**3GPP TSG-RAN WG4 Meeting # 103-e R4-2210538**

**Electronic Meeting, 09 – 20 May 2022**

**Agenda item:** 11.1

**Source:** Moderator (Intel Corporation)

**Title:** [Draft] Email discussion summary for [103-e][335] FR2\_enhTestMethods

**Document for:** Information

# Introduction

*This document focuses on discussions for the Enhanced Test Methods for FR2 study item, covered in AI 11.1.*

# Topic #1: Study on enhanced test methods for FR2 in NR (AI 11.1)

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2207691  Proposal to conclude the study on enhanced test methods for FR2 in NR | Apple | Withdrawn |
| [**R4-2207692**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_103-e/Docs/R4-2207692.zip)  Draft CR to 38.884 on finalizing the study outcomes | Apple | Editor’s notes have been removed from several clauses in the TR |

## Open issues summary

### Sub-topic 1-1: Updates to TR 38.884

**Issue 1-1: TR 38.884 updates to finalize study outcomes**

* Draft CR R4-2207692 removes editor’s notes from several clauses of TR 38.884
* Recommended WF
  + Moderator suggests companies provide any feedback on the current content of draft CR R4-2207692 directly into **Section** [**1.3.2 CRs/TPs comments collection**](#_CRs/TPs_comments_collection).
  + Additionally, companies may share their views on content/agreements/bracket removal, if any, that is not currently captured in TR 38.884 and can be included in this draft CR in the [**Open issues**](#_Open_issues) section.

## Companies views’ collection for 1st round

### Open issues

Issue 1-1: TR 38.884 updates

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| --- | --- |
| **Company** | **Comments** |
| Apple | Could we revise this CR to capture outcomes of Topic 2? Or is the plan to have another big CR for those changes? |

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2207692 | LGE:  Add the agreements from earlier RAN4 meetings to R4-2207692 to section 5.6 Extension of frequency applicability for FR2-2.  **For PC1 and PC2 UEs**  -Worst-case antenna array configuration (MxN) for PC1 and PC2 on MU assessment shall be  - PC1: [144(12\*12)]  - PC2: [40 (10\*4)]  - Adopt embedded UE only testing for FR2 vehicular UEs. The term embedded UE implies the OBU/TCU + antenna + optional ground plane.  - Avoid developing a standardized ground plane for FR2 vehicular UEs as part of this SI  - Consider the optional ground plane designed and manufactured by the OEM an integral part of the FR2 vehicular UE DUT submitted for conformance testing.  - Consider battery and AC/DC powered operation acceptable for FR2 vehicular UEs and request manufacturers to provide proper guidance on cable routings. |

## Summary for 1st round

### Open issues

|  |  |
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|  | **Status summary** |
| **Sub-topic # 1-1: TR 38.884 updates** | *Candidate option:*   * Add the agreements from earlier RAN4 meetings to R4-2207692 to section 5.6 Extension of frequency applicability for FR2-2.   **For PC1 and PC2 UEs**  -Worst-case antenna array configuration (MxN) for PC1 and PC2 on MU assessment shall be  - PC1: [144(12\*12)]  - PC2: [40 (10\*4)]  - Adopt embedded UE only testing for FR2 vehicular UEs. The term embedded UE implies the OBU/TCU + antenna + optional ground plane.  - Avoid developing a standardized ground plane for FR2 vehicular UEs as part of this SI  - Consider the optional ground plane designed and manufactured by the OEM an integral part of the FR2 vehicular UE DUT submitted for conformance testing.  - Consider battery and AC/DC powered operation acceptable for FR2 vehicular UEs and request manufacturers to provide proper guidance on cable routings.  *Tentative agreement: Revise Draft CR R4-2207692 to include previous agreements for PC1 and PC2*  *Recommendations for 2nd round:*  *Review draft CR R4-2207692 updates and provide feedback on captured content* |

