**3GPP TSG-RAN WG4 Meeting #109 R4-23xxxxx**

**Chicago, US, November 13 – 17, 2023**

**Agenda item:** 8.2.6

**Source:** Qualcomm Incorporated

**Title:** Topic summary for [109][334] FS\_NR\_FR2\_OTA\_enh

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion (e.g. list of treated agenda items) and provide some guidelines for email discussion if necessary.*

The summary is to summarize the open issues for Rel-18 SI on NR FR2 OTA testing enhancements. The summary covers the contributions submitted under the following agendas:

* 8.2 Study on NR FR2 OTA testing enhancements
	+ 8.2.1 General aspects
	+ 8.2.2 Test methods for RF requirements
	+ 8.2.3 Test methods for RRM requirements
	+ 8.2.4 Test methods for Demodulation requirements
	+ 8.2.5 Test uncertainty assessments

# Topic #1: Test method for UE RF

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2318838 | Keysight | *Observation 1: While nine UE orientation options have been defined for legacy FR2 UE RF smartphone/tablet testing, only three alignment/orientation options are defined for testing within the range of zenith angles 0°<≤90°.**Observation 2: Certain alignment options are better for certain array implementations to reduce blocking from the positioner, e.g., alignment options 1 and 2 seem more appropriate for arrays on opposite sides while alignment option 2 seems most appropriate for arrays on adjacent sides and alignment option 3 introduces positioner blocking for arrays on opposite and adjacent sides.**Observation 3: The difference between Orientation 2 (Option 1) and Orientation 2 (Option 2) is a rotation of 180° around the roll axis/f. For a conventional positioner movement of 0°≤q≤180° and 0°≤f≤360°, such rotation would not make a difference but for the multi-Rx UE RF positioner movement of 0°≤q≤360° and half a rotation in f, it might if OEMs require testing in 0°≤f≤180° or 180°≤f≤360°.**Observation 4: For some array implementations, some alignment options manage to have the beam peak directions not aligned within the xz plane (plane of AoAs), e.g., for Alignment Option 2, the arrays on adjacent sides never have the beam peak directions aligned within the xz plane.**Observation 5: The optimized re-positioning approach with minimized probe blocking cannot completely eliminate probe blocking. The minimum angular separation between positioner and probe(s) is tabulated in Table 2 and is always less than 90°.**Observation 6: The Enhanced IFF QoQZ MU is not applicable for multi-RX UE RF testing***Proposal 1: OEMs to provide feedback on whether multi-RX UE RF should be tested in 0°≤f≤180°, 180°≤f≤360°, or based on a vendor declaration.****Proposal 2: OEMs to provide feedback on whether the UE alignments and orientations in Table 1 are indeed the desired starting orientations for testing.****Proposal 3: The re-positioning concept, test procedures with the re-positioning concept, and the QoQZ MU including QoQZ validation procedure require adjustments from legacy procedures and re-evaluations** |
| R4-2318986 | vivo | **Observation 1:** The hemisphere division for multi-Rx is different from single AoA test. **Observation 2:** Current re-positioning of single AoA may bring unexpected performance degradation in multi-Rx system.**Proposal:** The re-positioning procedure to avoid blockage need to be redesigned for multi-Rx test system. |
| R4-2319268 | Samsung | **Observation 1: it is just necessary to focus on the MU at the concerned AoA offset(s) for each implementation, i.e., same face 🡪 30&60deg; adjacent faces 🡪 90deg; opposite faces 🡪 120&150deg****Observation 2: For a MxN (M>N) array, the measurement grid is dominated by the M value, so the measurement grid based on 6x1 array is much similar as that of 6x2 array. 6x2 array does not fit into mobile phone form factor well, hence we can use 6x1 array instead.****Observation 3: The measurement grid step size for 2AoA spherical coverage is not sensitive to antenna panel array size.****Observation 4: The measurement grid step size for legacy 1AoA spherical coverage is not sensitive to antenna panel array size.****Proposal 1: MU for 15deg step size is lower than 0.5% and therefore 15deg step size is feasible to be adopted as measurement grid step size for Multi-Rx DL 2AoA spherical coverage.****Proposal 2: If the connect sequence of AoA1 and AoA2 does not matter, it can be considered to test only once (one measurement, two records).** |
| R4-2319917 | OPPO | **Observation 1: It is unavoidable that one of AoAs is blocked by the positioner for some test points.****Proposal 1: It is necessary to adopt the re-positioning concept for multi-Rx measurement to avoid AoA blockage.****Proposal 2: when adopting the re-positioning approach, the location of AoA2 should be reorganized to keep the location of the AoA pair aligned with the intended AoA pair to be measured.** |
| R4-2319918 | OPPO | **Proposal: Down-select the test procedure from Option 1 and Option2. And capture the test procedure for multi Rx RF performance into TR 38.871.** |
| R4-2320382 | Qualcomm | **Observation 1: For 6\*2 antenna configuration, the biggest gap between 10deg and 15deg step size is 2.3% for absolute value and 5.5% for the relative ratio.****Observation 2: For multi-Rx UE RF testing, the DL power is not decreasing which is to measure with a fixed step size that will significantly reduce the testing time compared to legacy EIS/EIS spherical coverage testing.****Proposal 1: RAN4 to adopt 10deg as the step size of measurement grid for multi-Rx UE RF testing.****Proposal 2: The additional alignment option shown in Figure 2.2-1 should be considered together with 9 UE orientation in J.3.X of TS 38.101-2. The total number of UE orientations is 12.****Proposal 3: Re-positioning should be able to apply for each of the 12 UE orientations.** |
| R4-2320411 | Huawei, HiSilicon | **Proposal 1: Recommend 15deg as measurement grid step size.** |
| R4-2319922 | OPPO | **TP to TR38.871 for test procedure of UE RF multi-Rx** |
| R4-2319923 | OPPO | **TP to TR 38.871 for UE coordinate system** |
| R4-2320386 | Qualcomm | **TP to TR 38.871 on step size of measurement grid** |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 1-1: Measurement grid

