**3GPP TSG-RAN WG4 Meeting #94-e R4-20xxxxx**

**Electronic Meeting, Feb.24th – Mar.6th 2020**

**Agenda item:** 10.2.1

**Source:** CAICT

**Title:** Email discussion summary for RAN4#94e\_#97\_FS\_NR\_MIMO\_OTA\_test

**Document for:** Information

# Introduction

In the last RAN4 meeting, the actions for finalizing FR2 MIMO OTA were agreed in the WF [1]:

*Actions for finalizing FR2 MIMO OTA：*

* + *Channel model and Quality of Quiet Zone validation procedures:*
		- *TPs to finalize FR2 channel model validation procedure and quiet zone validation procedure*
	+ *3D MPAC calibration and test procedures:*
		- *TPs to finalize calibration and test procedures*
	+ *MU assessment*
		- *Define key elements and descriptions*
	+ *Study feasible SNR ranges for 3D MPAC*
		- *Provide FR2 SNR analysis based on whole 3D-MPAC system*
	+ *UE Direction of Travel for FR2 channel models*
		- *Make decision on DoT for FR2, based on the same approach for FR1 in [R4-1915060]*
	+ *CE vendors align on channel model tap resolution*
		- *Initial phase definition of channel model shall be studied*

In the RAN plenary meeting, the NR MIMO OTA SI was approved to extend to March 2020 [2]. This is the last RAN4 meeting to finalize all the FR2 MIMO OTA open issues.

List of candidate target of email discussion for 1st round and 2nd round

* 1st round: make decision on the open issues for FR2 NR MIMO OTA, update the TPs based on the comments.
* 2nd round: finalize the content of TPs for each open issue of FR2 MIMO OTA.

# Topic #1: FR2 test methods

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000505 | Qualcomm Incorporated | Proposal: Capture SNR upper bound values in Table 2 and attached calculator in TR38.827.**Table 1: SNR upper bound value for MIMO OTA with measurement distance of 0.75m**

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|  | **Channel Bandwidth** | **Maximum SNR with 1 probe** | **Maximum SNR with 8 probe3** |
| Multi-band UE (Note) | 100 MHz | [24.4dB] | [33.4dB] |
| Note 1: For ∑MBp from TS 38.101-2 Table 6.2.1.3-4 allow up to 2 dB.Note 2: The SNR is calculated based on the UE noise floor derived by REFSENS.Note 3: Compared with 1 probe, 8 probes can reach up to 9dB gain. |