### CRs/TPs

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2207692 | *To be revised* |

## Discussion on 2nd round

**Sub-topic 1-1: Updates to TR 38.884**

* Recommended WF
  + Companies are encouraged to share their views on content/agreements/bracket removal, if any, not currently captured in TR 38.884 and which can be included in a draft CR in the [**Open issues**](#_Open_issues_1) section. For example, consider whether we can remove brackets in:
    - Table 6.2.3-1: Maximum SNR preliminary extension to band n263 (single band)
    - Table 7.2.3-2: Maximum DL testable SNR preliminary extension for band n263 (single band UE 100/400/800 MHz CBW)
  + Additionally, companies should provide feedback on the revision of draft CR R4-2207692

## Companies views’ collection for 2nd round

### Open issues

Sub-topic 1-1: TR 38.884 updates

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| **Company** | **Comments** |
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## Summary for 2nd round

### Open issues

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|  | **Status summary** |
| **Sub-topic # 1-1: TR 38.884 updates** | *Agreement:*   * *Include minimum range length of DFF system table with new column for 71 GHz* * *Add previous PC1 and PC2 agreements* * *Include measurement grid assumptions* |

# Topic #2: OTA test methods for UE RF, RRM and demodulation for 52.6~71GHz (AI 11.1.2.1)

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2207927**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_103-e/Docs/R4-2207927.zip)  On FR2-2 Measurement Grids | Keysight Technologies UK Ltd | **Observation 1:** A slight increase in measurement grid points for the beam peak search can be observed for FR2-2 when compared to FR2-1.  **Observation 2:** A slight increase in measurement grid points for the spherical coverage test can be observed for FR2-2 when compared to FR2-1 with a slight increase in MU.  **Observation 3:** A slight increase in measurement grid points for the TRP test can be observed for FR2-2 when compared to FR2-1 with similar MUs.  **Proposal 1:** If the UE antenna assumptions can be confirmed, include the measurement grid assumptions in [TR 38.884]. |
| [**R4-2210212**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_103-e/Docs/R4-2210212.zip)  General aspects of test methods for 52.6~71GHz | Intel Corporation | **Proposal 1:** Add a column for 71 GHz to the minimum range length of DFF table and include in the TR.  Table 5.2.1.2-1: Minimum Range Length of DFF System for D = 5cm   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | f [GHz]  QZ [cm] | 24.25 | 30 | 40 | 50 | 52.6 | 71 | | **15** | 0.45 | 0.55 | 0.72 | 0.88 | 0.93 | 1.23 | | **30** | 0.53 | 0.63 | 0.79 | 0.96 | 1.00 | 1.31 |   **Observation 1:** While MU assessment will focus on PC3 in Rel-17, several agreements for PC1 and PC2 were reached. RAN4 should discuss whether the permitted test methods can apply to PC1 and PC2 and consider communicating the outcome to RAN5. |

## Open issues summary

### Sub-topic 2-1: General aspects

*During RAN4 #102e, the current radiating aperture D = 5cm was agreed to be reused for PC3 (R4-2207201). To complete the full extent of FR2 range, a column for 71 GHz should be added to the minimum range length of DFF table.*

**Issue 2-1: Minimum range length of DFF at 71GHz**

* Option
  + Proposal 1: Add a column for 71 GHz to the minimum range length of DFF table and include in the TR.

Table 5.2.1.2-1: Minimum Range Length of DFF System for D = 5cm

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| f [GHz]  QZ [cm] | 24.25 | 30 | 40 | 50 | 52.6 | 71 |
| **15** | 0.45 | 0.55 | 0.72 | 0.88 | 0.93 | 1.23 |
| **30** | 0.53 | 0.63 | 0.79 | 0.96 | 1.00 | 1.31 |

* Recommended WF
  + Companies should provide their views on Proposal 1, where this should be captured and if additional wording needs to be included.

### Sub-topic 2-2: UE types

*Preliminary MU assessment required to conclude the FR2-2 test methods objective will focus on PC3 (RP-220924). In RAN4 #101Bis-e, the worst-case antenna array size for PC3 was agreed after core discussions converged on an 8-elment array to define FR2-2 requirements (R4-2203079).*

**RAN4 #101e agreement (R4-2120767):** MU assessment for FR2-2 will focus on PC3 in Rel-17 timeline. This, however, does not deprioritize the general work on other UE types in the WI (i.e., FWA and vehicular).