*Sub-topic description:*

*Open issues and candidate options before meeting:*

**Issue 1-1-1: Step size of the measurement grid**

* Proposals
	+ Proposal 1 (Qualcomm): RAN4 to adopt 10deg as the step size of measurement grid for multi-Rx UE RF testing.
	+ Proposal 2 (Samsung, Huawei): RAN4 to adopt 15deg as the step size of measurement grid for multi-Rx UE RF testing.
* Recommended WF
	+ RAN4 to adopt [15deg] as the step size of measurement grid for multi-Rx UE RF testing.

### Sub-topic 1-2: UE orientations and positioner blocking

**Issue 1-2-1: Starting of UE orientations for multi-Rx UE RF testing**

* Proposals
	+ Proposal 1 (Qualcomm): The additional alignment option shown in Figure 1.2.2-1 should be considered together with 9 UE orientation in J.3.X of TS 38.101-2. The total number of UE orientations is 12.



* Figure 1.2.2-1: The additional alignment option
	+ Proposal 2 (Keysight): OEMs to provide feedback on whether multi-RX UE RF should be tested in 0°≤ f ≤180°, 180°≤ f ≤360°, or based on a vendor declaration and whether the UE alignments and orientations in Table 1.2.2-1 are indeed the desired starting orientations for testing.

Table 1.2.2-1: Overview of the nine proposed UE orientations for FR2 UE RF multi-RX testing