Observation 1: The SNR upper bound for MIMO OTA with 8 probes is 33.4dB for 100MHz channel bandwidth. |
| R4-2000894 | CAICT | TR38.827 v1.1.0 NR MIMO OTA |
| R4-2000896 | CAICT | TP to TR 38.827 v1.1.0 on FR2 preliminary MU assessment |
| R4-2000897 | CAICT | TP to TR 38.827 v1.1.0 on general part |
| R4-2002073 | Spirent Communications | Proposal 1: Agree on 6 probes, 3 per scaled channel model, in FR2 MPAC MIMO OTA to be minimum number of probes.Proposal 2: Use table 1 to place probe 1 in chamber for each channel model. Adjacent probes will be placed by optimizing the locations and weights.Proposal 3: Adopt the table 2 probe locations with target PSP values.Observation 1: CDL-A InO is single cluster model, while CDL-C UMi has two significant clusters. |
| R4-2002074 | Spirent Communications | TP for System Design and Probe layout for FR2 MPAC MIMO OTA |
| R4-2002100 | Spirent Communications | Proposal 1: Adopt the simplified two step validation technique to FR2 channel model validation. |
| R4-2002102 | Spirent Communications | TP for Verification of FR2 channel models in MPAC system |
| R4-2002365(rev of R4-2002102) | Spirent Communications | Revised TP for Verification of FR2 channel models in MPAC system |
| R4-2002117 | ROHDE & SCHWARZ | Proposal 1: Whether to utilize a DFF or IFF system is left up to the system implementation. Only the figure of merit and measurement uncertainty are defined.Proposal 2: Specific system implementation details like the antenna position and number of antennas are defined separately for each system type (DFF/IFF).Observation 1: IFF are preferred over DFF systems for RF/RRM/Demod testing.Observation 2: For RF testing IFF systems provide smaller uncertainties than DFF systems and a higher SNR range.Observation 3: It is only important for a test system to meet the specified figure of merit. |
| R4-2002151 | Keysight Technologies UK Ltd | TP to TR38.827: FR2 MIMO OTA Calibration and Test Procedures |
| R4-2002152 | Keysight Technologies UK Ltd | TP to 38.827 to introduce EUT orientations for FR2 |
| R4-2002153 | Keysight Technologies UK Ltd | Observation 1: For a single-probe setup, the maximum achievable SNR is ~17.4dB.Observation 2: The SNR increase due to the multi-probe configuration for the simplified assumption used in this contribution is ~3.5dB.Observation 3: The estimated maximum achievable SNR for the N probe system with the assumptions made in this contribution is ~20.9dB. |
| R4-2002154 | Keysight Technologies UK Ltd, Spirent Communications | Observation 1: The PSP simulations between the two CE vendors that have provided PSP simulations in the past are aligned, with some additional comparisons in progressObservation 2: Beamforming assumptions are aligned between the two CE vendors that have provided PSP simulations in the past |
| R4-2002xxx(rev of R4-2002154) | Keysight Technologies UK Ltd | **Observation 1: The PSP simulations between the two CE vendors that have provided PSP simulations in the past are aligned****Observation 2: Beamforming assumptions are aligned between the two CE vendors that have provided PSP simulations in the past** |
| R4-2002155 | Keysight Technologies UK Ltd | Pending proposals |
| R4-2002xxx (rev of R4-2002155) | Keysight Technologies UK Ltd | **Observation 1: The 6 probes are spread in a sector of 48° in the azimuth domain and around 14° in the elevation domain.****Observation 2: The mean PSP% obtained for InO CDL-A is >87% for a system with range length of 1m.****Observation 3: The mean PSP% obtained for UMi CDL-C is > 89% for a system with range length of 1m****Proposal 1: For the NR FR2 MIMO OTA 3D MPAC system, utilize a total of 6 probes****Proposal 2: Adopt the 6-probe NR FR2 MIMO OTA 3D MPAC probe configuration tabulated in Table 1** |
| R4-2002157 | Keysight Technologies | Observation 1: For the reasonable measurement parameters required for the estimation, the corresponding measurement times could be large. Therefore, it is crucial to define suitable measurement parameters that are efficient in terms of time and the estimation accuracy is not compromised.Proposal 1: Further investigation is required for defining suitable measurement parameters. Feedback and proposals are welcomed. |

## Open issues summary

### Sub-topic 1-1 FR2 probes layout

**Issue 1-1-1: FR2 probes layout for 3D-MPAC**

* Proposals
	+ Option 1: 6 probes approach:
		- Proposal 1: Agree on 6 probes, 3 per scaled channel model, in FR2 MPAC MIMO OTA to be minimum number of probes.
		- Proposal 2: Use table 1 to place probe 1 in chamber for each channel model. Adjacent probes will be placed by optimizing the locations and weights.
		- Proposal 3: Adopt the table 2 probe locations with target PSP values.
	+ Option 2: updated proposals in R4-2002155
* Recommended WF
	+ TBA

**Issue 1-1-2: feasible SNR ranges for 3D MPAC**

* Proposals
	+ Option 1: The SNR upper bound for MIMO OTA with 8 probes is 33.4dB for 100MHz channel bandwidth.
	+ Option 2: update proposal based on the late contribution in R4-2002153
* Recommended WF
	+ TBA

