[RAN95e-RAN4-R18Prep-05] - Version 0.0.4
RAN

3GPP TSG RAN Meeting #95-e RP-220023

Electronic Meeting, March 17 - 23, 2022

Agenda Item:

Source: RAN Vice-Chair (AT&T)

Title: Moderator's summary for discussion [RAN95e-RAN4-R18Prep-05] RAN4 Testing Enhancements

Document for: Information & Decision

The discussion in this thread covers [RAN95e-RAN4-R18Prep-05] RAN4 Testing Enhancements. Deadlines and NWM organization are based on the guidelines provided by the RAN Chair in RP-220003.

1 Initial Round

The initial round will focus on providing feedback on the potential projects identified in the outcome of the email discussion in RP-212682 and to summarize the corresponding objectives.

The goal is to get to a clear and limited scope that can be accomplished within the TU budget defined by the RAN Chair and RAN WG Chairs.

1.1 Collection of company views

1.1.1 General high-level views

For the topics/areas identified below, please provide any general high-level views. In addition, the moderator proposes to handle any eventually agreed FR2 OTA testing areas in the same study item with the exception of the EMC enhancement. A separate feedback form is available below concerning this proposal.

Feedback Form 1: General high-level views

1 – Guangdong OPPO Mobile Telecom. For clarification of the guidance above "*moderator proposes to handle any eventually agreed FR2 OTA testing areas in the same study item*", does this mean only one FR2 OTA testing SI or WI will be introduced in Rel-18? Does this include the FR2 MIMO OTA WI which might not be able to complete in Rel-17 and continue in Rel-18?
2 – QUALCOMM JAPAN LLC.

OTA testing is a very important area and 3GPP has to deliver testing solutions for the industry. It is also an area that can delay the deployment of advanced features if the testing solutions do not keep up with the development of the latest features. For example, there are many proposals for FR2 RRM enhancements that quote performance issues or bottlenecks but no test or field data has been shown to support the claims. Enhanced testing methods would greatly help in device development and identifying performance issues without having to do complicated field testing.

3 – MediaTek Inc.

We have couple of general views:

1) Test method development shall base on outcome of core requirement.

2) Test method development shall be step-by-step, from basic one to advanced one.

3) Test time (reduction) is important and shall be considered.

4) Make WID (objectives) clear about "FR1/FR2-1/FR2-2", "SISO/MIMO OTA", and "simultaneous/switching reception" would be helpful.

4 – SAICT

A clarification question about "to handle any eventually agreed FR2 OTA testing areas in the same study item": we think the "eventually agreed FR2 OTA testing areas" only include the FR2 OTA testing areas in this discussion, i.e., 1.1.2, 1.1.3, 1.1.4, is our understanding correct?

5 – SAICT

It is beneficial to reuse the existing test setups/methodologies as much as possible.

6 – Intel Deutschland GmbH

The scope of Rel-18 FR2 test methods should be carefully controlled to ensure the work is completed in a timely manner. Therefore, we prefer to select up to 2 candidate objectives as the main direction of Rel-18 evolution.

7 – Apple Italia S.R.L.

We suggest to take the following testability areas into account for the Rel-18 package:

- FR1/EN-DC TRP/TRS work continuation (since the WI has a performance part, this should be considered in September)
- Expected conclusion of the currently ongoing FR2 test methodology enhancement study
- Multi-panel test methodology development

We would like to further discuss the scope of FR2 dynamic OTA proposals, with the understanding that the overall workload associated with this effort is quite large and to consider whether the multi-panel enhancement can be seen as a stepping stone toward dynamic OTA in a future release.

8 – TELECOM ITALIA S.p.A.

We share the view expressed by Mediatek and Intel. We should avoid "overtesting"

9 – Huawei Technologies France

Although enhanced OTA testing is attractive to the industry, the scope is so large for the available RAN4 TUs that we need to identify more valuable potential objectives.

Similar question as OPPO commented. Is it one FR2 OTA testing SI or WI will be introduced in Rel-18?

Should any eventually agreed FR2 OTA testing areas be handled in the same study item?

Which objectives will be included needs to be discussed first.

Feedback Form 2: Should any eventually agreed FR2 OTA testing areas be handled in the same study item?

1 – Guangdong OPPO Mobile Telecom.

No strong view, but it depends on the contents whether they are tightly connected or independent with each other. The main principle in our view is to facilitate discussion and efficient work in RAN4 rather than hard combine independent items into one SI or WI to make Rel-18 OTA package looks small.

2 – QUALCOMM JAPAN LLC.

How to group the items can be discussed after it is clear which items can be approved and what is the scope. In principle, testing for FWA devices could be kept separate from Dynamic OTA testing and multi-panel testing as the targets are different and the FWA testing methodology is an extension of the existing test methodology for PC3.

3 – MediaTek Inc.

1) No strong view on how many study item(s) before we have clear agreed objectives.

2) Echo OPPO's comment "The main principle in our view is to facilitate discussion and efficient work in RAN4 rather than hard combine independent items into one SI or WI to make Rel-18 OTA package looks small."

4 – China Telecommunications

No strong view, and depends on how many objectives will be included.

5 – SAICT

Share similar views with OPPO and Qualcomm. How to group the areas should depend on whether they are related and suitable to be in the same SI. It can be further discussed after it is clear which areas can be approved and what are the scopes.

6 – Intel Deutschland GmbH

We agree with the moderator's proposal that all agreed FR2 OTA testing areas be handled in the same study item. A separate item can be considered for EMC testing enhancements.

7 – Apple Italia S.R.L. We anticipate a new Rel-18 WI on FR1/EN-DC TRP/TRS to be initiated upon the conclusion of the Rel-17 work (in September), and we recommend reusing the same TR and TS as we continue to develop the associated requirements. If the only test methodology enhancement we agree is related to multi-panel Rx, then it makes sense to keep the related objective together with the multi-panel Rx WID. If we end up considering multiple FR2 test methodology enhancements, then it makes sense to bundle the work into a testability umbrella.
8 – Samsung Electronics Co. The leftover issues of ongoing Rel-17 SISO OTA and MIMO OTA which are supposed to be completed by Sep 2022 shall be discussed seperately later in Sep RAN plenary. Whether to include the leftover issues in the same SI shall be also discussed later. For multi-panel test method, we also prefer to include in WI with core requirements.
9 – Huawei Technologies France Which objectives will be included needs to be discussed first.

1.1.2 Dynamic OTA testing method for FR2-1

The following summarized the way forward for the proposed objective for Dynamic OTA testing method for FR2-1 at the outcome of the email discussion in RP-212682.

- Dynamic OTA testing method for FR2-1
    - No intention to introduce the new RAN4 requirements in Rel-18
    - Take the test method and outcome in Rel-17 MIMO OTA WI into account

NOTE: to agree on the objectives for dynamic OTA testing method, further discussions on the benefit of dynamic OTA testing method compared to the existing multi-AoA tests and beam management tests are needed.

NOTE: to stabilize the objectives, further discussion on whether Rel-17 MIMO OTA will impact the work for dynamic OTA testing is needed

In the initial round, please provide your views and/or recommendations for a detailed set of objectives for Dynamic OTA testing method for FR2-1. Please consider the recommendations and way forward identified above.

Feedback Form 3: Dynamic OTA testing method for FR2-1

1 – QUALCOMM JAPAN LLC.

The detailed objectives were proposed already during the Rel.17 package discussion as follows:

WI objectives:

The objective of this Study Item is to define end-to-end testing methodology for the verification of FR2 NR UEs performance in a dynamic environment. The test methodology for multi-panel UE should also be considered.

The study proceeds within the following scope:

- For the following device types:

- Smartphone is the first priority.

- Other UE types are not precluded for discussion as a second priority

- Identify test scenarios:

- Stage 1: UE rotation-based scenario

o Change UE rotation during the testing

o Study the feasibility of reusing 3D-MPAC system

- Stage 2: UE travel-based scenario

o Change both UE rotation and beams from gNB(s) during the testing

o Study the enhancement on 3D-MPAC system

o Up to 2 beams is the first priority

- Identify each test scenario with proper justification and avoid unnecessary overlapping test cases.

o Test metric should be based on the current core/performance requirements.

Note: RAN4 will not start Stage 2 before Stage 1 is completed.

- The test methodology shall include both NSA and SA.

o For setups intended for measurements of UE characteristics in non-standalone (NSA) mode, an LTE link antenna setup is used to configure the NR link

- Using the channel models defined in TR38.901 as the starting point to develop dynamic environment

- Channel model framework in TR38.827 should be taken as the basis

- Study whether and which parameters for channel mode defined in TR38827 will have big impact on UE performance and could be reused for dynamic testing.

- Study the applicable test methodology verification procedures

- Study the preliminary uncertainty budget for the methodology

- The uncertainty budget in TR38827 should be the basis for developing the uncertainty.

- Study the additional uncertainty due to the dynamic environment

- The test methodology shall initially assume a black box approach to ensure the test of multi-panel Tx/Rx UE is covered.

- The dynamic environment tests shall take the test system complexity and test time into account to keep the whole test costs within a reasonable level.

- This SI not to introduce the new RAN4 requirements in Rel-18.

During this study item, ongoing communication with 3GPP RAN WG5, CTIA OTA Working Group (MOSG, 5G mm-wave OTA Sub-Working group and MUSG), and CCSA TC9 WG1 shall be maintained to ensure industry coordination on this topic.

The objectives can be further refined as needed. One important aspect is that the methodology/test setup for multi-panel reception should also be considered such that a unified testing method/test setup can be developed. This should greatly with the economics of OTA testing.

2 – Guangdong OPPO Mobile Telecom.

Ok with the contents proposed by QC.

3 – MediaTek Inc.

1) "Dynamic MIMO OTA" and "simultaneous multi-panel reception" shall be decoupled, because each of themselves even related to other SI/WI, respectively.

2) "Dynamic MIMO OTA" shall take the test method and outcome in Rel-17 (static) MIMO OTA WI into account.

3) (Static) MIMO OTA only consider "**1** strongest transmitting beam is generated from BS", not **2** beams. "Dynamic MIMO OTA" shall follow current ongoing (static) MIMO OTA. i.e. "Up to **1** beams is the first priority"

4) Support below objectives:

- "Study the feasibility of reusing 3D-MPAC system"
- "Identify each test scenario with proper justification and avoid unnecessary overlapping test cases."
- "Test metric should be based on the current core/performance requirements."
- "RAN4 will not start Stage 2 before Stage 1 is completed."
- "The dynamic environment tests shall take the test system complexity and test time into account to keep the whole test costs within a reasonable level."

4 – China Telecommunications

In general, we support to include Dynamic OTA testing method for FR2-1 in RAN4 R18 package, with the purpose of guaranteeing FR2-1 UE performance/requirements in mobility and rotation status.

5 – SAICT

We basically support to study dynamic OTA testing method for FR2-1 in R18 without introducing new RAN4 requirements. The test method and outcome in R17 NR MIMO OTA WI shall be taken into account. It is beneficial to reuse the existing test setup/methodology as much as possible.

6 – Nokia Corporation

It is our understanding that "dynamic OTA testing" is mainly an RRM/mobility testing improvement. The "dynamic" enhancement would be that the AoAs can change during the test, as well as the UE position/rotation.

For us this issue is very disjoint from the MIMO OTA testing enhancements.

But in general we are supportive for the proposal but would like to get more clarity which UE requirements are in scope of this testing package proposal.

7 – vivo Communication Technology

we are supportive for this study. For the detailed objectives, some aspects may need update:

1. In the 1st stage, for UE rotation-based scenario, reusing current channel models in 827 is preferred. Potential new FoM under rotation scenario can be studied. blocking issue during UE rotation and performance impacts can be studied and quantified.

2. In the 2nd stage, UE travel-based scenario, it would be good to further separate this stage into two subcases: case a) fixed UE position with new dynamic channel model; case b) rotated UE with new dynamic channel model. Case b would be more complex which needs more comprehensive studies. FFS whether UE beam lock function is needed.

3. Although from test methodology development perspective, single system can cover both dynamic MIMO OTA test case and multi-panel RF/RRM/Demod tests is nice to have, we think it would be good to decouple these discussions.

8 – China Mobile Group Device Co.

In general, we support to study Dynamic OTA testing for FR2-1 in RAN4 R18 without introducing new RAN4 requirements.

9 – Intel Deutschland GmbH

We are ok with the overall direction of this objective but consider it a lower priority compared to FR2 OTA testing of UEs with multi-panel reception and 4DL layer for FR2-1 and the Testing framework for FR2 FWA devices.

10 – Apple Italia S.R.L.

The proposals to introduce test scenarios which verify the UE's core and performance requirements in the presence of dynamically changing AoAs of signals represent a very large amount of scope, potentially impacting RF, RRM, and demodulation test setups.

If considering this test scenario for the verification of core requirements (RF or RRM), then we should follow the principle of defining test methodology following the core requirements. So far, we have seen proposals to define requirements for multi-panel UEs, which can be considered a logical stepping stone toward enabling the dynamic AoA in a future release. The dynamic OTA testing enhancement should only be targeted for future features or enhanced capability UEs (multiple panels) but would not introduce new test requirement for existing RRM core/perf requirements.