|  |  |
| --- | --- |
| **UE Alignments/ Orientations** | **Array Implementation** |
| **opposite** | **adjacent** |
| **Alignment Option 1, Orientation 1** | A diagram of a machine  Description automatically generated | A diagram of a machine  Description automatically generated |
| **Alignment Option 1, Orientation 2 (Option 1)** | A diagram of a machine  Description automatically generated | A diagram of a machine  Description automatically generated |
| **Alignment Option 1, Orientation 2 (Option 2)** | A diagram of a machine  Description automatically generated | A diagram of a machine  Description automatically generated |
| **Alignment Option 2, Orientation 1** | A diagram of a machine  Description automatically generated | A diagram of a physics experiment  Description automatically generated |
| **Alignment Option 2, Orientation 2 (Option 1)** | A diagram of a machine  Description automatically generated | A diagram of a machine  Description automatically generated |
| **Alignment Option 2, Orientation 2 (Option 2)** | A diagram of a machine  Description automatically generated | A diagram of a machine  Description automatically generated |
| **Alignment Option 3, Orientation 1** | A diagram of a machine  Description automatically generated | A diagram of a machine  Description automatically generated |
| **Alignment Option 3, Orientation 2 (Option 1)** | A diagram of a machine  Description automatically generated | A diagram of a machine  Description automatically generated |
| **Alignment Option 3, Orientation 2 (Option 2)** | A diagram of a machine  Description automatically generated | A diagram of a machine  Description automatically generated |

* Recommended WF
	+ UE alignments and orientations in Table 1.2.2-1 are indeed the desired starting orientations for multi-Rx testing.
	+ The following additional alignment option should be considered on top of UE alignments and orientations in Table 1.2.2-1. The total starting UE orientations is 12.



**Issue 1-2-2 Positioner blocking**

* Proposals
	+ Proposal 1 (Qualcomm, OPPO, vivo, Keysight): It is necessary to adopt the re-positioning concept for multi-Rx measurement to avoid AoA blockage.
	+ Proposal 2 (Keysight): The re-positioning concept, test procedures with the re-positioning concept, and the QoQZ MU including QoQZ validation procedure require adjustments and re-evaluations. The initial positioner/UE orientation is selected to be (-90° - ½ angular separation). The minimum angular separation between positioner and probe(s) are listed below.

 Table 1.2.2-2: Minimum angular separation between positioner and probe(s)

|  |  |
| --- | --- |
| **Declared Angular Separation [°]** | **Min Angular Separation between Positioner and Probe(s) [°]** |
| 30 | 75 |
| 60 | 60 |
| 90 | 45 |
| 120 | 30 |
| 150 | 15 |

* + Proposal 3 (OPPO): When adopting the re-positioning approach, the location of AoA2 should be reorganized to keep the location of the AoA pair aligned with the intended AoA pair to be measured.
	+ Proposal 4 (vivo): The re-positioning procedure to avoid blockage need to be redesigned for multi-Rx test system.
* Recommended WF
	+ RAN4 to adopt the re-positioning concept for multi-Rx measurement to avoid AoA blockage.
	+ The re-positioning concept, test procedures with the re-positioning concept, and the QoQZ MU including QoQZ validation procedure require adjustments and re-evaluations. Need further discuss the following two alternatives to apply for the re-positioning in multi-Rx measurement:
		- Alt 1: The initial positioner/UE orientation is selected to be (-90° - ½ angular separation). The minimum angular separation between positioner and probe(s) are listed below.

|  |  |
| --- | --- |
| **Declared Angular Separation [°]** | **Min Angular Separation between Positioner and Probe(s) [°]** |
| 30 | 75 |
| 60 | 60 |
| 90 | 45 |
| 120 | 30 |
| 150 | 15 |

* + - Alt 2: The location of AoA2 should be reorganized to keep the location of the AoA pair aligned with the intended AoA pair to be measured

### Sub-topic 1-3: Test procedure

**Issue 1-3-1: Test procedure**

* Proposals
	+ Proposal 1 (OPPO): Introduces the 2-DL MIMO signals with TRP1&TRP2 sequentially and select the best UE performance.



Figure 1.2.3-1: The test procedure of proposal 1

* + Proposal 2 (OPPO, Samsung): Introduces the 2-DL MIMO signals with TRP1&TRP2 simultaneously



Figure 1.2.3-2: The test procedure of proposal 2

* Recommended WF
	+ Proposal 2 is agreed as the baseline. Capture the test procedure in TR 38.871.

