**3GPP TSG RAN meeting #90e RP-20xxxx**

**Electronic Meeting, 7-11 December 2020**

**Agenda item:** TBA

**Source:** Email discussion moderator (Intel)

**Title:** Report from Email Discussion [90E][43][60GHz\_OTA]

**Document for:** Discussion and decision

# Introduction

This document provides as summary of the following email discussion during RAN#90-e:

**[90E][43][60GHz\_OTA]**

Goal: Generate an agreeable way forward.

Input contributions covered: 2661

# Discussion

## Background

The following summarizes the key observations and proposals listed in RP-202661:

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| ***Observation #1: OTA test methods are used as a baseline approach for NR mmWave test methodology for RF, RRM, and Demodulation testing.***  ***Observation #2: The existing mmWave OTA UE test methods are applicable to FR2 frequency bands and their extension to carrier frequencies above 52.6 GHz should be further studied***  **Proposal #1: Further study and define NR 52.6-71GHz OTA test methods within the Rel-17 timeframe**   * + **Option 1: Initiate a separate SI in parallel with NR 52.6 – 71 GHz WI**   + **Option 2: Extend the scope of the NR 52.6 – 71 GHz WI to cover the testability aspects**   **Proposal #2: Consider the following SI/WI objectives to enable NR 52.6-71GHz OTA test methods**   * + *Study and define the over the air (OTA) test methods for UE RF, RRM, and demodulation requirements for the 52.6GHz-71GHz frequency range [RAN4]*     - *Extend the applicability of the FR2 OTA test methods in TR 38.810 wherever possible*     - *Identify any changes needed, including general testing and calibration, permitted test methods, multi-path fading propagation conditions, measurement applicability criteria.*     - *Target device types: Handheld UE, laptop, tablet, FWA, vehicular mounted device; other UE types not precluded.* |

## Initial round

### Open issues

The following questions are proposed to be discussed in the initial round:

* Question #1: Whether to further study and define NR 52.6-71GHz OTA test methods within the Rel-17 timeframe
* Question #2: How to organize the NR 52.6-71GHz OTA test methods studies within the Rel-17 timeframe
  + Option 1: Initiate a separate SI to study NR 52.6-71GHz OTA test methods
  + Option 2: Extend the scope of the NR 52.6 – 71 GHz WI to cover the testability aspects
  + Option 3: other options?
* Question #3: Candidate study objectives
  + *Option 1: Study and define the over the air (OTA) test methods for UE RF, RRM, and demodulation requirements for the 52.6GHz-71GHz frequency range [RAN4]*
    - *Extend the applicability of the FR2 OTA test methods in TR 38.810 wherever possible*
    - *Identify any changes needed, including general testing and calibration, permitted test methods, multi-path fading propagation conditions, measurement applicability criteria.*
    - *Target device types: Handheld UE, laptop, tablet, FWA, vehicular mounted device; other UE types not precluded.*
    - *Utilize free space testing configuration for test methods definition.*

### Companies views’ collection

**Question #1: Whether to further study and define NR 52.6-71GHz OTA test methods within the Rel-17 timeframe?**

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| **Company** | **Comments** |
| Qualcomm | Q1: some study is definitely needed as there is a gap in testing for this frequency range. |
| ZTE | It is fine to study in Rel-17 timeframe if TU allowed, however this work should be started until RF core requirements is stable, otherwsie it seems no base are upon for further discussion. |
| Intel | Support to study in Rel-17. Agree with QC that there will be gap in case the test methods are not defined and RAN4 core requirements and RAN5 conformance requirements cannot be defined.  To ZTE: the work can start in May 2020 or later once some progress is made with RF requirements definition. |
| Apple | We suggest seeing 1 or 2 quarters of progress in 52.6 - 71 GHz work item before initiating testability work, since test methodology development for this frequency range will have dependencies on the core requirement definition |
| Huawei, HiSilicon | Before rushing to study in Rel-17 for 52.6-71GHz OTA test methods, we need to have a better understanding whether existing test framework for FR2 can be reused for 52.6-71GHz, which should be based on available RF requirements. However, requirements are not studied yet. |
| Keysight | The decision to extend NR to 71 GHz seems to have been made. It is therefore inevitable that there will be requirements at some point in the future and that those requirements will have to be tested. It is also the case that existing FR2 test system that have to operate down to 24.25 GHz cannot be extended to 71 GHz without significant changes in architecture. It is therefore essential that 3GPP gives the test community a clear and early message that test systems covering the range 52.6 GHz to 71 GHz are expected in order that essential design work can be prioritized. Keysight therefore supports studying this during Rel-17. |
| MTK | Fine to have some study. But we would prefer to first focus on whether the existing FR2 testing framework can be re-used here for 52.6-71GHz. If we later identify new issues for 52.6-71GHz, we can further discuss how and where to discuss new test methods |
| Ericsson | Test methods are clearly needed for the UE (and also the BS). For the BS, our understanding is that developing test methodologies is already part of the performance part of the WI, where the BS conformance spec is written. For the UE if it makes sense to roll together with other OTA issues a SI could make sense. No need to link the UE work in any way with the BS, but regarding timing, considering RAN4 workload it could make sense to start this work at the same time the performance part of the WI starts (which is when the corresponding BS work starts too). |
| vivo | We support to do some study. We also need to consider that the FR2 testability is always started after we have some initial thinking of core requirements. So maybe the starting time need to be further discussed. |