If considering this test scenario for the verification of demodulation requirements, perhaps as an enhancement of the FR2 MIMO OTA test setup, then we should also take care to complete the baseline building block, namely FR2 MIMO OTA in a static AoA condition.

In summary, we consider the multi-panel test setup to be a logical stepping stone toward dynamic OTA, and this can be considered in Rel-18. Whether there is enough TUs in RAN4 to also consider dynamicAoAs as a MIMO OTA enhancement should be further discussed once the current scope of FR2 MIMO OTA work, which also has a performance part, concludes successfully.

11 – Beijing Xiaomi Mobile Software

For the Dynamic OTA testing method for FR2-1. we see QC has proposed it as a study item and we agreee with that.

Since this is an additional test method comparing the current ”static” MIMO OTA test method, the applicability of this test method should not influence current RAN4 core and RRM requirement, for example. specific FoM of MIMO OTA is specified.

12 – TELECOM ITALIA S.p.A.

“Dynamic MIMO OTA” and “simultaneous multi-panel reception” shall be decoupled, because each of themselves even related to other SI/WI, respectively.

We have strong concern to include Dynamic OTA testing methods in Rel 18. It seems to be an over-testing scenario, which leads to increased testing time / more complex test environments with not clear benefits in terms of conformance verification.

The big risk is to delay UE availability in the market.

As a minimum a check with GCF should be done to verify the real need for this kind of testing.

13 – Huawei Technologies France

Compared to the existing multi-AoA tests and beam management tests, we do not see significant advantages for dynamic OTA testing, because what they all have in common is changing the AOAs in the UE coordinate system. Regarding the two scenarios including UE rotation and traveling, it is just an ideal assumption to simulate a real scenario. In fact, we know that dynamic OTA testing cannot replace field testing and only increase the complexity and cost of testing. Regarding dynamic performance testing, we think it makes more sense to do it in the field testing. Regarding benefits in device development, we agree, but this is implemented by the UE vendor itself and should not be specified in the specification.

1.1.3 FR2 OTA testing for UEs with multi-panel reception and 4DL layer for FR2-1

The following summarized the way forward for the proposed objective for FR2 OTA testing for UEs with multi-panel reception and 4DL layer for FR2-1 at the outcome of the email discussion in RP-212682.

- FR2 OTA testing for UEs with multi-panel reception and 4DL layer for FR2-1
    - Depend on the status of other Rel-18 RAN4-led items proposal where core requirements will be specified
    - How to handle multi-panel reception, i.e., assuming simultaneous multi-panel reception and/or multi-panel reception with switching between panels is decided depending on objectives to specify relevant core requirements in another potential WI proposal

In the initial round, please provide your views and/or recommendations for a detailed set of objectives for FR2 OTA testing for UEs with multi-panel reception and 4DL layer for FR2-1. Please consider the recommendations and way forward identified above.

Feedback Form 4: FR2 OTA testing for UEs with multi-panel reception and 4DL layer for FR2-1

1 – QUALCOMM JAPAN LLC.

This is clearly an area in which 3GPP testing is lagging and is becoming a bottleneck for more advanced FR2 MIMO features.

The following high level objectives should be considered:

- develop testing methodology for devices that can receive/transmit simultaneously from multiple angles
    - consider at least 2 angles for RF/demod testing
    - consider up to 4 angles for RRM testing with TE simultaneous transmission/reception from 2 angles at a time
- the test setup should cover any 2 angle pairs to the extent possible (the angular distance between any 2 angles that can be tested should be minimized)
- The test setup should enable testing of up to 4 Layers with dual polarization for each angle
- Smartphone form factor should be the first priority, other UE types should also be discussed as 2nd priority

As stated in the dynamic testing comments, the requirements for this test methodology/setup should be considered jointly with the dynamic OTA testing requirements to aim for a unified test setup.

2 – MediaTek Inc.

1) WID (objective) shall clearly clarify "**simultaneous** multi-panel reception" or "multi-panel reception with **switching** between panels"

2) Test method development shall base on outcome of core requirement. If there is no "necessary additional requirement for simultaneous multi-panel reception", there is no need on "testing methodology development". Moreover, we don't have clear picture on potential necessary additional requirement for "simultaneous multi-panel reception" currently, it would be too early to shape the testing methodology objectives in too detailed. Hence, we have **concerns** on these objectives:

- "develop testing methodology for devices that can receive/transmit simultaneously from multiple angles"
    - "consider at least 2 angles for RF/demod testing"

- ”consider up to 4 angles for RRM testing with TE simultaneous transmission/reception from 2 angles at a time”

- ”the test setup should cover any 2 angle pairs to the extent possible (the angular distance between any 2 angles that can be tested should be minimized)”

3) We understand the intention about ”considered jointly”, however, it would be too early to bundle ”dynamic MIMO OTA test” and ”simultaneous multi-panel reception OTA test”.

3 – China Telecommunications

We support this R18 work. Based on our understanding of previous discussion, both “simultaneous multi-panel reception” and “multi-panel reception with switching between panels” are to be covered.

4 – Nokia Corporation

We support both “FR2 OTA testing for UEs with multi-panel reception” and “FR2 OTA testing for 4DL layer”. Though, these two topics are separate from each other. Please also see our comments in [RAN95e-RAN4-R18Prep-02]; 4DL layers are also possible with a single panel.

We strongly agree with QC’s observation that OTA testing is lagging behind feature and requirement specification. In particular, demod is suffering from the current single direction, rank 2 keyhole channel OTA test setup.

Finally, we agree that the testing enhancement should be considered jointly with the requirements discussed in [RAN95e-RAN4-R18Prep-02].

5 – vivo Communication Technology

We support this work in Rel-18, and suggest the following objectives:

Investigate and specify the following aspects:

- The conclusions in TR38.810/884 should be the basis.
- Develop test methods for the following device types:
- Smartphone is the first priority
- Tablet
- Wearable device
- Fixed wireless access (FWA) terminal
- Laptops
- Vehicular mounted device
- The test methods shall include both NSA and SA
- Developing test methods with the following capability:
- The test methods in TR38.810/884 for RF/RRM/Demod can be further extended to support multi-panel reception performance
- Focus on DL test cases with 2 AoAs simultaneously for RF/RRM/Demod test
- The test setup should enable testing of up to 4 Layers DL signal
- FFS whether Fading model should be updated

- The angel separation should consider typical UE implementation
- Test methods development can be started after core requirements finalized.
- The test procedure for Quality of the quiet zone validation should be further studied
- Given the antenna pattern has been changed from single beam to multi-beams, FFS whether the related Measurement Grids should be updated
- The preliminary MU assessment for the enhanced test methodology should be done in RAN4

6 – Intel Deutschland GmbH

1) We support the objective to define methodology for FR2 OTA testing of UEs with multi-panel reception and 4DL layer for FR2-1

2) Candidate objectives:

- *Define test methodology for RF/RRM/Demodulation requirements testing for multi-panel devices that can receive/transmit simultaneously from multiple AoAs*

- *Consider at least 2 angles for RF/RRM/Demod testing*
- *Define a test methodology for 4 DL MIMO layer demodulation testing*
- *Rel-15 and Rel-17 FR2 test methods should be used as the baseline*

7 – Apple Italia S.R.L.

We suggest the following high-level objectives (we are fine to further refine these during the discussion):

- Develop a test setup/methodology that can support the RF, RRM and demodulation requirements for UEs supporting simultaneous reception with multiple panels
- The conclusions and agreements in TR38.810/884 should be taken into account
- Develop the related preliminary uncertainty assessment

8 – Beijing Xiaomi Mobile Software

1, We support this WID but to keep in mind that the test method should be based on the core requirement outcome of the other work item.

2, For the two pannel switching cases, we see some discussion as SISO OTA antenna TX swtiching and this can be some input to the new test methodology.

9 – Huawei Technologies France

We agree MediaTek that the test should be based on core requirements, which should be figured out firstly whether there are necessary addtional requirements. On the other hand, we think ”dynamic MIMO OTA test” and “multi-panel reception” should be decoupled.

1.1.4 Testing framework for FR2 FWA devices (PC1/PC5 in FR2)

The proposed objective for Testing framework for FR2 FWA devices (PC1/PC5 in FR2) was placed in brackets at the outcome of the email discussion in RP-212682 as shown below.

- [Testing framework for FR2 FWA devices (PC1/PC5 in FR2)]

In the initial round, please provide your views and/or recommendations for a detailed set of objectives for Testing framework for FR2 FWA devices (PC1/PC5 in FR2). In addition, please identify if the brackets can be removed.

Feedback Form 5: Testing framework for FR2 FWA devices (PC1/PC5 in FR2)

1 – QUALCOMM JAPAN LLC.

Clearly there is a hole now in the FR2 testing framework since only devices with a diagonal size of up to 15 cm and radiating panels of up to 5cm in diameter can be tested. FR2 FWA devices are expected to use larger panels than handheld devices that will require a larger quiet zone.

The high level objectives could be as follows:

- Study the test setup, test methodology and coarse MU for FWA devices (diagonal size up to 40cm?)
- The test setup/methodology should reuse the existing PC3 testing setup/methodology to the extent possible
- The test setup/methodology should enable RF, RRM and demod testing

2 – Guangdong OPPO Mobile Telecom.

For clarification, in RAN5 38.521-2 also RAN4 TR38810 there is no restriction of panel size for IFF, and it seems FWA already been covered by current spec. Is there something missing?

3 – MediaTek Inc.

Measurement grid are related to UE array size and affects test time directly. Further consider test time (reduction) would be needed for PC1/5, and the test time reduction method shall also be applied to other PCs.

4 – Nokia Corporation

Objectives proposed by Qualcomm are a good starting point. We support removal of brackets.

5 – AT&T GNS Belgium SPRL

We are OK with considering this work in Rel-18 as it is important to have conformance testing in place for FR2 FWA devices. However, we do need to ensure that the work that RAN4 is doing does not repeat the work already done by RAN5 on larger QZs and device sizes and is focused on any necessary gaps in the testing framework for FR2 FWA devices.

6 – vivo Communication Technology

The measurement grid for PC1 has been captured in RAN5 spec, the quiet zone size supporting D=55cm (cover large devices) has also been defined in RAN5, other parts of test methodology are quite generic for all the PCs. So we are not clear about the exact working scope for this topic in RAN4.

7 – Intel Deutschland GmbH

We agree with Qualcomm's proposals to extend the Testing framework for FR2 FWA devices, and suggest extending the scope and allowing the testing of devices with larger form factors, including non-FWA devices (e.g., laptops)

8 – TELECOM ITALIA S.p.A.

in principle ok, but we share the comment from AT&T

9 – Huawei Technologies France

Regarding FWA test issue, currently quite zone size of 30cm, 40cm and 50cm are already agreed by RAN5. As discussing how the existing OTA test methods could be further extended to FR2-2 in Rel-17, the testing also can be extended to FWA UE. We see no need to develop a new testing framework for FWA.

1.1.5 EMC enhancement

The outcome of the email discussion in RP-212682 indicated that the justification and scope in the draft WID in RP-211825 are stable and acceptable. In the initial round, the moderator proposes to confirm that the justification and scope in EMC enhancement draft WID can be agreed and that this area will be managed with a separate WID.

Feedback Form 6: Are the justification and scope in the draft WID in RP-211825 acceptable?

1 – Nokia France

The WID is quite stable now.

Some minor points:

1. Investigate ~~the~~ potential ~~following~~ alternatives to achieve EMC test simplification (if any possible) considering both Emission and Immunity testing scenarios, with the priority on MSR/AAS BS. The potential alternatives include but are not limited to the following:

In Objective 2, there is a reference to "bullet 7"; it is not clear which is bullet 7.

In NOTE 3, there is a reference to "bullets 9 - 12"; it is not clear which are these bullets.

2 – Ericsson LM

It is also our assessment that the WID is stable.

Thanks to Nokia for the comments. We are fine with the suggested update in objective 1 on BS EMC part.

To Nokia's questions:

- In Objective 2, bullet 7, should be bullet 1. This is actually overall 7th bullet since 1-6 are for UE EMC. In some earlier version, BS objective 1 was 7.
- In NOTE 3, bullets 9-12, should be accordingly bullets 3-6.

We will make these corrections in the next version and will instead objective instead of bullet for referencing.

3 – vivo Communication Technology

we are supportive for the EMC work in Rel-18.

4 – Intel Deutschland GmbH

The timelines of the UE and BS EMC enhancement study and implementation stages should be clarified since the current WID has ambiguity on the actual work duration.

Prioritization of UE EMC objectives may be required. Current WID includes a list of additional UE features. We prefer to focus on NR UEs and leave EUTRA UEs out of scope.

5 – Beijing Xiaomi Mobile Software

Thanks Intel for the comment. Fo rthe EUTRA UEs, our initial thinking as stated in the WID is to base on the study outcome of NR UEs and similar rules can apply which will be quite straight forward. But if it is inssited to leave it out of the scope, we are also OK with that.

6 – Ericsson LM

Regarding timelines and TU allocation: we can update the timelines.

Note that the timeline and TU were updated in a later version submitted to RAN#94-e (RP-213426)) http://3gpp.org/ftp/tsg*ran/TSG*RAN/TSGR_94e/Docs/RP-213426.zip.

