | -88.11  | -98.53  |
| **85%-tile** | -84.71  | -87.96  | -97.60  |
| **90%-tile** | -84.43  | -87.93  | -97.34  |
| **95%-tile** | -83.26  | -87.58  | -97.20  |
| **Total amount of samples****(Threshold: 15)**  | 23 | 19 | 15 |
| **Option 2** | **80%-tile** | -86.92  | Same asOption 1 | Same asOption 1 |
| **85%-tile** | -86.38  |
| **90%-tile** | -85.75  |
| **95%-tile** | -85.63  |
| **Total amount of samples****(Threshold: 15)**  | 18  |
| **Option 3** | **80%-tile** | -87.49  | -88.59  | Same asOption 1 |
| **85%-tile** | -86.96  | -88.58  |
| **90%-tile** | -86.90  | -88.36  |
| **95%-tile** | -86.24  | -88.14  |
| **Total amount of samples****(Threshold: 15)**  | 13 | 15 |

*In the approved Framework R4-2405468, it was agreed that the value at [85%] percentile of the CDF curve can be selected as the starting point for requirement discussion.*

* Proposals
	+ Proposal 1 (CAICT): Adopt the values at 85% percentile of the CDF curves as starting point for requirements discussion.
		- For band n28, define the performance requirement in the range of -87.0 to -84.7 dBm/15kHz.
		- For band n5, define the performance requirement in the range of -88.6 to -88.0 dBm/15kHz.
		- For band n1, define the performance requirement as -97.6 dBm/15kHz.
* Recommended WF
	+ Respect the approved framework and the CDF analysis.

Discussion:

Apple : Consider 90%-tile CDF as a starting point, i.e., n28: -84.43, n5: -87.93, n1: -97.34

Samsung: Ok to start with 90%-tile CDF as starting point. Allow more margin for n1.

CAICT: Consider 85%-tile CDF.values .

Samsung: Are we going to decide the final requirement directly or agree on the starting point first?

Apple: Why 85%-tile CDF is proposed?

CAICT: In the approved Framework, it was agreed that the value at [85%] percentile of the CDF curve can be selected as the starting point for requirement discussion.

OPPO: Support to decide the starting point first and consider additional margin on top of it.

Vivo: Suggest to agree on tentative agreement of n28 and n5 first. Further discuss n1 this week.

Tentative agreement:

Further discuss the requirement within below range:

N28: [-85.45,-83.26 ] dBm/15kHz

N5: [-88.11, -87.58] dBm/15kHz

Further discuss the requirement of n1 in this week. N1 requirement range is not limited within 80%-95% percentile CDF.