**RAN4 #101Bis-e agreement (R4-2203079):** The worst-case antenna assumption for testability and MU assessment of handheld UEs in FR2-2 is [8 x2]. Single UE antenna element pattern parameters, similar to Table 5.2.3.3-1, need to be finalized in RAN4#102-e.

*Discussions for other UE types (FWA and vehicular UE) also progressed and produced agreements (RP-220924).*

**RAN4 #102e agreement (R4-2207201):** Worst-case antenna array configuration (MxN) for PC1 and PC2 on MU assessment

* PC1: [144(12\*12)]
* PC2: [40 (10\*4)]

**RAN4 #101Bis-e agreement (R4-2203079):**

* Avoid developing a standardized ground plane for FR2 vehicular UEs as part of this SI.
* Consider the optional ground plane designed and manufactured by the OEM an integral part of the FR2 vehicular UE DUT submitted for conformance testing.
* Consider battery and AC/DC powered operation acceptable for FR2 vehicular UEs and request manufacturers to provide proper guidance on cable routings.

**RAN4 #101e agreement (R4-2120767):** Adopt embedded UE only testing for FR2 vehicular UEs. The term embedded UE implies the OBU/TCU + antenna + optional ground plane.

/

*Based on the above, RAN4 should discuss whether the permitted test methods in TR 38.810 can apply to PC1 and/or PC2 and consider what information may be relevant to communicate to RAN5.*

**Issue 2-2: PC1 and PC2 agreements**

* Recommended WF
  + Companies are encouraged to share their views on where we should capture the above agreements for PC1 and PC2, what they mean in terms of permitted test methods applicability and what we may communicate to RAN5.

### Sub-topic 2-3: Measurement grid assumptions

**Agreement (RAN4#102-e):**

* Single UE antenna element pattern parameters can be reused as Table G.1.1-1 in TR38.810, with below exceptions:
  + half-power beamwidth: [80º/60º] as starting point
  + Gain: [5dBi]

**Agreement (RAN4#102-e):** Reuse the beam steering assumptions in TR38.810 for PC3

**Agreement (RAN4#101-bis-e):** The worst-case antenna assumption for testability and MU assessment of handheld UEs in FR2-2 is [8 x2].

**Issue 2-3: UE antenna assumptions and measurement grid assumptions**

* Option
  + Proposal 1: If the UE antenna assumptions can be confirmed, include the measurement grid assumptions in [TR 38.884]. (Keysight, R4-2207927)
* Recommended WF
  + Companies should provide their views on Proposal 1 and whether the tentative antenna agreements currently in brackets for PC3 can be confirmed.
    - Can also discuss the simulation results comparison in R4-2207927 and what content to include in TR 38.884.

## Companies views’ collection for 1st round

### Open issues

Issue 2-1: Minimum range length of DFF at 71GHz

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Support proposal 1 |
| R&S | We support proposal 1 |
| QCOM | Proposal 1 is ok |
| Huawei,  Hisilicon | OK with Proposal 1 |
| vivo | Support proposal 1 |
| Intel | As proponents, we support Proposal 1 |

Issue 2-2: UE types (PC1 and PC2 agreements)

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| --- | --- |
| **Company** | **Comments** |
| LGE | Capture the agreement to TR by modifying Draft CR R4-2207692. Proposal made in Section 1.3.2 CRs/TPs comment collection. |
| Intel | Agree with LGE, agreements can be captured in the TR by revising draft CR R4-2207692, and/or including content in a big CR |

Issue 2-3: Measurement grid assumptions

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Support proposal 1 |
| R&S | We support proposal 1 |
| Vivo | Proposal is Ok |