7 – Huawei Technologies France

In general we agree with the previously proposed scope and objectives, but for sake of futute workload optimization we would like to suggest to add addtional objectives as:

1. Define ONE single EMC spec for UE covering all RATs (instead of the current approach of RAT-specific specs). The relarted legacy EMC specs (e.g. 36.124, 38.124) would be replaced by such single spec.

2. Define ONE single EMC spec for network notes (BS/NR repeater/IAB) covering all RATs. The relarted legacy EMC specs (e.g. 36.113, 37.113, 37.114, 38.113, 38.114, 38.175) would be replaced by such single spec. Motivation for such approach is that multiple existing EMC specs require significant maintenance work, and are ~90% copy-paste of each other.

Feedback Form 7: Do you agree that the EMC enhancement topic will be managed with a separate WID?

1 – China Telecommunications Agree it can be a separate WI.
2 – Nokia France Yes
3 – Ericsson LM Yes
4 – SAICT Yes
5 – MediaTek Inc. Yes
6 – Intel Deutschland GmbH Yes, we support the proposals made by the moderator
7 – Beijing Xiaomi Mobile Software Yes, we support moderator's proposal since EMC is a different filed compared to OTA testing.
8 – Huawei Technologies France Yes

1.1.6 Others

This section will focus on collecting comments and suggestions concerning any additional RAN4 Testing Enhancements.

Feedback Form 8: Others

1 – Guangdong OPPO Mobile Telecom. In the previous discussion, two ongoing Rel-17 work items were not been discussed widely, one is the SISO OTA, the other is the MIMO OTA, both will be planned to be close in September but may still have some items not been completed. For these two work items they might need to be continued in Rel-18. How to handle them is not clear up to now. Maybe the best time to discuss them is the June Plenary meeting. Could moderator clarify this, or they also need to be decided in the March RAN4 R18 package? **For the SISO OTA, there were proposals in last RAN4 meeting (R4-2202050) as below:**

The objective of this core part Work Item:

- Develop SISO OTA test methodology for UE with multi-antenna
    - TRP Test methodology for UE with Tx antenna switching
    - TRP Test methodology for UE with UL Transmit Diversity
- Further consider test time reduction for FR1 TRP and TRS measurement
- Study the test method for FR1 NR CA
- Rel-17 leftovers
    - Specify the test methodology for other UE types except smartphone
        - For example: Tablet, wearable device, other innovative type of UE, and so on, if needed

The objective of this performance part Work Item:

- Specify Performance requirement for corresponding bands with Wide Grip Hand Phantom, if not specified in Rel-17
- Specify Performance requirement for other types of UE based on operator requests
- Specify Performance requirement for other NR bands based on operator requests
- Consider TRS requirement relaxation on some particular EN-DC band combinations

For MIMO OTA, there were proposals in last RAN4 meeting (R4-2202047) as below:

- FR2 MIMO OTA test methodology enhancement and leftovers
    - Basic test parameters for FR2 MIMO OTA are defined in TS 38.151, further refinement and supplement is needed based on simulation alignment and practical measurement in the chambers
    - Further refinement on channel models when necessary for FR2 MIMO OTA measurement
    - Specify channel model verification requirement for both simulation and lab alignment, if not accomplished in Rel-17 timeline
- FR1 MIMO OTA test methodology enhancement
    - Study on test time reduction for FR1 MIMO OTA
    - Study on enhancement to improve test accuracy and repeatability for FR1
    - Study the necessity of hand phantom based MIMO throughput testing
    - Introduce more FR1 channel models based on operator requests
- FR2 performance requirements:

- Finish the Rel-17 leftovers if there is any, may include the following:
  - Perform FR2 MIMO OTA simulation and/or lab alignment, and confirm the aligned labs
  - Collect the measurement data for FR2 MIMO OTA for performance requirement development
- Further specify MIMO OTA performance requirement for FR2 bands based on operator requests

- FR1 performance requirements:
  - Further specify MIMO OTA performance requirement for other FR1 bands based on operator requests

2 – MediaTek Inc.

Rel-17 SISO/MIMO OTA leftover shall be further considered, it also affects when/how we kick-off advanced OTA test method development.

3 – vivo Communication Technology

TRP TRS WI have achieved quite good progress in RAN4 with main part of test method finalized and performance work started. The WI is expected to be finalized in Aug. meeting. However, given TRP TRS was the last WI to start within REL-17 timeline in RAN4, current working scope is quite focused on partial test methods and limited number of example requirements.

As we proposed in RAN#93e meeting with high-level objectives, some works should be continued in Rel-18 for TRP TRS to provide a full set of test methods and requirements to the industry, including but not limited to:

1. Test method enhancement (including phantom development) to support FR1 wearable device
2. Test method enhancement to support FR1 devices with carrier aggregation
3. Other test methods of Rel-17 leftovers
4. Requirements of smartphone for the bands not finalized in Rel-17 those listed as 1st priority in the WID, other bands based on operators' interest
5. New requirements work for other UE type

Considering the TRP TRS work is on-going with requirements unsettled, it seems not possible to get a clear view on Rel-18 working scope in March RAN-P meeting. Therefore, we suggest RAN plenary to consider further discussion of Rel-18 TRP TRS WI in September meeting, the following recommendation is proposed:

"TRP TRS working scope for Rel-18 can be further discussed in September RAN plenary meeting"

1.2 Moderator Summary and recommendation for further discussion

Thanks for the valuable feedback and proposals shared in the initial round. The summary and recommendations for each topic are as follows.

1) **General high-level views**

The moderator would like to clarify that the intent of the question, “Should any eventually agreed FR2 OTA testing areas be handled in the same study item?” was to consider only the items in 1.1.2, 1.1.3, and 1.1.4. It was not to consider any Rel-17 leftovers or additional OTA items. It may be possible for some of the leftovers or additional OTA items to be merged into the study item but this would be handled as a separate discussion.

There were some general views expressed across different companies that seem like good principles to follow in the process. The moderator has collected these general views below for consideration.

1) Enhanced OTA testing is important to the industry as it can help in device development and identifying performance issues without having to do complicated field testing.

2) Test method development shall be based on the outcome of core requirement.

3) Test method development shall be step-by-step, from basic one to advanced one.

4) Test time (reduction) is important and shall be considered.

5) Making WID (objectives) clear about “FR1/FR2-1/FR2-2”, “SISO/MIMO OTA”, and “simultaneous/switching reception” would be helpful.

6) Re-use the existing test setups/methodologies as much as possible

Concerns were raised about RAN4 available TUs for OTA testing areas and over-testing. Initial down-scoping to two areas or less to allow for Rel-17 leftovers and/or Rel-17 follow-on work were suggested.

The majority of companies preferred to wait until it was clear which items can be approved for FR2 OTA testing and the corresponding scope before decided how to group the items for subsequent study item(s).

Some discussion was held on leftover issues and/or follow-up work for ongoing Rel-17 SISO OTA and MIMO OTA. The moderator proposes that these topics be discussed separately in September RAN Plenary as suggested by Samsung.

2) **Dynamic OTA testing method for FR2-1**

There was no consensus that the requirements for this test methodology/setup should be considered jointly with the FR2 OTA testing for UEs with multi-panel reception and 4DL layer for FR2-1 to aim for a unified test setup. The moderator proposes that this aspect be discussed at a future date after more details are known concerning both test methodologies.

Qualcomm provided a set of objectives based on their previous Rel-17 submission as shown below and indicated that the objectives can be further refined as needed.

——

The objective of this Study Item is to define end-to-end testing methodology for the verification of FR2 NR UEs performance in a dynamic environment. The test methodology for multi-panel UE should also be considered.

The study proceeds within the following scope:

- For the following device types:
    - Smartphone is the first priority.
    - Other UE types are not precluded for discussion as a second priority
- Identify test scenarios:
    - Stage 1: UE rotation-based scenario
        - Change UE rotation during the testing
        - Study the feasibility of reusing 3D-MPAC system
    - Stage 2: UE travel-based scenario
        - Change both UE rotation and beams from gNB(s) during the testing
        - Study the enhancement on 3D-MPAC system
    - Up to 2 beams is the first priority
- Identify each test scenario with proper justification and avoid unnecessary overlapping test cases.
    - Test metric should be based on the current core/performance requirements.
- Note: RAN4 will not start Stage 2 before Stage 1 is completed.
- The test methodology shall include both NSA and SA.
    - For setups intended for measurements of UE characteristics in non-standalone (NSA) mode, an LTE link antenna setup is used to configure the NR link
- Using the channel models defined in TR38.901 as the starting point to develop dynamic environment
- Channel model framework in TR38.827 should be taken as the basis
- Study whether and which parameters for channel models defined in TR38827 will have big impact on UE performance and could be reused for dynamic testing.
- Study the applicable test methodology verification procedures
- Study the preliminary uncertainty budget for the methodology
- The uncertainty budget in TR38827 should be the basis for developing the uncertainty.
- Study the additional uncertainty due to the dynamic environment
- The test methodology shall initially assume a black box approach to ensure the test of multi-panel Tx/Rx UE is covered.
- The dynamic environment tests shall take the test system complexity and test time into account to keep the whole test costs within a reasonable level.
- This SI not to introduce the new RAN4 requirements in Rel-18.

During this study item, ongoing communication with 3GPP RAN WG5, CTIA OTA Working Group (MOSG, 5G mm-wave OTA Sub-Working group and MUSG), and CCSA TC9 WG1 shall be maintained to ensure industry coordination on this topic.

——

The set of objectives above were generally supported by 9 of the 13 commenting companies (Intel supported but also sees it as lower priority compared to FR2 OTA testing for UEs with multi-panel reception and 4DL layer for FR2-1) with the exception of handling it jointly with FR2 OTA testing for UEs with multi-panel reception and 4DL layer for FR2-1.

vivo suggested that an additional figure of merit may need to be studied as part of the rotation scenario and that blocking issue during UE rotation and performance impacts should be studied and quantified. In addition, vivo suggested to separate the travel-based scenario into two cases; case a) fixed UE position with new dynamic channel model; case b) rotated UE with new dynamic channel model. Case b would be more complex which needs more comprehensive studies. MediaTek suggested that Dynamic OTA should cover up to 1 beam as first priority to match the outcome of the Rel-17 (Static) MIMO OTA work and supported a sub-set of the objectives proposed by Qualcomm.

Concerns related to additional test time, large test complexity/scope, and/or available RAN4 TUs were raised by Apple, Telecom Italia, and Huawei.

The moderator has provided a WF for the objectives based on the feedback in the intermediate round for consideration.

3) **FR2 OTA testing for UEs with multi-panel reception and 4DL layer for FR2-1**

There was no consensus that the requirements for this test methodology/setup should be considered jointly with the dynamic OTA testing requirements to aim for a unified test setup. The moderator proposes that this aspect be discussed at a future date after more details are known concerning both test methodologies.

Based on the Nokia comment that 4DL layers are also possible with a single panel, the moderator has proposed to split this out as a separate bullet item in the objectives and to highlight that the multiple AoA test setup should leverage the 4DL MIMO layer demodulation test methodology.

Many companies expressed the view that the testing enhancements should be considered jointly with the requirements discussed in [RAN95e-RAN4-R18Prep-02]. Some of the details on the test methodology for RF/RRM/Demodulation requirements testing for devices that can receive/transmit simultaneously from multiple AoAs can be further expanded once the objectives for the core requirement are clearer.

The additional details on the test methodology for RF/RRM/Demodulation requirements testing for devices that can receive/transmit simultaneously from multiple AoAs described by Qualcomm, China Telecom, and Intel can be considered at a later date to align the test methodology with the core requirements.

Rel-15 and Rel-17 FR2 test methods should be used as the baseline. As such, the conclusions and agreements in TR 38.810 and TR 38.884 should be taken into account.

The moderator has provided a WF for the objectives based on the feedback in the intermediate round for consideration.

4) **Testing framework for FR2 FWA devices (PC1/PC5 in FR2)**

Many companies expressed the view that RAN5 has already specified larger quiet zone size supporting up to D=55cm and that it is possible that FR2 FWA devices may already be able to be tested based on the RAN5 test specification.

Some companies indicate that the impact of the larger panels and array size expected to be utilized in FR2 FWA devices may necessitate additional work in RAN4.

The moderator has provided a WF for the objectives based on the feedback in the intermediate round for consideration.

5) **EMC enhancement**

It was agreed that the EMC enhancement topic will be managed with a separate WID. No further discussion is required on this aspect.

The general view was that the justification and scope in the draft WID in RP-211825 is stable and generally acceptable. Nokia suggested a modification to Objective 1 which seemed agreeable and will be updated in the next draft WID. In addition, some references were identified as incorrect in Objective 2 and NOTE 3. These references will be fixed in the updated draft WID. Intel requested further details on the timeline. Ericsson proposed to update the timeline as suggested in RP-213426. Intel also suggested to remove E-UTRA from the scope for the UE work. Huawei suggested to move towards single EMC specifications (one for UE and one for network nodes) that would cover all RATs to optimize future maintenance workload.