# Topic #3: FR2 MIMO OTA

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| **[R4-2407662](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407662.zip)** | CAICT | Updated Framework and time plan for FR2 MIMO OTA performance requirements development (May 2024)**Proposal 1: Approve the updated framework and time plan in Section 2 of this contribution for FR2 MIMO OTA performance requirements development.** |
| R4-2407663 | CAICT | Summary of 3GPP Rel-18 FR2 MIMO OTA lab alignment results |
| **[R4-2408907](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408907.zip)** | CAICT | On concluding Performance part of Rel-18 MIMO OTA WI**Observation 5: Different UEs show difference performance on the numbers of test points fail to reach 90% TP vs. 70% TP. For some of the UEs, the numbers of test points fail to reach 90% TP and 70% TP are similar; but for some other UEs, the number of test points fail to reach 90% TP significantly increased when compared with the number of test points fail to reach 70% TP.** **Observation 6: The measurement grid of FR2 MIMO OTA testing is relatively coarse compared with the narrow beams, which may result in inaccurate measurement results on the number of test points fail to reach 90% TP.** **Proposal 7: It is not necessary to define the additional criteria on 90%TP for FR2 MIMO OTA in Rel-18.** **Proposal 8: Conclude the Rel-18 FR2 MIMO OTA lab alignment activity at this meeting.**  |
| **[R4-2409432](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409432.zip)** | Qualcomm Incorporated | On FR2 MIMO OTA requirement**Proposal 1: RAN4 take the minimum number of test point where UE can meet 90% TP under the maximum downlink power condition as 17 as the starting point. The final decision should be made relying on the measurement data.****Proposal 2: RAN4 use existing measurement results (including measurement results submitted to RAN4#111 meeting) to derive FR2 MIMO OTA requirements.****Proposal 3: RAN4 take 85% as the threshold percentile at CDF curve as the starting point and further discuss the final limit.** |
| **[R4-2407064](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407064.zip)** | Apple | [Measurement campaign] On FR2 MIMO OTA measurement resultsObservation 1: Apple’s FR2 MIMO OTA lab alignment results need correction based on a technical issue found with the FR2 MIMO OTA integrated system.Observation 2: The outcome of the FR2 MIMO OTA lab alignment activity remains the same.Observation 3: The averaging method adopted during the lab alignment activity introduces an unnecessary error into the data analysis.Proposal 1: Calculate the average values for performance requirements based on the technically correct approach, i.e., the linear power average in mW.Proposal 2: 3GPP RAN4 to accept the FR2 MIMO OTA data point on band n261 provided by Apple into the pool of data for performance requirement definition.Proposal 3: 3GPP RAN4 to consider Apple’s additional n261 data points provided after the RAN4#111 TD submission deadline to be included in the FR2 MIMO OTA data pool. |
| **[R4-2409425](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409425.zip)** | Huawei,HiSilicon | [Measurement campaign] FR2 MIMO OTA measurement campaign data submission |
| **[R4-2407664](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407664.zip)** | CAICT, CMCC | [Measurement campaign] FR2 MIMO OTA measurement campaign data submission |
| R4-2407665 | CAICT | Analysis of FR2 MIMO OTA measurement campaign and Proposals on performance requirements**Proposal 1: Select the values in the range of 80% ~ 90% percentile of the CDF curve, i.e., -102.3 ~ -101.6 dBm/120 kHz, as starting point for requirement discussion.** |

## Open issues summary

### Sub-topic 3-1 Additional criteria for FR2 MIMO OTA

**Issue 3-1: Additional criteria for FR2 MIMO OTA**

*Moderator: WF of the last meeting:*

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| --- |
| **Issue 2-1-4: Other criteria for FR2 MIMO OTA****Agreement:*** Encourage volunteer labs to also provide FR2 MIMO OTA measurement results at 90% TP outage (including sensitivity values at each of test points and the number of test points where DUT fails to reach 90% TP) when submitting Lab alignment activity/Measurement campaign results.
* FFS the additional criterion for FR2 MIMO OTA on the minimum number of test points at 90% TP outage under the maximum downlink power condition.
 |

* Proposals
	+ Proposal 1 (CAICT): It is not necessary to define the additional criteria on 90%TP for FR2 MIMO OTA in Rel-18.
	+ Proposal 2 (Qualcomm): RAN4 take the minimum number of test point where UE can meet 90% TP under the maximum downlink power condition as 17 as the starting point. The final decision should be made relying on the measurement data.
* Recommended WF
	+ Due to the limited Rel-18 timeline and few observations on measurement results, P1 is recommended.

Discussion:

Apple: support proposal 1.

QC: we can compromise to proposal 1.

Samsung: option 1.

Agreement: Not to define the additional criteria on 90%TP for FR2 MIMO OTA in Rel-18

### Sub-topic 3-2 FR2 MIMO OTA lab alignment activity

**Issue 3-2: FR2 MIMO OTA lab alignment outcome**

*Moderator: At the last meeting, the 1st round lab alignment activity was concluded:*

|  |
| --- |
| **Issue 2-2-2: FR2 MIMO OTA lab alignment results****Agreement:*** Based on the analysis in R4-2405464, RAN4 concludes the 1st round FR2 MIMO OTA lab alignment activity at this meeting with the following outcome:
	+ The 4 labs (Apple, CAICT, CMCC, Huawei) are aligned at 28-GHz band.
* The remaining lab can submit the PAD measurement results at the next meeting and be confirmed as aligned labs, without affecting the confirmation of the aligned labs in the 1st round.
 |

*However, the remaining lab didn’t submit the PAD measurement results at this meeting.*

* Proposals
	+ Proposal 1 (CAICT): Conclude the Rel-18 FR2 MIMO OTA lab alignment activity at this meeting with the following outcome:
		- 4 labs (Apple, CAICT, CMCC, Huawei) are aligned at 28-GHz band.
* Recommended WF
	+ Agree to the proposal.

Agreement: Agree to the proposal 1.