### Sub-topic 1-3: TPs to TR 38.871

**Issue 1-3-1: Is TP for UE coordinate system in R4-2319923 agreeable?**

* Proposals
	+ Proposal 1: Yes
	+ Proposal 2: No, specify the comments if any
* Recommended WF
	+ TBA

**Issue 1-3-2: Is TP for test procedure in R4-2319923 agreeable?**

* Proposals
	+ Proposal 1: Yes
	+ Proposal 2: No, specify the comments if any
* Recommended WF
	+ TBA

**Issue 1-3-3: Is TP step size of measurement grid in R4-2320386 agreeable?**

* Proposals
	+ Proposal 1: Yes
	+ Proposal 2: No, specify the comments if any
* Recommended WF
	+ TBA

# Topic #2: Test method for UE RRM

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2320383 | Qualcomm | **Proposal 1: To update test procedure of Option 2 as follows: In the period of T1, DUT connects TCI state 0 via Probe#1. In the period of T2, DUT measures the SSBs from Probe 2 and Probe 3 while keeping the connection from Probe 1. And then DUT simultaneously switches from Probe 1 to Probe 2 and 3.** **Proposal 2: In the period of T1, the candidate test direction is selected from legacy EIS spherical coverage. In the period of T2, the candidate test directions (AoA pairs) are selected from multi-Rx spherical coverage requirements defined in UE RF session.****Proposal 3: Capture pros and cons provided Table 1 in TR 38.871 for listed options.****Proposal 4: Option 2 is adopted as the measurement setup for Category 2 scenario, i.e., Dual TCI switching test case for Multi-Rx RRM testing.** |
| R4-2320410 | Huawei, HiSilicon | **Proposal 1: Consider the measurement setup below as baseline for Dual TCI switching.**Figure 3: Measurement setup for Dual TCI switching. |
| R4-2320387 | Qualcomm | **TP to TR 38.871 on RRM test method** |
| R4-2320409 | Huawei,HiSilicon | **TP on TR 38.871 for RRM test method** |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 2-1: Measurement setup

*Sub-topic description*

*Open issues and candidate options before meeting:*

**Issue 2-1-1: Measurement setup for Dual DCI switching (i.e., Category 2)**

* Proposals
	+ Proposal 1 (Qualcomm): To update test procedure as follows: In the period of T1, DUT connects TCI state 0 via Probe#1. In the period of T2, DUT measures the SSBs from Probe 2 and Probe 3 while keeping the connection from Probe 1. And then DUT simultaneously switches from Probe 1 to Probe 2 and 3.



Figure 2.2.1-1: Illustration of measurement setup for Dual TCI switching

* + Proposal 2 (Huawei): Consider the measurement setup below as baseline for Dual TCI switching



Figure 2.2.1-2: Illustration of test procedure for Dual TCI switching

* Recommended WF
	+ Proposal 1 and proposal 2 are agreed as the measurement setup for Dual TCI switching
	+ To capture both two proposals in TR 38.871.

**Issue 2-1-2: Side condition for Dual TCI switching**

* Proposals
	+ Proposal 1 (Qualcomm): In the period of T1, the candidate test direction is selected from legacy EIS spherical coverage. In the period of T2, the candidate test directions (AoA pairs) are selected from multi-Rx spherical coverage requirements defined in UE RF session.
* Recommended WF
	+ Proposal 1 is agreed

**Issue 2-1-3: Pros and Cons of measurement setup for Category 2 scenario (Dual TCI switching)**

* Proposals:
	+ Proposal 1 (Qualcomm): Capture pros and cons provided Table 1 in TR 38.871 for listed options.

Table 2.2.1-1: Pros and Cons Comparison

|  |  |  |
| --- | --- | --- |
|  | Pros | Cons |
| Option 1 | * The setup can fully verify the performance of dual TCI switching.
 | * Test system will at least support 4 physical probes.
* Two of the same AoA offsets from RF session is needed.
* Reusing of existing test system is not possible
 |
| Option 2 | * The complexity of test system is lower, e.g., 3 physical probes is needed.
* The test condition could follow AoA offset from RF session.
* Reusing the existing is possible.
 | * The setup can partially verify the performance of dual TCI switching.
 |
| Option 3/3a | * The complexity of test system is lowest, e.g., 2 physical probes is needed.
 | * The setup cannot verify the real performance of dual TCI switching such as the beam directions are not changed from T1 to T2.
* This implies a perfect polarization alignment between DUT and TE in order to separate the beams, which is not feasible based on current test systems
 |

* Recommended WF
	+ Proposal 1 is agreed as the baseline.
	+ Discuss the details of pros and cons in TP R4-2320387.