**Issue 1-1-3: New proposed system for FR2 MIMO OTA**

* Proposals
	+ Proposal 1: Whether to utilize a DFF or IFF system is left up to the system implementation. Only the figure of merit and measurement uncertainty are defined.
	+ Proposal 2: Specific system implementation details like the antenna position and number of antennas are defined separately for each system type (DFF/IFF).
* Recommended WF
	+ New system without clear studied channel model generation, validation and test procedure, is not recommended at this stage

### Sub-topic 1-2 Calibration and validation

**Issue 1-2-1: calibration and test procedures**

* Proposals
	+ Check and refine text proposals in R4-2002151
* Recommended WF
	+ Update and finalize the calibration and test procedure based on the initial proposals in R4-2002151

**Issue 1-2-2: Channel model and Quality of Quiet Zone validation procedures**

* Proposals
	+ Option 1: Adopt the simplified two step validation technique to FR2 channel model validation. In R4-2002102
	+ Option 2: Joint Power-Angle-Delay validation approach for FR2. In R4-2002157
* Recommended WF
	+ Make decision on how to validate the channel models, and finalize the test proposals in the 2nd round.

**Issue 1-2-3: MU assessment**

* Proposals
	+ FR2 preliminary MU assessment in TP R4-2000896
* Recommended WF
	+ Update the MU assessment elements based on the Test Proposals in R4-2000896. Finalize the text proposals in the 2nd round.

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| Keysight | Sub topic 1-1: * Issue 1-1-1: We believe Spirent’s approach of selecting 6 probes (3 for CDL-C and 3 for CDL-C) can be further optimized. As outlined in the revised contribution of 2155, better performance can be achieved with a 6 configuration where all probes are used for each channel model. Additionally, technical concerns with the contribution 2073 will be outlined separately.
* Issue 1-1-2: As outlined in 2153 (late contribution), we believe the achievable SNR in 0505 is overestimated by setting the “Allowed noise increase dB” to 20 instead of 1 (compared to TR38.810). Additionally, the SNR increase of 9dB from 1 probe to 8 probes assumes omnidirectional UE antennas. An SNR increase of ~3.5dB (based on our simple assumption in 2153) for a multiprobe setup seems more realistic. At this point, we recommend highlighting the achievable SNR values for information and not include them in the TR38.827.
* Issue 1-1-3: MIMO OTA in the past did not consider FF conditions as an underlying requirement for MPAC systems; instead, the range length was determined based on the realization of channel models. This is different for the RTS method where the antenna pattern had to be measured in the far-field. In RAN4#90bis, it was decided "Number of probes and placement of probes for MPAC system for FR1 and FR2 have to be standardized in the MIMO OTA SI." per WF R4-1904160. It is therefore proposed to stick with this agreement to avoid different implementations resulting in different results.

Sub topic 1-2:* Issue 1-2-1:
* Issue 1-2-2: In Section 7.4.1.6 of 2102, it is proposed to perform the PSP validation based on rms spatial correlation error. It was previously agreed to use PSP instead of correlation error. While we can agree with the other additions, we cannot agree with Section 7.4.1.6.
* Issue 1-2-3:

Others: |
| Qualcomm | Sub topic 1-1: * Issue 1-1-1: In option 1, the layout is derived under the assumption of 4\*4 UE antenna. If UE has other antenna configurations e.g., 4\*1 or 4\*2, will different antenna configurations lead to different layout? For both option 1 and option 2, is it possible to further optimize PSP with different configurations? Or lead to different probe layout?
* Issue: 1-1-2: The achievable SNR for single probe in paper R4-2002153 reuses the calculation from TR38810 which is under the assumption that artificial noise is transmitted from TE (to make sure SNR difference between reference point and baseband is less than 1dB). While in MIMO OTA, the noise-limited condition was agreed. Therefore, we need re-calculate the achievable SNR under the noise-limited condition. In our paper R4-2000505,20dB instead of 1dB is used to emulate the test condition that there is no artificial noise from TE. For the SNR gain due to the multi-probe, we agree 9dB is an ideal estimation. The actual gain would depend on channel model. We could capture the single probe achievable SNR and multi-probe gain range, e.g. 3.5-9dB in TR.
* Issue 1-1-3: A clarification question: Is it possible to introduce the alternative test system in WI phase considering this is proposed in this stage of SI?