### Sub-topic 3-3 FR2 MIMO OTA performance requirements

**Issue 3-3-1: Updated Framework for FR2 MIMO OTA performance requirements**

*An updated framework was provided in R4-2407662 for approval (CAICT).*

* Proposals
	+ Proposal 1 (CAICT): Not to consider the impact of the number of antenna panels on FR2 MIMO OTA requirements, and to remove Subsection 2.2.5 from the framework.
* Recommended WF
	+ Due to limited simulation and test resource, RAN4 actually have not studied the impact of the number of antenna panels. Meanwhile, the device pool should already include devices with different numbers of antenna panels. It is recommended to agree to P1.
	+ Approve the updated framework at this meeting.

Agreement: Approve the updated framework

**Issue 3-3-2: Data pool for performance requirement**

*Moderator’s note: R4-2407665(Analysis of FR2 MIMO OTA measurement campaign) is updated to include Apple’s additional n261 data points.*

* Proposals
	+ Proposal 1 (Apple): 3GPP RAN4 to accept the FR2 MIMO OTA data point on band n261 provided by Apple into the pool of data for performance requirement definition. *(The data was corrected by 3-dB offset)*
	+ Proposal 2 (Apple): 3GPP RAN4 to consider Apple’s additional n261 data points provided after the RAN4#111 TD submission deadline to be included in the FR2 MIMO OTA data pool.
	+ Proposal 3 (Qualcomm): RAN4 use existing measurement results (including measurement results submitted to RAN4#111 meeting) to derive FR2 MIMO OTA requirements.
* Recommended WF
	+ The FR2 data pool is frozen before the start of RAN4#111, and the FR2 MIMO OTA requirements will be derived based on the current data pool.

Agreement: The FR2 data pool is frozen before the start of RAN4#111, and the FR2 MIMO OTA requirements will be derived based on the current data pool.

**Issue 3-3-3: How to process PADs measurement results to be included into the data pool**

*Moderator’s note: The data analysis is presented in R4-2407665,and corresponding average values and CDF values are provided based on 4 options . The 70%~100%-tile CDF results are the same for the four options.*

* Options
	+ Option 1: linear average in mW with Lab A’s original data
	+ Option 2: linear average in dB with Lab A’s original data
	+ Option 3: linear average in mW with Lab A’s corrected data
	+ Option 4: linear average in dB with Lab A’s corrected data
* Recommended WF
	+ Companies are invited to share views.

Apple: support option 3.

Samsung: support option 4.

QC: support option 3.

**Issue 3-3-4: FR2 MIMO OTA performance requirements**

*Moderator’s note: The CDF analysis is presented in R4-2407665.*

Table 2. Summary of MASC CDF analysis results [dBm/120 kHz]

|  |  |
| --- | --- |
| **Percentile (pass rate)** | **n261 MASC70** |
| **80%-tile** | -100.54 |
| **85%-tile** | -100.26 |
| **90%-tile** | -100.11 |
| **95%-tile** | -99.85  |
| Amount of DUT samples | 13 |

*Recommended TT for band n261 was defined as 2.525 dB.*

* Proposals
	+ Proposal 1 (Qualcomm): RAN4 take 85% as the threshold percentile at CDF curve as the starting point and further discuss the final limit.
	+ Proposal 2 (CAICT): Select the values in the range of 80% ~ 90% percentile of the CDF curve, i.e., -100.5 ~ -100.1 dBm/120 kHz, as starting point for requirement discussion.
* Recommended WF
	+ TBA

Discussion:

Apple: Support 90%-tile CDF. We can compromise to use the same range as FR1 MIMO OTA, i.e. 80%-95% CDF.

QC: Support 80%-95% CDF.

Samsung: Support to consider a wider range on top of 80%-95% CDF

Apple: Support Samsung.