### Sub-topic 2-2: TPs to TR 38.871

**Issue 2-2-1: Are TPs for UE RRM test method in R4-2320387 and R4-2320408 agreeable?**

* Proposals
	+ Proposal 1: Yes
	+ Proposal 2: No, specify the comments if any
* Recommended WF
	+ To combine TPs R4-2320387 and R4-2320408

# Topic #3: Test method for UE Demodulation

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2318837 | Qualcomm | **Proposal 1: RAN4 recommends setting the MU introduced by non-ideal minimum isolation within 1dB. The final minimum isolation and MU values should be determined by RAN5.** |
| R4-2316321 | Keysight Technologies UK Ltd | *Observation 1: For legacy FR2 demod testing, a minimum isolation of 12 dB was agreed.**Observation 2: For legacy FR2 demod testing, the determined MUs were considered a systematic uncertainty due to the asymmetric nature of the impact of the isolation on the SNR, i.e., the impact on MU is more significant since the MU is not RSS’ed.**Observation 3: If the ‘Impact on non-ideal isolation for the wireless cable mode’ MU element can be shown to be device/chipset independent, this impact on SNR be “corrected” and thus not be considered a measurement uncertainty.**Observation 4: Based on the results in Table 1 and Table 3, the impact of non-ideal isolation MUs are very large for the proposed minimum isolation level of 12 dB for separate processing.**Observation 5: Based on the results in Table* ***2****, the impact of non-ideal isolation MUs are generally better for joint processing than for separate processing but still ~1.5 dB (r = -15)/~3 dB (r = -12) for the proposed minimum isolation level of 12 dB.**Observation 6: With separate processing, multi-RX demod testing seems untestable with r = -12 (current baseline in WI discussions) and the proposed isolation level of 12 dB.***Proposal 1: Limit the minimum isolation of 12 dB for FR2 4x4 multi-RX demod testing.****Proposal 2: More discussions between the SI delegates (working on the testability) and WI delegates (working on the requirements) are necessary in RAN4 to determine the next steps unless this discussion is deferred to RAN5.** |
| R4-2320388 | Qualcomm | TP to TR 38.871 on Demodulation test method |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 3-1: Minimum isolation requirements

*Sub-topic description:*

*Open issues and candidate options before meeting:*

**Issue 3-1-1: Minimum isolation**

* Proposals
	+ Proposal 1 (Qualcomm): RAN4 recommends setting the MU introduced by non-ideal minimum isolation within 1dB. The final minimum isolation and MU values should be determined by RAN5.
	+ Proposal 2 (Keysight): Limit the minimum isolation of 12 dB for FR2 4x4 multi-RX demod testing.
	+ Proposal 3: (Keysight): More discussions between the SI delegates (working on the testability) and WI delegates (working on the requirements) are necessary in RAN4 to determine the next steps unless this discussion is deferred to RAN5.
* Recommended WF
	+ Recommend to have joint discussion between SI delegates and WI delegates in FS\_NR\_FR2\_OTA\_enh ad-hoc
	+ If no conclusion on the minimum isolation and corresponding MU, defer the discussion to RAN5Sub-topic 3-3: TPs and TR 38.871

**Issue 3-1-2: Is TP for UE demodulation testing in R4-2320388 agreeable?**

* Proposals
	+ Proposal 1: Yes
	+ Proposal 2: No, specify the comments if any
* Recommended WF
	+ TBA