**Question #2: How to organize the NR 52.6-71GHz OTA test methods studies within the Rel-17 timeframe**

* **Option 1: Initiate a separate SI to study NR 52.6-71GHz OTA test methods**
* **Option 2: Extend the scope of the NR 52.6 – 71 GHz WI to cover the testability aspects**
* **Option 3: other options?**

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| **Company** | **Comments** |
| Qualcomm | Q2: Option 3: We believe there are also other OTA testing issues arising from different WIs, there should be a broader discussion on how we handle all of them. Each could be handled in its own WI/SI (basically Option 2 applied independently to each item), however this might not be the most efficient way. Considering that OTA discussions are mainly handled by the same delegates, it should be discussed whether a study item handling all OTA issues in one release should be used. This could be an ongoing SI in which topics are added and concluded one by one. Such handling would offer a wholistic approach which would be very important to achieve a unified testing discussion. Divergence in terms of testing solutions/methodologies would be very harmful for the eco-system. |
| ZTE | Option 2 is more preferred as this 52.6-71GHz OTA test method should be similar as the existing FR2 OTA test.  Given QC’s comments, we are also fine to put all FR2 OTA testing issues in one umbrella SI as OTA delegates should be same for different topics. |
| Apple | We would like to suggest a new option: once sufficient progress is achieved in the 52.6 - 71 GHz work item, specific objectives related to testability in this frequency range can be added to the Rel-17 study on enhanced FR2 test methods (FS\_FR2\_enhTestMethods). The study is already handling the extension of frequency range up to 49 GHz and can further accommodate the expansion of scope following 1 or 2 quarters of progress in the 52.6 – 71 GHz core work item. |
| Intel | Prefer Option 1 to have a separate SI. The SI scope aims to define test methods for RF/RRM/Demod requirements. We assume that the work can progress during the Rel-17 Performance stage. So, in case we add objectives to the WI, there is a risk that the whole WI Core part should be extended in case the test methods work is incomplete by the Core part completion deadline.  We are also OK to put all mmWave OTA testing aspects in one umbrella SI. In this case it makes sense to extend the objectives of Rel-17 FR2 Test Methods enhancements SI. |
| Huawei, HiSilicon | Option 2. The test methods are relevant to the RF requirements specified in the WI. Once the requirements are available, the test methods can be studied. |
| Keysight | Don’t have a strong preference. It may be that there is overlap with existing test systems < 52.6 GHz and the issue of CA should also be considered so the extension to 71 GHz cannot necessarily be handled in isolation of other bands. |
| MTK | Option 3. We prefer to first start the feasibility study in existing ongoing SI to check if FR2 test methods can be re-used first. It seems to us this will bring the least impact in TU budget and is easiest to be handled the same group of OTA experts. Once we have a clear study conclusion, we can know better how to start the following works. |
| vivo | Option3. Existing test methods can be the starting point for higher frequency, we prefer to discuss a proper way to treat the FR2 testability issue.  Now the FR2 upper frequency of the test system has been changed several times from 43.5GHz~49GHz~71GHz. A big picture of FR2 test method project is much helpful for RAN4 FR2 OTA management. |

**Question 3: Candidate study objectives**

* ***Option 1: Study and define the over the air (OTA) test methods for UE RF, RRM, and demodulation requirements for the 52.6GHz-71GHz frequency range [RAN4]***
  + ***Extend the applicability of the FR2 OTA test methods in TR 38.810 wherever possible***
  + ***Identify any changes needed, including general testing and calibration, permitted test methods, multi-path fading propagation conditions, measurement applicability criteria.***
  + ***Target device types: Handheld UE, laptop, tablet, FWA, vehicular mounted device; other UE types not precluded.***
  + ***Utilize free space testing configuration for test methods definition.***

Companies are encouraged to share views on the candidate objectives of the studies and whether proposed Option 1 objectives are acceptable.