Tentative agreement:

Further discuss FR2 MIMO OTA requirement within below range:

n261: [-100.54, -99] dBm/120 kHz

# Topic #4: CRs to TS 38.151 and TR 38.761

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| **[R4-2407230](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407230.zip)** (Rel-18 Cat F) | Spirent Communications | Autocorrelation Channel Model Speed Correction**Summary: Speed in Table D3.3-3 mobile speed needs to be 12km/hr instead of 3km/hr** |
| R4-2407444 (reserved, corresponding Rel-18 Cat A) | Spirent Communications | Autocorrelation Channel Model Speed Correction |
| R4-2407793 (reserved, corresponding Rel-17 Cat A) | Spirent Communications | Autocorrelation Channel Model Speed Correction |
| **[R4-2407654](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407654.zip)** | CAICT | CR to 38.151 on FR2 MIMO OTA FoM**Summary: The Figure of Merit and additional criteria for PC1 UE are added based on the agreement in the WF R4-2406083.** |
| **[R4-2407655](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407655.zip)** | CAICT | CR to 38.151 on MIMO OTA performance requirements**Summary: The MIMO OTA minimum requirements for bands n28, n5, n1, n261 are added.** |
| **[R4-2407901](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407901.zip)** | Samsung | CR to TS 38.151 on introduction of FR2 PC1 MIMO OTA performance metric**Summary: Capture the agreed performance metric of FR2 PC1 MIMO OTA into TS 38.151** |
| **[R4-2408733](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408733.zip)** | MVG | Update to FR1 Calibration Procedure**Summary: Added a note stating that other calibration methods are not excluded.** |
| **[R4-2409125](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409125.zip)** | OPPO | Formal CR 38151 Clarification of UE positioning for FR1 MIMO OTA**Summary: Add noise impact evaluation for n28 of Lab 7.** |
| **[R4-2407656](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407656.zip)** | CAICT, SAICT | CR to 38.761 on FR1 CDL-C UMa channel model validation results**Summary: Add CDL-C UMa channel model validation results for band n1, n5, n8 submitted by volunteer labs in R4-2400032 (CAICT), R4-2405313 (CMCC&BUPT).** |
| **[R4-2407657](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407657.zip)** | CAICT, SAICT | CR to 38.761 on FR1 channel model validation results**Summary: Add CDL-C UMi channel model validation results for bands n1, n5, n8 submitted by volunteer labs in R4-2400195 (Apple), R4-2301048 (CAICT), R4-2320068(CAICT), R4-2313899 (CMCC, BUPT), R4-2307506 (MediaTek), R4-2311064 (MediaTek), R4-2401184 (Xiaomi)** |
| **[R4-2407658](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407658.zip)** | CAICT, SAICT | CR to 38.761 on n28 lab alignment campaign**Summary: Add Rel-18 FR1 MIMO OTA lab alignment activity measurement results and outcome.** |
| **[R4-2407659](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407659.zip)** | CAICT, SAICT | CR to 38.761 on FR2 lab alignment campaign**Summary: Add Rel-18 FR2 MIMO OTA lab alignment activity measurement results and outcome.** |
| **[R4-2409124](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409124.zip)** | OPPO | Formal CR for 38.761 on Lab 7 noise impact evaluation for n28**Summary: Add noise impact evaluation for n28 of Lab 7.** |

## Recommendations on the CRs

**CRs to TS 38.151**

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| --- | --- | --- |
| **CR** | **Moderator’s comments** | **Recommendations** |
| R4-2407230 | The CR fixed an error in the Spec., which is expected to be non-controversial.  | Agreeable |
| R4-2407654 | Can be revised to capture the agreements on additional criteria for FR1 MIMO OTA if any  | Pending on discussion outcome |
| R4-2407655 | To be revised to capture the performance requirements agreed at this meeting | To be revised |
| R4-2407901 | The corresponding dCR was endorsed at the last meeting. | Agreeable |
| R4-2408733 | The original CR was endorsed but with cover page issues. Per MCC’s guidance, the source company re-submitted this CR with cover page issues fixed.  | Agreeable |
| R4-2409125 | The corresponding dCR was endorsed at the last meeting. | Agreeable |

**CRs to TR 38.761**

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| **CR** | **Moderator’s comments** | **Recommendations** |
| [R4-2407656](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407656.zip) | To be revised to capture the newly submitted channel model validation results in R4-2407062. | To be revised  |
| [R4-2407657](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407657.zip) | The corresponding dCR was endorsed at the last meeting. | Agreeable |
| [R4-2407658](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407658.zip) | The CR is expected to be non-controversial.  | Agreeable |
| [R4-2407659](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407659.zip) | To be revised based on the FR2 lab alignment outcome.  | To be revised |
| [R4-2409124](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409124.zip) | The corresponding dCR was endorsed at the last meeting. | Agreeable |