# Topic #4: MU assessment

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2320385 | Qualcomm Incorporated | **Proposal 1: The measurement uncertainty of wanted DL signal absolute power X% should be derived based on gap of percentage between normalized DL power, i.e., legacy EIS spherical coverage power level and uncertainty of wanted DL signal absolute power, e.g., 4.92dB (shown in Table 2.1-2). For example, for Arithmetic mean combining with adjacent modules, AoA offset=120deg, X%=9.3%.** **Proposal 2: The uncertainty related to measurement grid should be derived based on the gap of percentage between reference step size, e.g., 1deg and actual step size of measurement grid, e.g., 10deg. For example, for Arithmetic mean combining with adjacent modules, AoA offset=120deg, Y% = 1.1%****Proposal 3: Uncertainty assessment for multi-Rx UE RF testing in Table 2.1-2/3 is adopted for IFF measurement setup.****Proposal 4: The MU assessment of 2AoA UE RRM testing shown in Table 2.2-1 should be adopted for IFF measurement setup.** |
| R4-2318987 | vivo | **In this contribution, we provide our views on the value of X% and Y% in MU assessment.****Observation 1: The X% is similar across different AoA offset when same combining method is used.****Observation 2: The rules of RF requirement construction have small impact on the value of X%.****Observation 3: The difference of overall probability between 10° and 15° is not significant and the performance accuracy of 10° is not always better than 15°.****Observation 4: There is also no obvious trend for performance change when AoA offset increases.** **Proposal 1: For OR combing, take the X% = 6% as starting point, and for arithmetic mean combing, take X% = 4% as starting point.****Proposal 2: Take the Y% = 3.5% as the starting point.** |
| R4-2320389 | Qualcomm  | **TP to TR 38.871 on MU assessment** |
| R4-2320408 | Huawei, HiSilicon | **TP on TR 38.871 on RRM Measurement uncertainty** |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 4-1: MU assessment for UE RF testing

*Sub-topic description:*

*Open issues and candidate options before meeting:*

**Issue 4-1-1: The value of X%**

* Proposals
	+ Proposal 1 (vivo): For OR combing, take the X% = 6% as starting point, and for arithmetic mean combing, take X% = 4% as starting point.
	+ Proposal 2 (Qualcomm): For arithmetic mean combining with adjacent modules, X%=9.3% as the starting point
* Recommended WF
	+ Need more discussion.

**Issue 4-1-2: The value of Y%**

* Proposals
	+ Proposal 1 (vivo): Take the Y% = 3.5% as the starting point.
	+ Proposal 2 (Qualcomm): Table Y% = 1.1% as the starting point
* Recommended WF
	+ Need more discussion.

**Issue 4-1-3: Uncertainty assessment for UE RF testing**

* Proposals
	+ Proposal 1 (Qualcomm): The following tables are adopted as uncertainty assessment for UE RF testing.

Table 4.2.1-1: Uncertainty assessment for wanted DL signal absolute power in 2AoA coverage measurement with IFF