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| **Company** | **Comments** |
| Qualcomm | Q3: we mainly agree with the bullets, we believe that FWA and vehicular mounted device can be de-prioritize, at least for now. |
| ZTE | Just wondering in 52.6-71GHz, are we going to define so many device types? If not, we need to consider so many use cases here? |
| Apple | We recommend to have some initial core requirement agreements before properly scoping the study. It is also not clear whether the physical layer design will accommodate a vehicular mounted use case. |
| Intel | Support the objectives.  We are fine to prioritize handheld UE, laptop, tablet type of devices. FWA and vehicular mounted devices can be treated with the 2nd priority. |
| Huawei, HiSilicon | As commented for Q2, it’s too early to consider the detailed objectives as no RF requirements are specified yet. |
| Keysight | The need to test bands other than 52.6 to 71 GHz in the same test system needs to be made clear up front as this will have a major impact on the design of future systems. |
| MTK | Objectives are fine to us. The problem is about the timeline. There could be some dependency to either RAN1 work or RAN4 RF requirement. Some breakdown is needed to know which topics can be studied first and which topics should be started later. |
| vivo | Prioritization of UE type is needed, which is highly related to the system capability. We also suggest to study preliminary MU assessment of the new test methods in RAN4, for 52.6GHz-71GHz frequency range. |

### Summary and recommendation for further discussion

**Question #1: Whether to further study and define NR 52.6-71GHz OTA test methods within the Rel-17 timeframe?**

* Summary of comments
  + 9 companies shared views
  + 6 companies support to perform studies in Rel-17 timeframe. 3 other companies did not object the studies and suggested to wait for further RF requirements progress.
  + 5 companies commented that sufficient progress on RF requirements definition should be achieved before triggering the OTA testability work.
  + 2 companies commented that RAN4 should first assess whether the existing FR2 testing framework can be re-used for 52.6-71GHz
  + 1 company commented that BS OTA test methods need to be considered and can be handled as a part of BS Conformance requirements objectives under the NR 52.6 – 71 GHz WI
  + One company commented that it is essential that 3GPP gives the test community a clear and early message that test systems covering the range 52.6 GHz to 71 GHz are expected.
* Moderator view
  + Majority view is that the work on NR 52.6-71 GHz OTA test methods development needs to be done in Rel-17 timeframe.
  + An early agreement to trigger the work on UE OTA Test Methods for NR 52.6 – 71 GHz in Rel-17 can be helpful to give a message to test systems vendors that such systems will be required.
  + Also, such agreement can be helpful for overall RAN4 TU budget planning.
  + Moderator proposes to confirm that the work shall be done in Rel-17.
    - The work on BS OTA test methods will be performed in the scope of NR 52.6 – 71 GHz WI as a part of conformance requirements definition objective (note: the objectives are already included in the original approved WID)
    - The work on UE OTA test methods can be performed separately. The exact timelines for the work need further discussion.

**Question #2: How to organize the NR 52.6-71GHz OTA test methods studies within the Rel-17 timeframe**

* Summary of comments
  + 9 companies shared views
  + In addition to the proposals shared by moderator, alternative options were proposed to keep all UE mmWave OTA topics under a single SI:
    - Option 3: Use a single “umbrella” study item handling all OTA issues in one release
    - Option 3a: Expand the scope of the ongoing the Rel-17 study on enhanced FR2 test methods (FS\_FR2\_enhTestMethods)
  + Option 1 (separate SI for NR 52.6 – 71 GHz OTA test methods) was supported by 1 company
  + Option 2 (extend the scope of the NR 52.6 – 71 GHz WI) was supported by 2 companies
  + New Options 3 and 3a were supported by 7 companies. (note: the moderator assumption is that proponents of Option 3 are also accepting the Option 3a)
* Moderator views
  + The majority of companies prefer to keep all UE mmWave OTA topics under a single SI. Many companies propose to extend the scope of the ongoing the Rel-17 study on enhanced FR2 test methods which seem to be a viable solution.
  + Moderator recommends the work on NR 52.6-71GHz UE OTA test methods will be performed in the scope of the Rel-17 study on enhanced FR2 test methods SI (FS\_FR2\_enhTestMethods)