Sub topic 1-2:Issue 1-2-2: Why PSP is measured by Omnidirectional antenna? But other parameters (PDP, power, Doppler, XPR) is measured by directive antenna? |
| MediaTek | **Issue 1-1-3: New proposed system for FR2 MIMO OTA**→ We support “Proposal 1” (#Whether to utilize a DFF or IFF system is left up to the system implementation. Only the figure of merit and measurement uncertainty are defined.) |
| MVG | Sub topic 1-1: * Issue 1-1-1:
* Issue 1-1-2:
* Issue 1-1-3: Agree with KS’s view. It was already agreed that an outcome of the SI must be to come up with a baseline system setup. Moreover, details of the system setup implementation must be provided in terms of number of probes, probes' locations, and range length. The latter was already agreed to be 0.75cm without considering any FF criteria. This issue seems to be conflicting with previous agreement

Sub topic 1-2:* Issue 1-2-1: block diagram in Figure 1 doesn't mention about any radio head. The latter will be needed to be connected to each probe element since CE and RCT are up to 6GHz. Further comments are below.
* Issue 1-2-2: Step 1 would imply using a directive antenna. Are there any requirements on the directive antenna in terms of directivity and half power beamwidth? We think the HPBW of the reference antenna should be at least the same as the sectors in azimuth and elevation where the probes are located.
* Issue 1-2-3: Row 5 -> CE uncertainty term related with absolute level, stability and linearity. Further comments are below.

Others: |
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### CRs/TPs comments collection

*NR MIMO OTA is a close-to-finalize SI, suggest to focus on finalizing the text proposals for TR.*

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| **CR/TP number** | **Comments collection** |
| R4-2000894 | Company A |
| Company B |
|  |
| R4-2000896 | MVG: Row 5 -> CE uncertainty term related with absolute level, stability and linearity CEs are designed with circuitry operating in the sub-6GHz band. In order for them to be used at mmWave, the so called radio head (up,and downconverter) must be added to each output before feeding the probe with a mmWave signal. Based on it, is the MU due to the radio head included in row5 uncertainty contributor? If it is the case, does it mean that on CE manufacturer datasheet the uncertainties related with the radio head are detailed? If CE data sheet would include radio head uncertainty, this must be specified in the description of the uncertainty term. |
| Company B |
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| R4-2000897 | Keysight: * suggest to add InO in Section 3.3.

suggest to reword "The test zone size is 20cm for both FR1 and FR2 MIMO OTA testing" in Section A.4 to "The test zone size is 20cm for both FR1 and FR2 MIMO OTA testing for PC3 UEs; test zone sizes for other power classes are FFS." |
| Company B |
|  |
| R4-2002074  | Keysight: We believe Spirent’s 6 probe locations can be further optimized, see revised contribution of 2155. We have some technical feedback on 2073 which is the baseline for 2074. Double checking the results in Figure 2 (single probe) showed some discrepancies in PSP simulations, especially in CDL-C. * InO CDL-A: KS simulations result in a PSP of 80.1% (Spirent: 81.61%)
* UMi CDL-C: KS simulations result in a PSP of 77.5% (Spirent: 84.03%).