Based on the initial round feedback received, the moderator proposes to move forward with the existing justification and scope in the draft WID in RP-211825 with the corrections identified above. In the intermediate round, further refinements can be considered based on the feedback received.

6) **Others**

The feedback shared in this topic was related to the leftover issues and/or follow-up work for ongoing Rel-17 SISO OTA and MIMO OTA. Both WIs are not expected to be completed until September. vivo mentioned that the TRP TRS work is on-going with requirements unsettled and it seems not possible to get a clear view on Rel-18 working scope in the March RAN Plenary meeting. This aligns with the feedback received from Samsung in the General high-level views. Therefore, the moderator suggests that further discussion on these topics be discussed separately in September RAN Plenary. No further discussion will be held in the intermediate round for the Others topic for RAN#95e Prep.

2 Intermediate Round

The intermediate round will focus on further convergence on the areas/objectives. In addition, initial views on the justification for each area should be provided.

2.1 Collection of company views

2.1.1 General high-level views

Given the limited RAN4 TUs and the possibility of the need to down-scope, please provide your views on the priority level for each of the FR2 OTA topics in 2.1.2, 2.1.3, and 2.1.4.

Feedback Form 9: Priority level for FR2 OTA topics

1 – MediaTek Inc.

Thanks for moderator's summary and the following WF draft.

About "Priority level":

Please refer to our high-level views as below. Further refine detailed objectives would be needed.

priority1: 2.1.4 (# SISO OTA, PC1/5)

If the "**test hole**" can be confirmed, this objective is kind of the basic test and shall be solved. Please proponent clarify whether there is "**test hole**" after considering current RAN4/RAN5 works as companies' reminder.

priority2: 2.1.2 (# dynamic MIMO OTA)

This objective makes MIMO OTA test more complete, from static to dynamic as an advanced test, for a mature/stable UE function/capability. We are okay to have this objective in general and would like to further discuss detailed objective in below discussion place.

priority3: 2.1.3 (# simultaneous multi-panel reception)

After we have clear picture on potential core requirement(s), we would be okay to have the objective in general to avoid "test hole". However, it seems more discussions on exact core requirement framework and value would still be needed. It's too early to shape the detailed objectives.

2 – Verizon UK Ltd

We support this FR2 OTA testing enhancement and agree to prioritize the test areas in the study item within the limited RAN4 TUs and deliver testing solutions for the industry.

3 – Apple Italia S.R.L.

Priority 1: 2.1.3 (FR2 OTA testing for UEs with multi-panel reception and up to 4DL layers for FR2-1)

Priority 2: Leftovers from Rel-17 (FR2 related, such as MIMO OTA, and FR1 related, such as TRP/TRS)

Priority 3: FR2 FWA testing framework

4 – China Telecommunications

For FR2 OTA topics:

First priority: 2.1.2 Dynamic OTA testing method for FR2-1

Second priority: 2.1.3 FR2 OTA testing for UEs with multi-panel reception and 4DL layer for FR2-1

5 – TELECOM ITALIA S.p.A.

We believe down-prioritization is required.

As per priorities:

1. 1.4 FWA devices

2. 1.3 FR2 OTA testing for UEs with multi-panel reception and 4DL layer for FR2-1

We have strong concern with dynamic OTA testing. This is increasing the testing time with no clear benefit to the industry. And adding extra tests is not ensuring good performance (please do remember the scandal with car manufacturers ”adapting” to the test procedures).

As a minimum before agreeing input from stakeholders like GCF is required.

In summary we object to approving this objective (1.2 Dynamic OTA testing)

6 – Nokia Corporation

Priority 1: Multi-panel reception

Priority 2: 4DL reception

Priority 3: Dynamic OTA

7 – vivo Communication Technology

FR2 FWA testing framework would be low priority, given much of work has been done in RAN5, at least RF test cases.

8 – Huawei Technologies France

Priority 1: Leftovers from Rel-17

Priority 2: 2.1.3

9 – Intel Corporation SAS

Our first priority is 2.1.3 FR2 OTA testing for UEs with multi-panel reception and up to 4DL layers for FR2-1. It is important to start the work on the test methods development in parallel with the Core part work on the definition of requirements to make sure that we don’t face situation of “no test methods” in the end of Rel-18.

2.1.4 and 2.1.2 have lower priority

2.1.2 Dynamic OTA testing method for FR2-1

The moderator proposes the following set of objectives as a way forward taken into account the initial round comments received. Based on the lack of consensus to handle it jointly with the FR2 OTA testing for UEs with multi-panel reception and 4DL layer for FR2-1, the moderator has removed these aspects. Whether to consider this study as second priority compared to the other FR2 OTA test methods or to defer until a later release is to be determined given there was a majority view that the study should be part of Rel-18.

The objective of this Study Item is to define end-to-end testing methodology for the verification of FR2 NR UEs performance in a dynamic environment.

The study proceeds within the following scope:

- “Dynamic MIMO OTA” shall take the test method and outcome in Rel-17 (static) MIMO OTA WI into account.
- For the following device types:

    - Smartphone is the first priority.
    - Other UE types are not precluded for discussion as a second priority

- Identify test scenarios:
    - Stage 1: UE rotation-based scenario
        - Change UE rotation during the testing
        - Study the feasibility of reusing 3D-MPAC system
        - Study if an additional figure of merit beyond data throughput is necessary/beneficial
        - Study blocking issue during UE rotation and performance impacts
    - Stage 2: UE travel-based scenario
        - Change both UE rotation and beams from gNB(s) during the testing
        - Consider splitting Stage 2 into two subcases: case a) fixed UE position with new dynamic channel model; case b) rotated UE with new dynamic channel model.
        - Study the enhancement on 3D-MPAC system
    - Up to [1 or 2] beams is the first priority
- Identify each test scenario with proper justification and avoid unnecessary overlapping test cases.
    - Test metric should be based on the current core/performance requirements.
- Note: RAN4 will not start Stage 2 before Stage 1 is completed.
- The test methodology shall include both NSA and SA.
    - For setups intended for measurements of UE characteristics in non-standalone (NSA) mode, an LTE link antenna setup is used to configure the NR link
- Using the channel models defined in TR38.901 as the starting point to develop dynamic environment
- Channel model framework in TR38.827 should be taken as the basis
- Study whether and which parameters for channel models defined in TR38827 will have big impact on UE performance and could be reused for dynamic testing.
- Study the applicable test methodology verification procedures
- Study the preliminary uncertainty budget for the methodology
- The uncertainty budget in TR38827 should be the basis for developing the uncertainty.
- Study the additional uncertainty due to the dynamic environment
- The test methodology shall initially assume a black box approach.

- The dynamic environment tests shall take the test system complexity and test time into account to keep the whole test costs within a reasonable level.
- This SI not to introduce the new RAN4 requirements in Rel-18.

During this study item, ongoing communication with 3GPP RAN WG5, CTIA OTA Working Group (MOSG, 5G mm-wave OTA Sub-Working group and MUSG), and CCSA TC9 WG1 shall be maintained to ensure industry coordination on this topic.

Feedback Form 10: Objectives: Dynamic OTA testing method for FR2-1

1 – MediaTek Inc.

We are fine for this moderator's draft.

2 – Verizon UK Ltd

We support this dynamic OTA test and related testing method. The moderator proposes is good for us, and we support the set of objectives as a way forward.

3 – Apple Italia S.R.L.

As we commented in the first round, the scope of this effort seems to be well beyond the available TUs we have for OTA work in addition to the priorities we listed in the earlier section.

In addition, we would also like to add that the study objectives as proposed seem stable to us and are a valuable way to enhance the FR2 MIMO OTA test methodology. We believe that RAN should consider this study after the following:

- FR2 MIMO OTA (with static AoA side condition) should conclude successfully in terms of test methodology and performance requirements (we should be able to determine the status in September)
- FR2 OTA test method and requirements with multi-panel reception should conclude

4 – QUALCOMM JAPAN LLC.

We are fine with the current version. On the number of beams, it is fine to limit in the beginning but we should only at least consider extensions to a higher number of beams so that this is future proof.

5 – China Telecommunications

ok with moderator suggestion.

6 – TELECOM ITALIA S.p.A.

We have strong concern with dynamic OTA testing. This is increasing the testing time with no clear benefit to the industry. And adding extra tests is not ensuring good performance (please do remember the scandal with car manufacturers "adapting" to the test procedures).

As a minimum before agreeing input from stakeholders like GCF is required.

Moreover the required workload in RAN4 is well beyond the available time units.

In summary this objective should be moved out of Rel 18

7 – vivo Communication Technology

We are fine with moderator suggestion in general. for the stage 1 case, the channel model in TR38.827 should be reused, the only enhancement aspect for this case is actually the dynamic rotation of UE, so we propose:

Stage 1: UE rotation-based scenario

- Change UE rotation during the testing
- **Reusing the 3D-MPAC system and channel model in TR 38.827**
- Study if an additional figure of merit beyond data throughput is necessary/beneficial
- Study blocking issue during UE rotation and performance impacts

8 – Huawei Technologies France

As we commented in the first round, we do not see clear and significant demands.

Please provide input on the justification section.

Feedback Form 11: Justification: Dynamic OTA testing method for FR2-1

2.1.3 FR2 OTA testing for UEs with multi-panel reception and 4DL layer for FR2-1

The moderator proposes the following set of objectives as a way forward taken into account the initial round comments received.

- Define a test methodology for RF/RRM/Demodulation requirements testing for devices that can receive/transmit simultaneously from multiple AoAs
    - The multiple AoA test setup should enable testing of up to 4 Layers with dual polarization for each angle and leverage the test methodology for 4DL MIMO layer demodulation testing
- Define a test methodology for 4 DL MIMO layer demodulation testing
- Smartphone form factor should be the first priority, other UE types should also be discussed as 2nd priority
- Develop the related preliminary uncertainty assessments for the test methodologies
- Rel-15 and Rel-17 FR2 test methods should be used as the baseline. As such, the conclusions and agreements in TR 38.810 and TR 38.884 should be taken into account.

Feedback Form 12: Objective: FR2 OTA testing for UEs with multi-panel reception and 4DL layer for FR2-1

1 – MediaTek Inc.

We'd like to share some comments one-by-one:

1) minor rephrase proposal for title:

- *"FR2-1OTA testing for UEs with multi-panel reception and 4DL layer* ~~***for FR2-1***~~*"*

2.a) propose to highlight 2 DL layers as the first priority.

2.b) would like ask proponent's clarification "4DL MIMO layer demodulation testing" firstly. In our understanding, current demodulation testing is one AoA and 2DL layers.

2.c) add DL to align the wording

- *"The multiple AoA test setup should enable testing of up to 4* ***DL*** *Layers,* ***and 2 DL Layers is the first priority****, with dual polarization for each angle* ~~***and leverage the test methodology for 4DL MIMO layer demodulation testing***~~

3) propose to add "2 DL layers as the first priority", and add "up to 4DL" to align detailed objectives

- *"Define a test methodology for* ***up to*** *4 DL MIMO layer demodulation test,* ***and 2 DL Layers is the first priority.***

4) propose to add this general objective, as dynamic OTA objective, as a general guideline:

- **"The tests shall take the test system complexity and test time into account to keep the whole test costs within a reasonable level.**

2 – Verizon UK Ltd

We also support FR2 OTA testing for UEs with multi-panel reception with 4DL layer. Also share the same view about OTA testing is lagging behind feature. For us, the moderator proposed the set of objectives is acceptable as a way forward.

3 – Apple Italia S.R.L.

We are fine with the moderator's proposed objectives. The clarifications from MediaTek are also valuable.

4 – QUALCOMM JAPAN LLC.

the subbullet of the first bullet should be ”up to 2 layers for each angle”, not 4 layers for each angle. It could also be up to 4 layers for each angle pair. MTK’s clarifications are also fine with us.

For RRM it should be mentioned that the target should be 4 angles with 2 angles used simultaneously.

5 – China Telecommunications

ok with moderator suggestion.

6 – vivo Communication Technology

Agree with QC, the test system can only support up to 2 layers per angle.

7 – Intel Corporation SAS

- The current objectives mention “*... devices that* ***can receive/transmit simultaneously*** *from multiple AoAs*”. We think that the studies can be limited to UEs which can simultaneously receive from multiple AoAs. Transmit capability can be considered with the 2nd priority.
- Besides that we are fine with moderator proposal
- We do not see the need to mention prioritization of 2 DL MIMO layers proposed by MediaTek.

Please provide input on the justification section.

Feedback Form 13: Justification: FR2 OTA testing for UEs with multi-panel reception and 4DL layer for FR2-1

1 – Apple Italia S.R.L.

We can suggest the following wording for the justification:

With RAN4 considering an objective to define requirements for UEs with multi-panel reception and up to 4DL layers for FR2-1, the FR2 test methodologies for RF, RRM, and demodulation need to be enhanced to support the verification of these new requirements, together with a preliminary assessment of the related uncertainties.

2 – Intel Corporation SAS

We agree with justification provided by Apple

2.1.4 Testing framework for FR2 FWA devices (PC1/PC5 in FR2)

The moderator proposes the following set of objectives as a way forward taken into account the initial round comments received.