**Question 3: Candidate study objectives**

* Summary of views
  + Three companies commented that proposed objectives are fine
  + Several companies proposed objectives update
    - Down-scoping in terms of the set of supported devices (e.g. deprioritize FWA and vehicular mounted devices)
    - Further clarify whether test methods shall be capable to test bands other than 52.6 to 71 GHz in the same test system
    - Add objectives to study preliminary MU assessment
  + Two companies commented that some initial core requirement agreements are required before properly scoping the study
  + One company commented that there could be some dependency on either RAN1 work or RAN4 RF requirement. Some breakdown is needed to know which topics can be studied first and which topics should be started later.
* Moderator views
  + Further adjustment of the objectives is needed at least for the following aspects
    - Prioritization of supported devices (e.g. deprioritize FWA and vehicular mounted devices)
    - Test methods applicability for to test devices with support of FR1, FR2 and 52.6 – 71GHz bands
    - Preliminary MU assessment
  + To address companies views the discussion on the detailed objectives can be postponed to a later stage. A dedicated email discussion can be helpful to make the fine-tuning of the exact objectives.

Based on the initial round feedback moderator makes the following proposal for the intermediate round discussion:

* **Proposal #1: Study and define NR 52.6-71GHz UE OTA test methods in Rel-17** 
  + **Include NR 52.6-71GHz UE OTA test methods objectives in the scope of the Rel-17 NR FR2 Test Methods Enhancements SI (FS\_FR2\_enhTestMethods)**
  + **The timelines of the work shall be further discussed.**
  + **Further discuss and refine detailed objectives of the studies before [RAN #91e].**
* **Proposal #2: Study and define NR 52.6-71GHz BS OTA test methods in Rel-17** 
  + **The work will be done the scope of Rel-17 NR 52.6 – 71 GHz WI as a part of RAN4 BS conformance requirements objective**
  + **The work can progress during the Rel-17 Performance stage**

## Intermediate round

**Proposal #1: Study and define NR 52.6-71GHz UE OTA test methods in Rel-17**

* **Include NR 52.6-71GHz UE OTA test methods objectives in the scope of the Rel-17 NR FR2 Test Methods Enhancements SI (FS\_FR2\_enhTestMethods)**
* **The timelines of the work shall be further discussed.**
* **Further discuss and refine detailed objectives of the studies before [RAN #91e].**

Companies are encouraged to provide the comments on Proposal #1 including the timelines of the work and further objectives discussion.

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| **Company** | **Comments** |
| CAICT | Sorry for not being able to express our views during the initial round. In general, we support the study of UE OTA test methods for 52.6-71GHz since it has been decided to extend the NR band to higher frequency.  It is beneficial to handheld the OTA topics in the same group. We just want to point out that the target completion date of the FR2 Test Methods Enhancement SI is June/2021, but 52.6-71GHz test methods could be some dependency on RF requirement as mentioned above, therefore, it is hard to make much progress before reaching some conclusions on the core part. So, if we are going to include 52.6-71GHz topics in the scope of this SI, the impact on completion time should be considered.  Regarding the objectives, does the extension of 52.6-71GHz applicability of the test method enhancement is also included in the scope? Need further discussion to clarify the detailed objectives. |
| Qualcomm | We do not think merging this work in the ongoing FR2 test enhancements SI is a good idea, not clear to use why the moderator made this assumption. That study was triggered by the need to bridge the gaps between requirements and testable values. The nature of this work is completely different.  We believe a broader discussion is needed since there will likely be needs to study testing aspects for other features that are discussed in different WIs. One example is the FeMIMO WI which handles different MIMO enhancements for which testing needs are different. A wholistic approach to understand all testing needs is a must to develop versatile test equipment to reduce testing costs. |
| Apple | We support this proposal.  We also would like to share a comment for CAICT: The completion target of June 2021 for FS\_FR2\_enhTestMethods was determined based on its current scope of objectives during RAN #89, and no additional extension has been proposed since then. Our understanding is that once the detailed objectives for the 52.6 – 71 GHz work are defined, a further extension of the SI can also be contemplated. |
| vivo | Support this proposal.  Extension of the testability from 43.5GHz to 49GHz was added in the scope of the Rel-17 NR FR2 Test Methods Enhancements SI, same approach can be done for 52.6-71GHz. Timeline and detailed objectives can be further discussed. |
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**Proposal #2: Study and define NR 52.6-71GHz BS OTA test methods in Rel-17**

* **The work will be done the scope of Rel-17 NR 52.6 – 71 GHz WI as a part of RAN4 BS conformance requirements objective**
* **The work can progress during the Rel-17 Performance stage**

Companies are encouraged to provide the comments on Proposal #2.

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| **Company** | **Comments** |
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## Fine-tuning round

# Conclusion

Based on the email discussion, the following are proposed:

* TBD