## Summary for 1st round

### Open issues

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic# 2-1: General aspects** | *Candidate option:*   * **Proposal 1:** Add a column for 71 GHz to the minimum range length of DFF table and include in the TR.   Table 5.2.1.2-1: Minimum Range Length of DFF System for D = 5cm   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | f [GHz]  QZ [cm] | 24.25 | 30 | 40 | 50 | 52.6 | 71 | | **15** | 0.45 | 0.55 | 0.72 | 0.88 | 0.93 | 1.23 | | **30** | 0.53 | 0.63 | 0.79 | 0.96 | 1.00 | 1.31 |   *Tentative agreement: Approve Proposal 1* |
| **Sub-topic# 2-2: UE types** | *Tentative agreement: Capture previous agreements for PC1 and PC2 in TR 38.884* |
| **Sub-topic# 2-3: Measurement grid** | *Candidate option:*   * **Proposal 1:** If the UE antenna assumptions can be confirmed, include the measurement grid assumptions in [TR 38.884].   *Tentative agreements: Approve Proposal 1 and incorporate relevant content into TR 38.884* |

## Discussion on 2nd round

* Recommended WF
  + Companies are encouraged to review the content to be added to TR 38.884 (min. range length, previous PC1 and PC2 agreements, measurement grid assumptions)
  + Views on how to capture the above content and any additional content in TR 38.884 can be provided to [**section 2.6.1**](#_Open_issues_2).

## Companies views’ collection for 2nd round

### Open issues

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| **Company** | **Comments** |
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## Summary for 2nd round

### Open issues

|  |  |
| --- | --- |
|  | **Status summary** |
| **TR 38.884 updates** | *As summarized in* [***section 1.7.1***](#_Open_issues_3)*, the following updates are being captured in draft CR R4-2210946*   * *Include minimum range length of DFF system table with new column for 71 GHz* * *Add previous PC1 and PC2 agreements* * *Include measurement grid assumptions* |

# Topic #3: Handling remaining work

*As captured in its latest status report (RP-220924), the remaining issues for this study relate to the extension of test methods to FR2-2.*

- Objective 7 (testability aspects for the extension to FR2-2)

- Conclude the measurement grid analysis and the related uncertainty contribution

- Conclude testable SNR and path delay grid for the demodulation methods

- Capture the preliminary MU assessment for the extension of RF, RRM, and demodulation permitted methods in TR38.810 to FR2-2

### Sub-topic 3-1: Measurement uncertainty

**Issue 3-1: Measurement uncertainty activity**

* Option (from GTW session)
  + Proposal 1: Leave measurement uncertainty assessment to RAN5
* Recommended WF
  + The proposal above is based on an option presented during the [GTW session on May 17th](%5bDRAFT%20R4-2210680%5d%20-%20WF%20on%20OTA%20test%20methods%20for%2052.6_71GHz_v00_AfterGTW.docx.doc). Considering the outcome of GTW session and 2nd round feedback, this is an agreeable way forward.

## Summary for 2nd round

### Open issues

|  |  |
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|  | **Status summary** |
| **Sub-topic # 3-1: Measurement uncertainty** | *Agreement:*  *Leave measurement uncertainty assessment to RAN5* |

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Comments** |
| R4-2210680 | WF on OTA test methods for 52.6~71GHz | Intel Corporation |  |
| R4-2210946 | Draft CR to 38.884 on finalizing the study outcomes | Apple | Revision of R4-2207692 |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-2207691 |  | Proposal to conclude the study on enhanced test methods for FR2 in NR | Apple |  | Withdrawn |
| R4-2207692 | R4-2210946 | Draft CR to 38.884 on finalizing the study outcomes | Apple | To be revised |  |
| R4-2207927 |  | On FR2-2 Measurement Grids | Keysight Technologies UK Ltd | Noted |  |
| R4-2210212 |  | General aspects of test methods for 52.6~71GHz | Intel Corporation | Noted |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-2210680 |  | WF on OTA test methods for 52.6~71GHz | Intel Corporation | [Agreeable] |  |
| R4-2207692 | R4-2210946 | Draft CR to 38.884 on finalizing the study outcomes | Apple | [Agreeable] |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents

# Annex

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
|  |  |  |

Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e., Company A (XX, XX)