| UID | Uncertainty source | Uncertainty value | Distribution of the probability | Divisor | Standard uncertainty (σ) [dB] |
| --- | --- | --- | --- | --- | --- |
| Stage 2: DUT measurement |
| 1 | Positioning misalignment | 0.00 | Normal | 2.00 | [0.00] |
| 2 | Measure distance uncertainty | 0.00 | Rectangular | 1.73 | [0.00] |
| 3 | Quality of Quiet Zone (NOTE 7) | 0.6 | Actual | 1.00 | [0.7] |
| 4 | Mismatch | 1.30 | Actual | 1.00 | [1.30] |
| 5 | Standing wave between the DUT and measurement antenna | 0.00 | U-shaped | 1.41 | [0.00] |
| 6 | gNB uncertainty on absolute level | 2.9 | Normal | 2.00 | [1.45] |
| 7 | Phase curvature  | 0.00 | U-shaped | 1.41 | [0.00] |
| 8 | Amplifier uncertainties | 2.1 | Normal | 2.00 | [1.05] |
| 9 | Random uncertainty  | 0.50 | Normal | 2.00 | [0.25] |
| 10 | Influence of the XPD | 0.01 | U-shaped | 1.41 | [0.00] |
| 11 | Insertion Loss Variation | 0.00 | Rectangular | 1.73 | [0.00] |
| 12 | RF leakage (from measurement antenna to the receiver/transmitter) | 0.00 | Actual | 1.00 | [0.00] |
| 13 | Multiple measurement antenna uncertainty (NOTE 6) | 0.15 | Actual | 1.00 | [0.15] |
| 14 | DUT repositioning | 0.00 | Rectangular | 1.73 | [0.00] |
| 15 | Influence of spherical coverage grid (NOTE 4) | 0.12 | Actual | 1 | [0.12] |
| Stage 1: Calibration measurement |
| 16 | Mismatch  | 0.00 | U-shaped | 1.41 | [0.00] |
| 17 | Amplifier Uncertainties | 0.00 | Normal | 2.00 | [0.00] |
| 18 | Misalignment of positioning System | 0.00 | Normal | 2.00 | [0.00] |
| 19 | Uncertainty of the Network Analyzer | 1.50 | Normal | 2.00 | [0.75] |
| 20 | Uncertainty of the absolute gain of the calibration antenna | 0.60 | Normal | 2.00 | [0.30] |
| 21 | Positioning and pointing misalignment between the reference antenna and the measurement antenna | 0.01 | Rectangular | 1.73 | [0.00] |
| 22 | Phase centre offset of calibration antenna | 0.00 | Rectangular | 1.73 | [0.00] |
| 23 | Quality of quiet zone for calibration process (NOTE 7) | 0.4 | Actual | 1.00 | [0.4] |
| 24 | Standing wave between reference calibration antenna and measurement antenna | 0.00 | U-shaped | 1.41 | [0.00] |
| 25 | Influence of the calibration antenna feed cable | 0.14 | Normal | 2.00 | [0.07] |
| 26 | Insertion Loss Variation | 0.00 | Rectangular | 1.73 | [0.00] |
|  | Measurement uncertainty | Value |
| Wanted DL signal absolute power (1.96σ - confidence interval of 95 %) [dB] | [4.92] |

Table 4.2.1-2: Total uncertainty assessment for 2AoA coverage measurement with IFF

| Measurement uncertainty | Value |
| --- | --- |
| Wanted DL signal absolute power (1.96σ - confidence interval of 95 %) [%] | [TBD]% |
| Uncertainty related to measurement grid | [TBD]% |
| Total Measurement uncertainty | Value |
| [2AoA spherical coverage] expanded uncertainty (1.96σ - confidence interval of 95 %) [%] | [TBD]% |
| NOTE 1: X% is derived based on the simulations with different DL power vs percentage of 2AoA metric.NOTE 2: Y% is derived based on the simulations with measurement step size vs percentage of 2AoA metric. |

* + Proposal 2: TBA
* Recommended WF
	+ Update X% and Y% based on agreements in Issue 4-1-1 and Issue 4-1-2

### Sub-topic 4-2: MU assessment for UE RRM testing

**Issue 4-2-1: MU assessment for UE RRM testing**

* Proposals
	+ Proposal 1 (Qualcomm): The MU assessment of 2AoA UE RRM testing shown in Table 4.2.2-1 should be adopted for IFF measurement setup.