- Study the test setup, test methodology and preliminary MU analysis for FWA devices

- Consider PC1/PC5 FWA devices up to [40cm] in diagonal
- The study should leverage the work done by RAN5 on larger QZs and device sizes and focus on any necessary gaps in the testing framework for FR2 FWA devices

- The test setup/methodology should reuse the existing PC3 testing setup/methodology to the extent possible
- The test setup/methodology should enable RF, RRM and demod testing

Feedback Form 14: Objective: Testing framework for FR2 FWA devices (PC1/PC5 in FR2)

1 – MediaTek Inc.

We'd like to share some comments one-by-one:

1) minor rephrase proposal for title, and clarification on scope is needed. Does the objective really wanna cover both FR2 (both FR2-1 and FR2-2)? Otherwise, maybe change from FR2 to FR2-1 to make it clearer.

- ***FR2(?) SISO OTA****testing framework for FWA devices (PC1/PC5)*

2) we'd like to add one general objective similar to other objectives as general guideline.

- **"The tests shall take the test system complexity and test time into account to keep the whole test costs within a reasonable level. Test time reduction method can be further study, and would also apply to PC2/3/4/6 if feasible"**

2 – QUALCOMM JAPAN LLC.

We will further check what is being done in RAN5 so that we can align. In our understanding, this is not only about the QZ size but also the measurement grid will be affected because expected beam width will be different compared to PC3. Also, a new test setup is needed for RRM because the current setup is not suitable for the PC1/PC5 spherical coverage. Angles that are closer together are probably needed.

3 – Huawei Technologies France

Before the questions in the initial round are clarified, we still have concerns with a new testing framework for FR2 FWA devices.

Please provide input on the justification section.

Feedback Form 15: Justification: Testing framework for FR2 FWA devices (PC1/PC5 in FR2)

1 – MediaTek Inc.

As commented in 2.1.1:

If the "**test hole**" can be confirmed, this objective is kind of the basic test and shall be solved. Please proponent clarify whether there is "**test hole**" after considering current RAN4/RAN5 works as companies' reminder.

2 – QUALCOMM JAPAN LLC.

We will further check this issue. As commented in the previous section, the RRM test setup also needs to be reconsidered as the PC3 setup is not adequate

3 – Intel Corporation SAS

Given the initial round comments from companies that RAN5 already supports the relevant device testing we should further make sure to avoid duplicated work. We may need to further reassess the scope before proceeding with this work.

2.1.5 EMC enhancement

The moderator proposes to move forward with the existing justification and scope with the corrections identified in the first summary above. In the intermediate round, further refinements can be considered based on the responses in the feedback forms below.

Feedback Form 16: Do you agree to remove E-UTRA UEs from the scope?

1 – Ericsson LM

We are fine to remove E-UTRA for UE EMC.

2 – Huawei Technologies France

While we understand the priority of the NR UE at the current stage, we are not sure if removal of EUTRA UE would allow us to reduce the workload in significant way. As indicated in the other topic, we have preference towards a unified approach (preferably into a single spec for UE). The WID text already seems to imply that the NR optimizations would also apply to the EUTRA UE spec. Maybe we can capture the following adjustment to reduce EUTRA scope, while still being able to reuse NR adjustments from the Study phase (WID section 4.1, Phase 1):

- "EUTRA UE: CA, DC (Based on the NR study outcome)~~, other features as captured in TS 36.101 v16.5.0 subclause 4.3A~~"

3 – Nokia France

E-UTRA is already lowest priority in the list. We are fine either way regarding removing it.

4 – Beijing Xiaomi Mobile Software

As E-UTRA indeed has some features which are different to NR, we can accept Huawei's modification, e.g. focus on the CA DC cases which can be largely similar to NR CA and DC cases and hence to reduce the workload while still have E-UTRA in the scope.

5 – Intel Corporation SAS

we are fine to remove or put lower priority

Feedback Form 17: Do you agree with the timeline outlined in RP-213426? Please also provide your views on the length of the study phase (until RAN#X).

1 – Huawei Technologies France

Timeline in RP-213426 is already outdated. We suggest that the Rapporteur fixes it in the final version of the WID by simply shifting the TU to start from the appropriate RAN4 meeting. For the study phase duration: please note that the initial proposal was for Rel-17, while now we can adjust to the Rel-18 timeline and the planned number of meetings. With this, we suggest the Rapporteur to propose the adjusted timeline (the current "phases" proposal seems ok, but we would be also fine to extend the study phase if Rel-18 timeline allows).

2 – Ericsson LM

Realistic length for study phase is 2 quarters for both UE and BS EMC work.

After the study phase, the implementation of the specification work will need 2 quarters for BS EMC (only has performance part) and 3 quarters for UE EMC (including both core and performance) as outline in RP-213426.

In summary assuming the WI will start from Q3/2022 like all other R18 items:

Study phase for UE/BS EMC:

- Q3-Q4 2022

Implementation phase:

- Q1-Q2 2023 (BS EMC)
- Q1-Q3 2023 (UE EMC)

3 – Nokia France

We agree with Ericsson's proposal.

4 – Beijing Xiaomi Mobile Software

We are fine with Ericsson's proposed timeline.

Feedback Form 18: Do you agree that we should move towards single EMC specifications (one for UE and one for network nodes) that would cover all RATs (37 series)?

1 – Nokia France

Creation of a single specification would itself require significant work, and with the current workload in RAN4 this does not seem a high priority to pursue. We therefore suggest not to include this objective.

2 – ZTE Corporation

The initial purpose of this WID related to BS is focus on simplication of the testing for MSR NR due to various possible RAT combination associated with the test configurations, which is only test parts are impact, no core part is included, also no new specfication will be generated.

If only ONE single EMC spec for network, then it would not only include all of the existing network feature, but also include unpredicate feature in future. There may exist potential risk to use one single EMC spec since requirements may big different between the features.

In adiditon, we share similar view as Nokia that it needs addtional workload to merge all the existing specs, which means more TU would be needed. To sum up, we also suggest not to inlcude this objective.

3 – Ericsson LM

We recognize that creation of the single spec for EMC will require extra work. But both in short term and in the long run having one common EMC spec will save lot of RAN4 time and effort. For UE there is only EMC spec for NR. So creating new UE EMC 837 series) is not so critical. Therefore, one compromise can be to create new EMC spec only for BS because for BS there are too many EMC specs. For every new network node creating new EMC spec is not efficient.

4 – Huawei Technologies France

Based on the past experience, we think that drafting of a single EMC spec for UE and a single EMC spec for network notes would be very quick. To address Nokia concerns on significant workload, we suggest to add objective #4 to the Study phase (WID section 4.1):

"

~~**For BS EMC enhancements**~~

~~No core part is included for BS EMC enhancements.~~

~~**For UE EMC enhancements:**~~

Phase 1 (Study phase till RAN#X):

1. Study on the need and motivation for additional UE features as per priority outlined below (highest to lowest):

a. NR UE: CA, DC

b. NR UE: SUL, UL MIMO and V2X

c. EUTRA UE: CA, DC (Based on the NR study outcome), other features as captured in TS 36.101 v16.5.0 subclause 4.3A

NOTE: Limit the scope within FR1 as currently the UE EMC specification only covers FR1 UE.

2. Investigate current 3GPP UE EMC radiated emission limit as whether current test frequency range is suitable, including the lower and upper test frequency range.

3. Investigate how to establish the communication link for NR and LTE UEs with different features:

a. Possible deltaRIB to be considered.

b. Possible MSD to be considered.

Note: These doesn't apply to UL MIMO.

4. *Study the possibility to draft a single EMC specification for UE (all RATs) and a single specification for network notes (BS, Repeaters, IAB, etc.; all RATs) to replace multiple legacy EMC specs.*"

With this, we would be able to present the proposed specs content and have further discussion in RAN4, if necessary. As already indicated: single EMC spec (one for UE, one for network nodes) would significantly reduce the EMC workload in future. At this stage we are not proposing any Rapporteur names.

5 – Huawei Technologies France

We are fine with Ericsson's suggestion to limit the optimization to the "BS/network nodes".

Please note, that currently we have six (6!) EMC specs for "BS/network nodes" in RAN4 (not counting UTRA spec). Companies involved in EMC work in RAN4 are well aware of very high level of copy-pasting among those specs. To fix one aspect in the overall EMC framework, do we prefer to have one CR, or six CRs? We can volunteer to draft such FULL spec (not just skeleton) as input for discussion – so the spec drafting workload argument is not an issue.

For ZTE comment on features: this can be easily solved by appropriate sub-sections to separate RAT-specifics. This is businees as usuall in 3GPP. At least we shall allow such discussion under the Study phase of the Rel-18 WI.

2.2 Moderator Summary and recommendation for further discussion

Thanks for your comments and working towards a way forward on the set of objectives for Rel-18 RAN4 Testing Enhancements in the intermediate round. The summary and recommendations for each topic are as follows.

1) **General high-level views**

In the intermediate round, companies provided their views on the priority level of FR2 OTA topics. Nine companies provided feedback. If a company did not specifically rank an item but showed general support, they have been grouped as "Support but with Unknown Priority Level". Some companies ranked Rel-17 leftovers and/or topics which were targeted for discussion at the September Plenary. In this case, it is the moderator's understanding that the companies are providing input that they would like to see available TUs for this work in the future by lowering the ranking for some of the topics in 2.1.2, 2.1.3, and 2.1.4. In addition, Telecom Italia expressed an objection to approving the Dynamic OTA testing method for FR2-1 objective. Below is a summary of the priority levels for each topic.

a) Dynamic OTA testing method for FR2-1

Priority 1: China Telecom

Priority 2: MediaTek

Support but with Unknown Priority Level: Verizon, vivo

Priority 3 and/or No Support: Apple, Telecom Italia, Nokia, Intel, Huawei

b) FR2-1 OTA testing for UEs with multi-panel reception and 4DL layer

Priority 1: Apple, Nokia, Intel

Priority 2: China Telecom, Telecom Italia, Huawei

Support but with Unknown Priority Level: Verizon, vivo

Priority 3 and/or No Support: MediaTek

c) Testing framework for FR2 FWA devices (PC1/PC5 in FR2)

Priority 1: Telecom Italia

Priority 2: None

Support but with Unknown Priority Level: Verizon

Priority 3 and/or No Support: MediaTek, Apple, China Telecom, Nokia, vivo, Huawei, Intel

Based on the summary above, the moderator can note the following observations.

a) Dynamic OTA testing method for FR2-1 has support from 4 companies out 9 with only 2 companies ranking it specifically in their top 2 priorities. However, 5 companies out of 9 specifically list it as lower priority/no support with one of the companies expressing objection.

b) FR2-1 OTA testing for UEs with multi-panel reception and 4DL layer has wide support as either Priority 1, Priority 2, or general support (8 companies out of 9).

c) Testing framework for FR2 FWA devices (PC1/PC5 in FR2) has support from only 2 companies. 7 companies out of 9 specifically list it as lower priority/no support.

Based on the relative support for the FR2 OTA topics, the moderator recommends the following way forward.

a) Dynamic OTA testing method for FR2-1 to be considered as a separate SI or merged with the Rel-18 FR2 OTA testing enhancements SI. Postpone any consideration until September Plenary. Consider it together with

the Rel-17 OTA leftovers and follow-up work for ongoing Rel-17 SISO OTA and MIMO OTA work based on available RAN4 TUs.

b) FR2-1 OTA testing for UEs with multi-panel reception and 4DL layer to be handled in Rel-18 FR2 OTA testing enhancements SI and can be considered for approval at RAN#95e.

c) Testing framework for FR2 FWA devices (PC1/PC5 in FR2) to be handled as a separate SI. Postpone any consideration until September Plenary to allow for time to confirm the FWA testing gaps beyond the available RAN5 testing for large devices. Consider it together with the Rel-17 OTA leftovers and follow-up work for ongoing Rel-17 SISO OTA and MIMO OTA work based on available RAN4 TUs.

2) **Dynamic OTA testing method for FR2-1**

With the exception of the priority level and/or lack of support described in the general high-level views, the objectives seemed quite stable. Apple proposed to consider this only after the conclusion of the FR2 MIMO OTA WI and FR2 OTA test method and requirements with multi-panel reception. Minor revisions were proposed by vivo to re-use the 3D-MPAC system and channel model in TR 38.827 for Stage 1. The moderator proposes to keep the original text to study the feasibility of reusing 3D-MPAC system but to add a statement that the target is to reuse the 3D-MPAC system and channel model in TR 38.827 as follows.

- Study the feasibility of reusing 3D-MPAC system <u>with the target to reuse the 3D-MPAC system and channel model in TR 38.827</u>

Qualcomm indicated that they are fine to limit the number of beams in the beginning but RAN4 should at least consider extensions to a higher number of beams so that the test method is future proof. Based on this, the moderator proposes to remove the brackets on the number of beams and to add another sub-bullet concerning the extensions to a higher number of beams as follows.

- Up to <u>1 beam</u> is the first priority
- <u>Extensions to a higher number of beams should be considered so that the test method is future proof.</u>

No input was provided in the second round concerning the proposed justification for this topic. Based on this, the moderator proposes to use the justification that was proposed in RP-212634 as shown below.

Justification:

“The key enablers for high data throughput and stable link connectivity in FR2 are beamforming and beam management techniques. These should be verified by corresponding tests.