Spirent’s proposed approach to calculate PSP in “totally in 7 positions in test volume, 6 on the boundaries and one in centre” is a good starting point but based on our experience, more points need be sampled within the volume and we would have expected the CDF curves with only 7 points to be more discrete. The CDL-A results in Figure 3 show worse performance for 8 probes which is unexpected. The max PSP values of ~98% in Figure 3 seem too high. Comparison PSP% results with the Spirent’s proposed 6 probe locations and the KS 6 probe locations with finer discretization of test points (same as outlined in revision of 2155) are shown below for CDL-Aand for CDL-C |
|  Qualcomm: The layout is derived under the assumption of 4\*4 UE antenna. If UE has other antenna configurations e.g., 4\*1 or 4\*2, will different configurations lead to different layout? Is it possible to further optimize PSP with different configurations? |
|  |
| R4-2002365 | Keysight: In Section 7.4.1.6 of 2102, it is proposed to perform the PSP validation based on rms spatial correlation error. It was previously agreed to use PSP instead of correlation error. While we can agree with the other additions, we cannot agree with Section 7.4.1.6 |
|  Qualcomm: Why PSP is measured by Omnidirectional antenna? But other parameters (PDP, power, Doppler, XPR) is measured by directive antenna? |
| MVG: Step 1 would imply using a directive antenna. Are there any requirements on the directive antenna in terms of directivity and half power beamwidth? We think the HPBW of the reference antenna should be at least the same as the sectors in azimuth and elevation where the probes are located. |
| R4-2002151 | MVG: block diagram in Figure 1 doesn't mention about any radio head. The latter will be needed to be connected to each probe element since CE and RCT are up to 6GHz. How to deal with that? Also in the calibration process there is no mention about radio head. Do this external HW need to be calibrated?For the TP procedure and mainly for the first step where setup must be verified. It looks like the lab would be required to verify channel environment any time before starting a TP vs Power measurement. Can you clarify on it? |
| Company B |
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| R4-2002152 |  Qualcomm: With different constant density implementations, the test results might be different. Do we need to specify the implementation approach for constant density? |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

*Recommendations on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

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| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #2: FR2 performance metrics and channel model

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000080 | Qualcomm Incorporated | Observation 1: The current static test mechanism cannot properly filter out UEs that do not proactively readjust their beams with a small delay.Proposal 1: A scenario where at least UE orientation is rotating over time during a test iteration should be considered for dynamic geometry-based MIMO OTA Testing. Other scenarios are FFS.Proposal 2: For UE orientation rotation-based tests, the following aspects will be discussed.* A common framework for RRM/RLM and/or Demod tests
* How to implement UE orientation rotation in 3D MPAC system
* How to define performance requirements
* Whether and how to cope with many different UE implementations especially in terms of beam pattern
 |
| R4-2000272 | Samsung | Observation 1: different spherical coverage percentile of different power classes, different UE form factors, and limitation of testability SNR range will lead to varying exception points quantity.Observation 2: exception points issue can be avoided by specifying the test points for TRMS calculation in a unified manner for all power classes.Proposal 1: define FR2 MIMO OTA performance metric as the averaging of the measured sensitivity at the test points within “MIMO OTA spherical coverage”, where the “MIMO OTA spherical coverage” means the spherical coverage in terms of MIMO OTA sensitivity rather than EIS. |
| R4-2000798 | MediaTek Beijing Inc. | Proposal1: Define fixed initial phase pattern(s) for sub-paths, for FR1 and FR2 respectively.Proposal2: Exact fixed initial phase pattern(s) is FFS, for FR1 and FR2 respectively. |
| R4-2000895 | CAICT | The sensitivity value at the [80th] percentile of the CCDF of the all the recorded data measured over the full sphere around UE is defined as the FR2 MIMO OTA requirement. |
| R4-2002069 | Spirent Communications | **Observation 1**: Thresholding of 30dB significantly reduces the number of taps to 1 tap in InO CDL-A, and three taps for UMi CDL-C.**Proposal 1**: Adopt an approximate 30 dB threshold to limit the number of Spatially filtered taps**Proposal 2 and 3:** Select improved DoT values of: InO CDL-A, DoT = 135 deg, UMi CDL-C, DoT = 100 deg, for use at all FR2 frequencies. |
| R4-2002364(rev of R4-2002069) | Spirent Communications | **Observation 1: Thresholding of 30dB significantly reduces the number of taps to 1 tap in InO CDL-A, and three taps for UMi CDL-C.****Proposal 1: Adopt an approximate 30 dB threshold to limit the number of Spatially filtered taps****Proposal 2 and 3: Select improved DoT values of: InO CDL-A, DoT = 112.51 deg, UMi CDL-C, DoT = 74.11 deg, for use at all FR2 frequencies.** |
| R4-2002070 | Spirent Communications | TP for DoT selection for FR2 channel model |
| R4-2002149 | Keysight Technologies UK Ltd | TP for Clarification of Beam Forming Weights |
| R4-2002150 | Keysight Technologies UK Ltd | Proposal 1: Keep the random initial phases as defined in [1] |
| R4-2002156 | Keysight Technologies UK Ltd | Observation 1: The number of spatial samples defined in wavelength becomes small as the test frequency decreases.Proposal 1: For the lowest four test frequencies, i.e., 617, 722, and 836.5 and 1575.42 MHz, adopt a spatial as λ/15 and λ/4 for first the quadrant of test zone circumference (270◦-180◦) and the remaining three quadrants, respectively.Proposal 2: For the highest five test frequencies, i.e., 1800, 2132.50, 2450, 3600 and 4700 MHz, adopt the spatial sampling as λ/10 and λ/2 for first quadrant of test zone circumference (270◦-180◦) and the remaining three quadrants, respectively, i.e., same as proposed in [2] |