Table 4.2.2-1: Uncertainty assessment for Multi-Rx RRM testing with IFF

| UID | Uncertainty source | Uncertainty value | Distribution of the probability | Divisor  | Standard uncertainty (σ) [dB] |
| --- | --- | --- | --- | --- | --- |
| Stage 2: DUT measurement |
| 1 | Positioning misalignment | 0.00 | Normal | 2.00 | [0.00] |
| 2 | Measure distance uncertainty | 0.00 | Rectangular | 1.73 | [0.00] |
| 3 | Quality of Quiet Zone (NOTE 4) | 0.6 | Actual | 1.00 | [0.7] |
| 4 | Mismatch | 1.30 | Actual | 1.00 | [1.30] |
| 5 | Standing wave between the DUT and measurement antenna | 0.00 | U-shaped | 1.41 | [0.00] |
| 6 | gNB uncertainty on absolute level | 2.9 | Normal | 2.00 | [1.45] |
| 7 | Phase curvature | 0.00 | U-shaped | 1.41 | [0.00] |
| 8 | Amplifier uncertainties | 2.1 | Normal | 2.00 | [1.05] |
| 9 | Random uncertainty  | 0.50 | Normal | 2.00 | [0.25] |
| 10 | Influence of the XPD | 0.01 | U-shaped | 1.41 | [0.00] |
| 11 | Insertion Loss Variation | 0.00 | Rectangular | 1.73 | [0.00] |
| 12 | RF leakage (from measurement antenna to the receiver/transmitter) | 0.00 | Actual | 1.00 | [0.00] |
| 13 | Multiple measurement antenna uncertainty (NOTE 3) | 0.15 | Actual | 1.00 | [0.15] |
| 14 | DUT repositioning | 0.08 | Rectangular | 1.73 | [0.05] |
| Stage 1: Calibration measurement |
| 15 | Mismatch | 0.00 | U-shaped | 1.41 | [0.00] |
| 16 | Amplifier Uncertainties | 0.00 | Normal | 2.00 | [0.00] |
| 17 | Misalignment of positioning System | 0.00 | Normal | 2.00 | [0.00] |
| 18 | Uncertainty of the Network Analyzer | 0.73 | Normal | 2.00 | [0.37] |
| 19 | Uncertainty of the absolute gain of the calibration antenna | 0.60 | Normal | 2.00 | [0.30] |
| 20 | Positioning and pointing misalignment between the reference antenna and the measurement antenna | 0.01 | Rectangular | 1.73 | [0.00] |
| 21 | Phase centre offset of calibration antenna | 0.00 | Rectangular | 1.73 | [0.00] |
| 22 | Quality of quiet zone for calibration process (NOTE 4) | 0.4 | Actual | 1.00 | [0.4] |
| 23 | Standing wave between reference calibration antenna and measurement antenna | 0.00 | U-shaped | 1.41 | [0.00] |
| 24 | Influence of the calibration antenna feed cable | 0.14 | Normal | 2.00 | [0.07] |
| 25 | Insertion Loss Variation | 0.00 | Rectangular | 1.73 | [0.00] |
|  | Systematic uncertainties (NOTE 2) | Value |
| 26 | Systematic error related to beam peak search | [0.5] |
| Total measurement uncertainty | Value |
| DL AWGN absolute power expanded uncertainty (1.96σ - confidence interval of 95 %) [dB] | [5.25] |
| NOTE 1: The analysis was done only for the case of operating in-band, non-CA.NOTE 2: In order to obtain the total measurement uncertainty, systematic uncertainties have to be added to the expanded root sum square of the standard deviations of the Stage 1 and Stage 2 contributors.NOTE 3: Applies to the system which has a structure of mechanical feed antenna positioning.NOTE 4: Value based on procedure defined in Annex D.2 of TR 38.810 [13] for Quiet Zone size less or equal to 30 cm.NOTE 5: The values in this table have been derived for DL powers above and equal to REFSENS. The values might need to be revisited for power levels below REFSENS |

* + Proposal 2: TBA
* Recommended WF
	+ Agree Proposal 1 as the baseline

### Sub-topic 4-3: TPs to TR 38.871

**Issue 4-3-1: Are TPs for MU in R4-2320408 and R4-2320389 agreeable?**

* Proposals
	+ Proposal 1: Yes
	+ Proposal 2: No, specify the comments if any
* Recommended WF
	+ To combine TPs 2320408 and R4-2320389

# Topic #4: Conclusion of SI

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2320390 | Qualcomm  | **TP to TR 38.871 on draft summary and editorial changes** |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 5-1: Conclusion of SI

*Sub-topic description:*

*Open issues and candidate options before meeting:*

**Issue 5-1-1: Is TP to TR 38.871 on draft summary and editorial changes agreeable?**

* Proposals
	+ Proposal 1: Yes
	+ Proposal 2: No, specify the comments if any
* Recommended WF
	+ TBD

**Issue 5-1-2: 3GPP TR 38.871 v0.6.0**

* Recommended WF
	+ For email approval