However, the current RRM test cases defined in TS38.133 are based on a static test environment, i.e. spatial relation between DUT and TE probe(s), such as (Z)AoA and (Z)AoD, doesn’t change during the test. Therefore, UE beam management behaviour is not thoroughly considered in the current RRM test cases.

The Rel-16 study item MIMO OTA SI included the objectives of MIMO throughput testing under dynamic environment and extension of Rel-15 RRM tests to dynamic geometry. The dynamic test method focusing on

the UE beam management performance was discussed based on the agreed static test setup. However, due to lack of time, no conclusion was reached. Companies preferred to start a new SI to study the FR2 testing under a "real-world" dynamic environment. Therefore, two scenarios are needed to be studied for FR2 UE dynamic testing. The first one is UE rotation-based scenario which is based on the current 3D-MAPC system. The second one is UE travel-based scenario which is additionally to consider the beams changing from gNB(s) on the basis of UE rotation-based scenario.

Moreover, in RAN1 Rel-17 WI on further enhancements on MIMO for NR (Acronym: NR_FeMIMO), the objective is to extend specification to support several aspects on NR MIMO including multi-panel UE which also has RAN4 impact. Therefore, it is necessary to study the test methodology in RAN4 which is also applicable for multi-panel devices for forward compatibility.

Therefore, a new study item to develop test methodology supporting dynamic testing and multi-panel UE is required in Rel-17."

The moderator has provided a WF for the justification and objectives based on the intermediate round feedback received on this topic and in the general high-level views in the final round for consideration.

3) **FR2-1 OTA testing for UEs with multi-panel reception and 4DL layer**

MediaTek suggested to rephrase the topic name. The moderator has modified the topic to align with the suggestion. MediaTek also provided some modifications to the objectives and proposed to treat 2DL layers as first priority. Qualcomm indicated that the multiple AoA test setup can support up to 2DL layers for each angle and to indicate that the RRM test setup should target 4 angles with 2 angles used simultaneously. Intel commented to limit the study to UEs which can simultaneously receive from multiple AoAs with the transmit capability considered as second priority. Intel also indicated that they did not see the need to mention the prioritization of 2 DL MIMO layers as suggested by MediaTek.

It is the view of the moderator that the requests to treat 2 DL MIMO layers and/or receive from multiple AoAs as first priority can be handled as part of the work plan, if needed. The previous goal to leverage the test methodology for 4 DL MIMO layer demodulation testing is proposed to be included as a generic "test system reuse" aspect in the last bullet item as it is related. Based on the feedback received concerning the comments from other companies, the moderator has proposed the following updates to the objectives with underlining.

- Define a test methodology for RF/RRM/Demodulation requirements testing for devices that can receive/transmit simultaneously from multiple AoAs
    - The multiple AoA test setup should enable testing of up to <u>2 DL</u> Layers with dual polarization for each angle
    - <u>For RRM, the target should be 4 angles with 2 angles used simultaneously</u>
- Define a test methodology for up to 4 DL MIMO layer demodulation testing
- Smartphone form factor should be the first priority, other UE types should also be discussed as 2nd priority
- Develop the related preliminary uncertainty assessments for the test methodologies

- Rel-15 and Rel-17 FR2 test methods should be used as the baseline. As such, the conclusions and agreements in TR 38.810 and TR 38.884 should be taken into account.
- The tests shall take the test system reuse, test system complexity and test time into account to keep the whole test costs within a reasonable level.

Apple provided suggested text for the justification section as below which was supported by Intel. No other companies commented.

Justification:

"With RAN4 considering an objective to define requirements for UEs with multi-panel reception and up to 4DL layers for FR2-1, the FR2 test methodologies for RF, RRM, and demodulation need to be enhanced to support the verification of these new requirements, together with a preliminary assessment of the related uncertainties."

The moderator has provided a WF for the justification and objectives based on the intermediate round feedback received on this topic and in the general high-level views in the final round for consideration.

4) **Testing framework for FR2 FWA devices (PC1/PC5 in FR2)**

MediaTek suggested to rephrase the topic name as "FR2(?) SISO OTA testing framework for FWA devices (PC1/PC5)" and to indicate if FR2 needs to be limited to FR2-1 or include all of FR2 (FR2-1 and FR2-2). The moderator will look for input in the final round concerning this suggestion. MediaTek also suggested to add another objective. The moderator has shown it below with a slight update to the verbiage.

- The tests shall take the test system complexity and test time into account to keep the whole test costs within a reasonable level. Test time reduction method can be further studied and would also apply to PC2/3/4/6, if feasible.

Qualcomm indicated that they would check on what is being done in RAN5 so that the efforts can be aligned. In their understanding, this is not only about the QZ size. The measurement grid will be affected because expected beam width will be different compared to PC3. In addition, a new test setup is needed for RRM because the current setup is not suitable for the PC1/PC5 spherical coverage. Angles that are closer together are probably needed.

MediaTek, Huawei, and Intel shared similar views concerning the lack of need for any additional work for an FWA testing framework.

No companies provided suggested text for the justification section. The moderator proposes to utilize the text provided in RP-212682 with a slight modification to account for the fact that there is an existing FR2 OTA test methodology which could be leveraged based on the discussion concerning the RAN5 updates to accommodate larger devices. The proposed justification text is as follows.

Justification:

“Power classes targeting at FWA devices in FR2 have been introduced from Rel-15 (PC1, more recently PC5), and RF and RRM requirements were defined. The FR2 OTA testing methodology needs to be updated to accommodate these FWA devices.”

The moderator has provided a WF for the justification and objectives based on the intermediate round feedback received on this topic and in the general high-level views in the final round for consideration.

5) EMC enhancement

In the intermediate round, a number of questions were asked in order to further refine the draft WID. The following summarizes the outcome.

a) Do you agree to remove E-UTRA UEs from the scope?

Support to remove or keep as low priority were both presented as options. Huawei indicated that the WID text already seems to imply that the NR optimizations would also apply to the EUTRA UE spec. They suggested to modify the text slightly to further reduce EUTRA scope while still being able to reuse NR adjustments from the Study phase (WID section 4.1, Phase 1) as follows.

- EUTRA UE: CA, DC (Based on the NR study outcome)~~, other features as captured in TS 36.101 v16.5.0 subclause 4.3A~~

The moderator suggests accepting the modified text from Huawei in the next draft WID and to not completely remove E-UTRA UEs from the scope given that there was no strong position presented. No further discussion is required.

b) Do you agree with the timeline outlined in RP-213426? Please also provide your views on the length of the study phase (until RAN#X).

Ericsson indicated that the realistic length for the study phase is 2 quarters for both UE and BS EMC work. After the study phase, the implementation of the specification work will need 2 quarters for BS EMC (only has performance part) and 3 quarters for UE EMC (including both core and performance) as outlined in RP-213426.

Based on this and assuming that the WI will start from Q3/2022 like all other R18 items will yield the following timeline.

Study phase for UE/BS EMC:

- Q3-Q4 2022

Implementation phase:

- Q1-Q2 2023 (BS EMC)

- Q1-Q3 2023 (UE EMC)

Company feedback was supportive of the timeline proposed by Ericsson. The moderator proposes to update the next draft WID accordingly and no further discussion is required on the timeline.

c) Do you agree that we should move towards single EMC specifications (one for UE and one for network nodes) that would cover all RATs (37 series)?

Nokia and ZTE expressed concerns with moving towards single EMC specifications (one for UE and one for network nodes) that would cover all RATs (37 series) based on the Huawei proposal. Ericsson presented a compromise to consider moving towards a single EMC specification for network nodes to improve efficiency. Huawei proposed to add an additional item under the study phase to study moving towards single EMC specifications. The moderator suggests adding this additional item with the modification to consider the Ericsson compromise as follows.

"4. Study the possibility to draft a single EMC specification for network nodes (BS, Repeaters, IAB, etc.; all RATs) to replace multiple legacy EMC specs."

The moderator will collect company views in the final round on this addition.

3 Final Round

The final round will focus on further convergence on the areas/objectives and feedback on the justification text for each area. In addition, the outcome of the final round discussions should result in the determination of the set of SID(s)/WID(s) to be presented at RAN#95e. At the outcome of the final round discussions, the moderator will request the necessary Tdoc numbers for the new SID(s)/WID(s) and provide the initial drafts as inputs to RAN#95e by Monday, 14 February, per the RAN Chair's guidelines shared in RP-220003.

3.1 Collection of company views

3.1.1 General high-level views

Based on the relative support for the FR2 OTA topics and the limited number of RAN4 TUs, the moderator recommends the following way forward.

a) Dynamic OTA testing method for FR2-1 to be considered as a separate SI or merged with the Rel-18 FR2 OTA testing enhancements SI. Postpone any consideration until September Plenary. Consider it together with the Rel-17 OTA leftovers and follow-up work for ongoing Rel-17 SISO OTA and MIMO OTA work based on available RAN4 TUs.

b) FR2-1 OTA testing for UEs with multi-panel reception and 4DL layer to be handled in Rel-18 FR2 OTA testing enhancements SI and can be considered for approval at RAN#95e.

c) Testing framework for FR2 FWA devices (PC1/PC5 in FR2) to be handled as a separate SI. Postpone any consideration until September Plenary to allow for time to confirm the FWA testing gaps beyond the available

RAN5 testing for large devices. Consider it together with the Rel-17 OTA leftovers and follow-up work for ongoing Rel-17 SISO OTA and MIMO OTA work based on available RAN4 TUs.

Feedback Form 19: General high-level views

1 – Guangdong OPPO Mobile Telecom.

Generally ok with the moderator proposals. It seems there will be a package for the FR2 OTA testing enhancements, if this is the plan then maybe in March RAN meeting could set up this WI/SI for the above three items which agreed, i.e. dynamic OTA, multi-pannel, FWA. And in september further discuss other Rel-17 OTA lefts/new for SISO/MIMO OTA with separate SI/WI.

2 – MediaTek Inc.

1) We have no special concern on SI handling, and okay for moderator's suggestion.

2) a/b/c are generally okay for us.

3) Just to clarify our position on c, we are actually positive on this objective if FWA testing gaps can be clearly clarified, because it is a basic SISO OTA test demand.

3 – Apple Italia S.R.L.

We are fine with the Moderator's proposals.

4 – Nokia Corporation

Ok with moderator proposal.

5 – TELECOM ITALIA S.p.A.

We would prefer to have an activity approved in March concerning #b only (since on #a and #c seems to need further discussion in September).

We re-affirm our objection to #a (many concerns stated in the different rounds) and we cannot accept to have a blank check on #a now

6 – Huawei Technologies France

The wording of the first sentence in a) and c) seems to be ambiguous in our understanding.

a) Dynamic OTA testing method for FR2-1 to be considered as a separate SI or merged with the Rel-18 FR2 OTA testing enhancements SI.

c) Testing framework for FR2 FWA devices (PC1/PC5 in FR2) to be handled as a separate SI.

It seems that we reach a consensus on the dynamic OTA testing method for FR2-1 and testing framework for FR2 FWA devices, just only postpone the conclusion until September Plenary, which differs from the summary in the intermediate round.

7 – vivo Communication Technology

We support both Dynamic OTA and multi-pannel RF/RRM/Demod test. However, given the quite different working direction of these areas, we suggest to decouple the discussions, then the suggestion on how to handle these topics is:

- FR2 Dynamic OTA in a dedicated SI

- Multi-pannel RF/RRM/Demod test merged in core part WI, if a dedicated WI is planned for Multi-pannel Rx work.

8 – QUALCOMM JAPAN LLC.

WE have confirmed with our RAN5 colleagues that RAN5 is now working on increased quiet zone for RF testing so it seems there is no need to discuss RF testing for FWA, however, RRM testing still needs discussion in RAN4 because the current test setup is not suitable given the narrower spherical coverage of FWA devices, we can postpone the discussion to better understand what the scope should be.

What is the rationale to postpone the approval of a and c until September? this does not seem to be inline with any previous guidance. This will only make the discussion longer.

9 – Intel Corporation SAS

Moderator's proposals are agreeable for us

3.1.2 Dynamic OTA testing method for FR2-1

The moderator proposes to use the justification that was proposed in RP-212634 as shown below.

Justification:

"The key enablers for high data throughput and stable link connectivity in FR2 are beamforming and beam management techniques. These should be verified by corresponding tests.

However, the current RRM test cases defined in TS38.133 are based on a static test environment, i.e. spatial relation between DUT and TE probe(s), such as (Z)AoA and (Z)AoD, doesn't change during the test. Therefore, UE beam management behaviour is not thoroughly considered in the current RRM test cases.

The Rel-16 study item MIMO OTA SI included the objectives of MIMO throughput testing under dynamic environment and extension of Rel-15 RRM tests to dynamic geometry. The dynamic test method focusing on the UE beam management performance was discussed based on the agreed static test setup. However, due to lack of time, no conclusion was reached. Companies preferred to start a new SI to study the FR2 testing under a "real-world" dynamic environment. Therefore, two scenarios are needed to be studied for FR2 UE dynamic testing. The first one is UE rotation-based scenario which is based on the current 3D-MAPC system. The second one is UE travel-based scenario which is additionally to consider the beams changing from gNB(s) on the basis of UE rotation-based scenario.