## Open issues summary

### Sub-topic 2-1 Performance metrics

**Issue 2-1: Performance metrics**

* Proposals
	+ Option 1: define FR2 MIMO OTA performance metric as the averaging of the measured sensitivity at the test points within “MIMO OTA spherical coverage”, where the “MIMO OTA spherical coverage” means the spherical coverage in terms of MIMO OTA sensitivity rather than EIS.
	+ Option 2: The sensitivity value at the [80th] percentile of the CCDF of the all the recorded data measured over the full sphere around UE is defined as the FR2 MIMO OTA requirement.
* Recommended WF
	+ TBA

### Sub-topic 2-2 Channel models

**Issue 2-2-1: Direction of Travel**

* Proposal

The UE travelling direction (**v, **v) are as follows for FR2:

* (121.51°,90°) for InO CDL-A channel model
* (74.11°,90°) for UMi CDL-C channel model
* Recommended WF
	+ TBA

**Issue 2-2-2: initial phases for channel models**

* Proposals
	+ Option 1: Define fixed initial phase pattern(s) for sub-paths, for FR1 and FR2 respectively. Exact fixed initial phase pattern(s) is FFS
	+ Option 2: Keep the random initial phases as defined in [1]
* Recommended WF
	+ TBA

**Issue 2-2-3: Beam Forming Weights**

* Proposal
	+ Include the proposed changes to the channel model coefficient equations in TR38.827. in R4-2002149
* Recommended WF
	+ TBA

### Sub-topic 2-3 others

**Issue 2-3-1: spatial sampling points for FR1 spatial correlation validation**

* Proposals
* Proposal 1: For the lowest four test frequencies, i.e., 617, 722, and 836.5 and 1575.42 MHz, adopt a spatial as λ/15 and λ/4 for first the quadrant of test zone circumference (270◦-180◦) and the remaining three quadrants, respectively.
* Proposal 2: For the highest five test frequencies, i.e., 1800, 2132.50, 2450, 3600 and 4700 MHz, adopt the spatial sampling as λ/10 and λ/2 for first quadrant of test zone circumference (270◦-180◦) and the remaining three quadrants, respectively, i.e., same as proposed in [2]
* Recommended WF
	+ TBA

**Issue 2-3-2: FR2 dynamic testing**

* Proposals
* Proposal 1: A scenario where at least UE orientation is rotating over time during a test iteration should be considered for dynamic geometry-based MIMO OTA Testing. Other scenarios are FFS.
* Proposal 2: For UE orientation rotation-based tests, the following aspects will be discussed.
* A common framework for RRM/RLM and/or Demod tests
* How to implement UE orientation rotation in 3D MPAC system
* How to define performance requirements

Whether and how to cope with many different UE implementations especially in terms of beam pattern

* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Keysight | Sub topic 2-1: * Issue 2-1:
	+ Option 1: We believe all measurements and not just the N best should be considered for performance requirements
	+ Option 2: what is the technical justification for [80]%? Should we maybe align the percentage with EIS spherical coverage percentage? Is the same [80]% percentage suggested for all PCs?