Moreover, in RAN1 Rel-17 WI on further enhancements on MIMO for NR (Acronym: NR_FeMIMO), the objective is to extend specification to support several aspects on NR MIMO including multi-panel UE which also has RAN4 impact. Therefore, it is necessary to study the test methodology in RAN4 which is also applicable for multi-panel devices for forward compatibility.

Therefore, a new study item to develop test methodology supporting dynamic testing and multi-panel UE is required in Rel-17."

Feedback Form 20: Justification: Dynamic OTA testing method for FR2-1

1 – MediaTek Inc. We have no concern on moderator's proposal.
2 – Apple Italia S.R.L. We are fine with the Moderator's proposal.
3 – Nokia Corporation We are ok with moderator proposal.
4 – TELECOM ITALIA S.p.A. No specific comment on this proposal, but we re-state the objection to include the topic for the many reasons stated in the different rounds: over-testing, increased time to market, risk of targeting the design to tests (=cheating)
5 – vivo Communication Technology If this is the justification only for dynamic OTA, then we suggest to remove the multi-panel related statement: ~~Moreover, in RAN1 Rel-17 WI on further enhancements on MIMO for NR (Acronym: NR_FeMIMO), the objective is to extend specification to support several aspects on NR MIMO including multi-panel UE which also has RAN4 impact. Therefore, it is necessary to study the test methodology in RAN4 which is also applicable for multi-panel devices for forward compatibility.~~
6 – QUALCOMM JAPAN LLC. We are fine with the moderator proposal. The multi-panel part should be kept because it is important to target a unified testing procedure.

The moderator has updated the set of objectives based on the intermediate round feedback. Please provide your feedback. Please avoid any feedback related to the high-level views already expressed as those are already covered in the way forward in section 3.1.1.

Objective:

The objective of this Study Item is to define end-to-end testing methodology for the verification of FR2 NR UEs performance in a dynamic environment.

The study proceeds within the following scope:

- "Dynamic MIMO OTA" shall take the test method and outcome in Rel-17 (static) MIMO OTA WI into account.
- For the following device types:
  - Smartphone is the first priority.
  - Other UE types are not precluded for discussion as a second priority

- Identify test scenarios:
    - Stage 1: UE rotation-based scenario
        - Change UE rotation during the testing
        - Study the feasibility of reusing 3D-MPAC system with the target to reuse the 3D-MPAC system and channel model in TR 38.827
        - Study if an additional figure of merit beyond data throughput is necessary/beneficial
        - Study blocking issue during UE rotation and performance impacts
    - Stage 2: UE travel-based scenario
        - Change both UE rotation and beams from gNB(s) during the testing
        - Consider splitting Stage 2 into two subcases: case a) fixed UE position with new dynamic channel model; case b) rotated UE with new dynamic channel model.
        - Study the enhancement on 3D-MPAC system
    - Up to 1 beam is the first priority
    - Extensions to a higher number of beams should be considered so that the test method is future proof.
- Identify each test scenario with proper justification and avoid unnecessary overlapping test cases.
    - Test metric should be based on the current core/performance requirements.
- Note: RAN4 will not start Stage 2 before Stage 1 is completed.
- The test methodology shall include both NSA and SA.
    - For setups intended for measurements of UE characteristics in non-standalone (NSA) mode, an LTE link antenna setup is used to configure the NR link
- Using the channel models defined in TR38.901 as the starting point to develop dynamic environment
- Channel model framework in TR38.827 should be taken as the basis
- Study whether and which parameters for channel models defined in TR38827 will have big impact on UE performance and could be reused for dynamic testing.
- Study the applicable test methodology verification procedures
- Study the preliminary uncertainty budget for the methodology
- The uncertainty budget in TR38827 should be the basis for developing the uncertainty.
- Study the additional uncertainty due to the dynamic environment
- The test methodology shall initially assume a black box approach.
- The dynamic environment tests shall take the test system complexity and test time into account to keep the whole test costs within a reasonable level.

- This SI not to introduce the new RAN4 requirements in Rel-18.

During this study item, ongoing communication with 3GPP RAN WG5, CTIA OTA Working Group (MOSG, 5G mm-wave OTA Sub-Working group and MUSG), and CCSA TC9 WG1 shall be maintained to ensure industry coordination on this topic.

Feedback Form 21: Objective: Dynamic OTA testing method for FR2-1

1 – MediaTek Inc. We have no concern on moderator's proposal.
2 – Apple Italia S.R.L. We are fine with the Moderator's proposal.
3 – TELECOM ITALIA S.p.A. This seems a monster activity, requiring a major effort in RAN4 and hardly fitting with the available TUs. We re-state the objection to include the topic for the many reasons stated in the different rounds: over-testing, increased time to market, risk of targeting the design to tests (=cheating)
4 – vivo Communication Technology We are fine with the Moderator's proposal.
5 – QUALCOMM JAPAN LLC. We are fine with the moderator's proposal. We do not understand Telecom Italia's objections since the current RRM testing is benign. For example, there is no test to ensure that a UE can properly change Rx beams to track the gNB Tx beam like when a UE is just rotating. We believe right now the risk that UEs will perform very poorly in the field is much bigger than a potential risk of vendors adapting designs for such tests. How can we know someone would cheat if the tests are not even defined?

3.1.3 FR2-1 OTA testing for UEs with multi-panel reception and 4DL layer

The moderator proposes to us the suggested text provided by Apple for the justification section as below.

Justification:

"With RAN4 considering an objective to define requirements for UEs with multi-panel reception and up to 4DL layers for FR2-1, the FR2 test methodologies for RF, RRM, and demodulation need to be enhanced to support the verification of these new requirements, together with a preliminary assessment of the related uncertainties."

Feedback Form 22: Justification: FR2-1 OTA testing for UEs with multi-panel reception and 4DL layer

1 – MediaTek Inc. We have no concern on moderator's proposal.
2 – Apple Italia S.R.L. We are fine with the Moderator's proposal.
3 – TELECOM ITALIA S.p.A. We are fine with the proposal
4 – vivo Communication Technology Suggest to add the following wording: "**In RAN1 Rel-17 WI on further enhancements on MIMO for NR (Acronym: NR_FeMIMO), the objective is to extend specification to support several aspects on NR MIMO including multi-panel UE which also has RAN4 impact.** With RAN4 considering an objective to define requirements for UEs with multi-panel reception and up to 4DL layers for FR2-1, the FR2 test methodologies for RF, RRM, and demodulation need to be enhanced to support the verification of these new requirements, together with a preliminary assessment of the related uncertainties."
5 – QUALCOMM JAPAN LLC. We are fine with the proposal.
6 – Intel Corporation SAS Moderator's proposals are agreeable for us

The moderator has proposed the following updates to the objectives indicated with underlining. Please provide your feedback. Please avoid any feedback related to the high-level views already expressed as those are already covered in the way forward in section 3.1.1.

Objective:

- Define a test methodology for RF/RRM/Demodulation requirements testing for devices that can receive/transmit simultaneously from multiple AoAs
    - The multiple AoA test setup should enable testing of up to <u>2 DL</u> Layers with dual polarization for each angle
    - <u>For RRM, the target should be 4 angles with 2 angles used simultaneously</u>
- Define a test methodology for up to 4 DL MIMO layer demodulation testing
- Smartphone form factor should be the first priority, other UE types should also be discussed as 2nd priority
- Develop the related preliminary uncertainty assessments for the test methodologies

- Rel-15 and Rel-17 FR2 test methods should be used as the baseline. As such, the conclusions and agreements in TR 38.810 and TR 38.884 should be taken into account.
- The tests shall take the test system reuse, test system complexity and test time into account to keep the whole test costs within a reasonable level.

Feedback Form 23: Objective: FR2-1 OTA testing for UEs with multi-panel reception and 4DL layer

1 – MediaTek Inc. We have no concern on moderator's proposal.
2 – Apple Italia S.R.L. We are fine with the Moderator's proposal.
3 – Samsung Electronics Co. We support moderator proposal. Meanwhile, as we commented in e-mail thread #2 (feedback from #32), we suggest to open the discussion on merging the test method and core requirements into single dedicated WI after the objective is stable. We prefer to have one dedicated WI with both core requirements and test methods.
4 – Nokia Corporation We support the objectives.
5 – TELECOM ITALIA S.p.A. ok
6 – vivo Communication Technology We support these objectives and share similar views with Samsung on how to treat this work.
7 – Intel Corporation SAS Moderator's proposals are agreeable for us

3.1.4 Testing framework for FR2 FWA devices (PC1/PC5 in FR2)

The moderator proposes to utilize the text provided in RP-212682 with a slight modification to account for the fact that there is an existing FR2 OTA test methodology which could be leveraged based on the discussion concerning the RAN5 updates to accommodate larger devices. The proposed justification text is as follows.

Justification:

"Power classes targeting at FWA devices in FR2 have been introduced from Rel-15 (PC1, more recently PC5), and RF and RRM requirements were defined. The FR2 OTA testing methodology needs to be updated to accommodate these FWA devices."

Feedback Form 24: Justification: Testing framework for FR2 FWA devices (PC1/PC5 in FR2)

1 – MediaTek Inc. We have no concern on moderator's proposal.
2 – Nokia Corporation We are ok with moderator proposal.
3 – TELECOM ITALIA S.p.A. Ok (and to clarify, ok for me it means support :-))
4 – vivo Communication Technology We support moderator's proposal, and suggest to add the following wording: "Power classes targeting at FWA devices in FR2 have been introduced from Rel-15 (PC1, more recently PC5), and RF and RRM requirements were defined. **Currently, some of the requirements of these FWA devices may not be testable,** the FR2 OTA testing methodology needs to be updated to accommodate these FWA devices."
5 – QUALCOMM JAPAN LLC. We are fine with the proposal. Please also see our comments in the general high-level views. It seems the scope could be reduced to RRM testing.

Please provide your feedback on the MediaTek suggestion to rephrase the topic name as "FR2(?) SISO OTA testing framework for FWA devices (PC1/PC5)" and to indicate if FR2 needs to be limited to FR2-1 or include all of FR2 (FR2-1 and FR2-2).

Feedback Form 25: Rephrase of topic name

1 – MediaTek Inc. Thanks Moderator to treat this issue. Our intention is to make the scope clearer, and would like to know other companies' view, because test configuration and chamber is quite frequency dependence.
2 – TELECOM ITALIA S.p.A. Focus on FR2-1. Products are already available on the market and we need to ensure proper testing. Opening to FR2-2 will lead to major discussion for uncertain market needs
3 – vivo Communication Technology For FR2 OTA from Rel-15, we never use "SISO OTA" wording for discussion, we understand the motivation but we do not suggest to change it, confusion would be introduced.

4 – QUALCOMM JAPAN LLC. We are fine with the suggestion. We could start with FR2-1 and later expand to FR2-2

The moderator has proposed the following updates to the objectives indicated with underlining. Please provide your feedback. Please avoid any feedback related to the high-level views already expressed as those are already covered in the way forward in section 3.1.1.

Objective:

- Study the test setup, test methodology and preliminary MU analysis for FWA devices
  - Consider PC1/PC5 FWA devices up to [40cm] in diagonal
  - The study should leverage the work done by RAN5 on larger QZs and device sizes and focus on any necessary gaps in the testing framework for FR2 FWA devices
- The test setup/methodology should reuse the existing PC3 testing setup/methodology to the extent possible
- The test setup/methodology should enable RF, RRM and demod testing
- <u>The tests shall take the test system complexity and test time into account to keep the whole test costs within a reasonable level. Test time reduction method can be further studied and would also apply to PC2/3/4/6, if feasible</u>

Feedback Form 26: Objective: Testing framework for FR2 FWA devices (PC1/PC5 in FR2)

1 – MediaTek Inc. Thanks Moderator, we are fine for this proposal.
2 – TELECOM ITALIA S.p.A. ok

3.1.5 EMC enhancement

The moderator proposes to move forward with the intermediate round justification and scope with the suggested updates related to E-UTRA UEs and the timeline. In the final round, the moderator would like to collect company views on the adding a study concerning the possibility of drafting a single EMC specification for network nodes only based on the compromise suggested by Ericsson using similar text as provided by Huawei. The moderator suggests adding this additional item with the modification to consider the Ericsson compromise as follows.

"4. Study the possibility to draft a single EMC specification for network nodes (BS, Repeaters, IAB, etc.; all RATs) to replace multiple legacy EMC specs."

Feedback Form 27: Do you agree with adding the study of a single EMC specification for network nodes?

1 – Ericsson LM We agree to study single EMC spec for network node. This can be part of the study phase.
2 – Huawei Technologies France As proponents, we do support to add objective #4 to the study phase, where we can address potential concerns related to workload, features applicability, etc.
3 – Nokia France We would prefer not to include the study objective due to the additional work involved and the fact that this impacts the core specs, whereas so far from the consensus reached from previous discussions, the scope of the WID excludes work on the core part of the BS EMC.