Sub topic 2-2:* Issue 2-2-1: While we agree with the Text proposal, we have concerns with P1 from 2069: “Proposal 1: Adopt 30 dB threshold for CDL-A to limit the number of spatially filtered taps.” and cannot agree with this proposal as is.
* Issue 2-2-2: The carrier frequency of simulations in 798 is not mentioned and needs to be specified. For an assumed frequency of 3GHz, the number of fading conditions is approximately 1, 42, and 416 in the cases listed in the table 1. Among these, both 1 and 42 samples are evidently not sufficient and therefore show the very large PDP variance. With >400 samples, it is shown that the PDP variance is better. Simulation/measurement times for LTE MPAC OTA testing were discussed in R4-111381 and at minimum 1000 (or 100) wavelengths were recommended. In LTE the measurement time was 20s.

The channel models defined in TR 38.827 are fading channel models. Fading is modelled as a random process with certain statistical characteristics. These are actualized only with a sufficient number of samples of the process. The MTK contribution presents PDP variation between random seeds. How about computing PDP and other deviations from the specified statistics. Fixing the random seed would not help in this if the number of samples is very small, at least if not hand picked specifically for certain simulation lengths.* Issue 2-2-3:

Sub topic 2-3:* Issue 2-3-1:
* Issue 2-3-2: Keysight supports at least one scenario of dynamic geometry-based MIMO OTA Testing

Others: |
| Qualcomm | Sub topic 2-1:* Issue 2-1: In general, compared with FR1, the rank condition and MIMO throughput in FR2 is highly related with test direction. Before we decide the performance metric, we might need to consider how many test points are valid to derive the performance which would impact TRMS requirements. We suggest to further decide the FR2 performance metric in WI phase with assist of test results or simulation results.
	+ For option 1, with top Nth percentage MIMO sensitivity, how many test points can satisfy the rank 2 test conditions and target MIMO throughput e.g. 70% or 90%? This would impact the selection through potions and the final TRMS requirements.
	+ For option 2, the target percentile, i.e. [80th] in TP, should be based on the power class. And similar comments as option 1. Without test results or simulation results, it is difficult to decide the performance metric. We suggest removing FR2 performance metric in TR and further discussing in WI phase.

Sub topic 2-2:Issue 2-3-2: RAN4 should clarify if #94-e meeting is the last meeting for MIMO OTA SI. If yes, we should capture proposal 1 in TR so that proposal 2 can be further discussed. |
| MediaTek | Issue 2-1: → We support Option 2. Compared to Option 1, we think Option 2 can mitigate the measurement uncertainty due to beam peak is captured or not, while the 3D scan test grid is [36] with constant density scanning.Issue 2-2-2: → We support Option 1.Issue 2-3-2: → Based on working model, we prefer to converge FR2 static testing issues firstly. |
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### CRs/TPs comments collection

*NR MIMO OTA is a close-to-finalize SI, suggest to focus on finalizing the text proposals for TR.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2000895 | Qualcomm: See our comments in Issue 2-1. We suggest removing FR2 performance metric in TR and further discussing in WI phase |
| Company B |
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| R4-2002070 | Company A |
| Company B |
|  |
| R4-2002149 | Company A |
| Company B |
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## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Refrenece

1. R4-1916174, WF on FR2 MIMO OTA, CAICT, Spirent, RAN4#93, Nov. 2019
2. Meeting Report, RAN#86, Dec. 2019