3.2 Moderator Summary and Final Recommendations

Thanks for your comments and very productive discussions for Rel-18 RAN4 Testing Enhancements during the Rel-18 RAN4 Email Prep for RAN#95e. All items are identified as RAN4-led with no aspects involving other WGs. The summary and final recommendations for each topic are as follows.

1) **General high-level views**

The vast majority of companies supported the moderator proposal.

There was a comment from Huawei that the wording of the first sentence for a) and c) was ambiguous and that it suggested that we reached consensus on these topics. The moderator was only indicating how these topics may be treated in the future (independent SI or merged with FR2 OTA testing enhancements SI) and there was no intent to indicate that there was consensus to approve these items at this time, or in the future, based on company feedback during the initial and intermediate rounds as well as the priority levels provided by companies. The latter two sentences for a) and c) mentioned that the topics would be postponed until September for further discussion and any final approval would be determined at that time based on any other OTA related topics and available RAN4 TUs. The moderator will add some clarification text to the final recommended way forward.

vivo suggested to take FR2 Dynamic OTA in a dedicated SI and Multi-panel RF/RRM/Demod testing to be merged in core part WI, if a dedicated WI is planned for Multi-panel UEs. The moderator proposes to keep Multi-panel RF/RRM/Demod testing as a separate SI under FR2 OTA testing enhancements for now since RAN4 has traditionally used study items for test methodology development.

Qualcomm confirmed that RAN5 is now working on increased quiet zone for RF testing, so it seems there is no need to discuss RF testing for FWA. They mentioned that RRM testing still needs discussion in RAN4 because the current test setup is not suitable given the narrower spherical coverage of FWA devices and that RAN can postpone the discussion to better understand what the scope should be.

Qualcomm also raised a concern about postponing the approval of a) and c) until September. In the moderator's view from the priority discussion and the company positions during the intermediate round, there was not consensus to approve a) and c) at this time.

The moderator recommends including the statement made earlier in the email discussion period that further discussion on Rel-17 OTA leftovers and follow-up work for ongoing Rel-17 SISO OTA and MIMO OTA work can be discussed separately in September RAN Plenary for Rel-18.

Based on the summary above, the moderator recommends the following way forward.

- Dynamic OTA testing method for FR2-1 to be considered as a separate SI or merged with the Rel-18 FR2 OTA testing enhancements SI. Postpone any consideration until September Plenary. Consider any possible approval together with the Rel-17 OTA leftovers and follow-up work for ongoing Rel-17 SISO OTA and MIMO OTA work based on available RAN4 TUs.
- FR2-1 OTA testing for UEs with multi-panel reception and 4DL layer to be handled in Rel-18 FR2 OTA testing enhancements SI and can be considered for approval at RAN#95e.
- Testing framework for FR2 FWA devices (PC1/PC5 in FR2) to be handled as a separate SI. Postpone any consideration until September Plenary to allow for time to confirm the FWA testing gaps beyond the available RAN5 testing for large devices. Consider any possible approval with the Rel-17 OTA leftovers and follow-up work for ongoing Rel-17 SISO OTA and MIMO OTA work based on available RAN4 TUs.
- Further discussion on Rel-17 OTA leftovers and follow-up work for ongoing Rel-17 SISO OTA and MIMO OTA work can be discussed separately in September RAN Plenary for Rel-18.

2) **Dynamic OTA testing method for FR2-1**

Given that the scope of the final round was to work towards justification text and a list of stable objectives, there was consensus with the moderator proposals with one suggested revision to the justification section by vivo.

vivo suggested to remove the multi-panel related statement from the justification. Qualcomm preferred to keep it as it is important to target a unified testing procedure.

In the moderator's view, test system re-use was an important aspect. For now, the moderator will place this statement in brackets, and it can be further discussed.

Based on the summary above, the moderator recommends that the following text for the justification section and objectives be used as the baseline for any future discussions.

Justification:

"The key enablers for high data throughput and stable link connectivity in FR2 are beamforming and beam management techniques. These should be verified by corresponding tests.

However, the current RRM test cases defined in TS38.133 are based on a static test environment, i.e. spatial relation between DUT and TE probe(s), such as (Z)AoA and (Z)AoD, doesn't change during the test. Therefore, UE beam management behaviour is not thoroughly considered in the current RRM test cases.

The Rel-16 study item MIMO OTA SI included the objectives of MIMO throughput testing under dynamic environment and extension of Rel-15 RRM tests to dynamic geometry. The dynamic test method focusing on the UE beam management performance was discussed based on the agreed static test setup. However, due to lack of time, no conclusion was reached. Companies preferred to start a new SI to study the FR2 testing under a "real-world" dynamic environment. Therefore, two scenarios are needed to be studied for FR2 UE dynamic

testing. The first one is UE rotation-based scenario which is based on the current 3D-MAPC system. The second one is UE travel-based scenario which is additionally to consider the beams changing from gNB(s) on the basis of UE rotation-based scenario.

[Moreover, in RAN1 Rel-17 WI on further enhancements on MIMO for NR (Acronym: NR_FeMIMO), the objective is to extend specification to support several aspects on NR MIMO including multi-panel UE which also has RAN4 impact. Therefore, it is necessary to study the test methodology in RAN4 which is also applicable for multi-panel devices for forward compatibility.]

Therefore, a new study item to develop test methodology supporting dynamic testing and multi-panel UE is required in Rel-17."

Objective:

The objective of this Study Item is to define end-to-end testing methodology for the verification of FR2 NR UEs performance in a dynamic environment.

The study proceeds within the following scope:

- "Dynamic MIMO OTA" shall take the test method and outcome in Rel-17 (static) MIMO OTA WI into account.
- For the following device types:
    - Smartphone is the first priority.
    - Other UE types are not precluded for discussion as a second priority
- Identify test scenarios:
    - Stage 1: UE rotation-based scenario
        - Change UE rotation during the testing
        - Study the feasibility of reusing 3D-MPAC system with the target to reuse the 3D-MPAC system and channel model in TR 38.827
        - Study if an additional figure of merit beyond data throughput is necessary/beneficial
        - Study blocking issue during UE rotation and performance impacts
    - Stage 2: UE travel-based scenario
        - Change both UE rotation and beams from gNB(s) during the testing
        - Consider splitting Stage 2 into two subcases: case a) fixed UE position with new dynamic channel model; case b) rotated UE with new dynamic channel model.
        - Study the enhancement on 3D-MPAC system
    - Up to 1 beam is the first priority
    - Extensions to a higher number of beams should be considered so that the test method is future proof.

- Identify each test scenario with proper justification and avoid unnecessary overlapping test cases.
    - Test metric should be based on the current core/performance requirements.
- Note: RAN4 will not start Stage 2 before Stage 1 is completed.
- The test methodology shall include both NSA and SA.
    - For setups intended for measurements of UE characteristics in non-standalone (NSA) mode, an LTE link antenna setup is used to configure the NR link
- Using the channel models defined in TR38.901 as the starting point to develop dynamic environment
- Channel model framework in TR38.827 should be taken as the basis
- Study whether and which parameters for channel models defined in TR38827 will have big impact on UE performance and could be reused for dynamic testing.
- Study the applicable test methodology verification procedures
- Study the preliminary uncertainty budget for the methodology
- The uncertainty budget in TR38827 should be the basis for developing the uncertainty.
- Study the additional uncertainty due to the dynamic environment
- The test methodology shall initially assume a black box approach.
- The dynamic environment tests shall take the test system complexity and test time into account to keep the whole test costs within a reasonable level.
- This SI not to introduce the new RAN4 requirements in Rel-18.

During this study item, ongoing communication with 3GPP RAN WG5, CTIA OTA Working Group (MOSG, 5G mm-wave OTA Sub-Working group and MUSG), and CCSA TC9 WG1 shall be maintained to ensure industry coordination on this topic.

3) **FR2-1 OTA testing for UEs with multi-panel reception and 4DL layer**

There was consensus with the moderator proposals with one suggested revision to the justification section by vivo.

vivo suggested to add introductory text to the justification section related to the Rel-17 WI on further enhancements on MIMO for NR which leads to the need for testing for multi-panel UEs. The moderator agrees that this introductory text is beneficial and will include it in the draft SID.

Samsung and vivo suggested to merge the test method and core requirements into a dedicated WI once the objectives are stable. As mentioned earlier, the moderator proposes to keep this topic as a separate SI under FR2 OTA testing enhancements for now since RAN4 has traditionally used study items for test methodology development. The majority of the companies support a separate SI.

Based on the summary above, the moderator recommends that the following text for the justification section and objectives be used as the baseline for the draft SID that will be submitted to RAN#95e in accordance with the RAN Chair's guidance in RP-220003.

Justification:

"In RAN1 Rel-17 WI on further enhancements on MIMO for NR (Acronym: NR_FeMIMO), the objective is to extend the specification to support several aspects on NR MIMO including multi-panel UEs which also has RAN4 impact. With RAN4 considering an objective to define requirements for UEs with multi-panel reception and up to 4DL layers for FR2-1, the FR2 test methodologies for RF, RRM, and demodulation need to be enhanced to support the verification of these new requirements, together with a preliminary assessment of the related uncertainties."

Objective:

- Define a test methodology for RF/RRM/Demodulation requirements testing for devices that can receive/transmit simultaneously from multiple AoAs
    - The multiple AoA test setup should enable testing of up to 2 DL Layers with dual polarization for each angle
    - For RRM, the target should be 4 angles with 2 angles used simultaneously
- Define a test methodology for up to 4 DL MIMO layer demodulation testing
- Smartphone form factor should be the first priority, other UE types should also be discussed as 2nd priority
- Develop the related preliminary uncertainty assessments for the test methodologies
- Rel-15 and Rel-17 FR2 test methods should be used as the baseline. As such, the conclusions and agreements in TR 38.810 and TR 38.884 should be taken into account.
- The tests shall take the test system reuse, test system complexity and test time into account to keep the whole test costs within a reasonable level.

4) **FR2 testing framework for FWA devices (PC1/PC5)**

There was consensus with the moderator proposals with one suggested revision to the justification section by vivo.

vivo suggested to add the following prepositional phrase to the last sentence of the justification.

"Currently, some of the requirements of these FWA devices may not be testable, ..."

The moderator agrees that the text is beneficial and will include it in the draft SID. The suggested text also would cover the Qualcomm comment that the scope could be reduced to RRM testing.

Concerning the MediaTek suggestion to rephrase the topic name as "FR2(?) SISO OTA testing framework for FWA devices (PC1/PC5)" and to indicate if FR2 needs to be limited to FR2-1 or include all of FR2 (FR2-1 and FR2-2), there were concerns raised.

vivo raised concern about using the term "SISO OTA" as it is not used during FR2 OTA discussions since Rel-15.

Concerning the topic of FR2, the view from companies at this time seemed to suggest that the scope should be limited to FR2-1. Qualcomm mentioned about extending it to FR-2 at a later time. The moderator proposes to

rephrase the topic name to "FR2 testing framework for FWA devices (PC1/PC5)" and to add an objective sub-bullet item that the study is for FR2-1. Later, if there is market need for the study to be extended to FR2-2, the update to the objective can be discussed and the topic name will be generic enough, if needed.

Based on the summary above, the moderator recommends that the following text for the justification section and objectives be used as the baseline for any future discussions.

Justification:

"Power classes targeting at FWA devices in FR2 have been introduced from Rel-15 (PC1, more recently PC5), and RF and RRM requirements were defined. Currently, some of the requirements of these FWA devices may not be testable, the FR2 OTA testing methodology needs to be updated to accommodate these FWA devices."

Objective:

- Study the test setup, test methodology and preliminary MU analysis for FWA devices
    - Consider FR2-1 FWA devices only
    - Consider PC1/PC5 FWA devices up to [40cm] in diagonal
    - The study should leverage the work done by RAN5 on larger QZs and device sizes and focus on any necessary gaps in the testing framework for FR2-1 FWA devices
- The test setup/methodology should reuse the existing PC3 testing setup/methodology to the extent possible
- The test setup/methodology should enable RF, RRM and demod testing
- The tests shall take the test system complexity and test time into account to keep the whole test costs within a reasonable level. Test time reduction method can be further studied and would also apply to PC2/3/4/6, if feasible

5) **EMC enhancement**

In the final round, a question was asked concerning adding a study of the possibility to draft a single EMC specification for network nodes as follows.

"4. Study the possibility to draft a single EMC specification for network nodes (BS, Repeaters, IAB, etc.; all RATs) to replace multiple legacy EMC specs."

Only three companies commented with two agreeing with the proposal and one not agreeing. As there was very little feedback in the final round, the moderator proposes to add the additional item in brackets so that it can be further discussed at RAN#95e.

The moderator way forward for EMC enhancement is provided below.

- Provide a draft WID that will be submitted to RAN#95e in accordance with the RAN Chair's guidance in RP-220003.

- The draft WID will use the justification and scope in the draft WID in RP-211825 as a baseline with the corrections identified in the initial round and suggested updates to E-UTRA UEs and the timeline identified during the intermediate round.
    - A revision marked and clean version will be provided
- Add the addition item to Phase 1 as follows in brackets to allow for further discussion at RAN#95e:
    - [4. Study the possibility to draft a single EMC specification for network nodes (BS, Repeaters, IAB, etc.; all RATs) to replace multiple legacy EMC specs.]