**3GPP TSG-RAN WG4 Meeting # 107**

**Incheon, KR, May 22nd – May 26th, 2023**

**Agenda item:** 5.2.9.2, 5.2.9.3

**Source:** Huawei

**Title:** Topic summary for FR2-2 BS RF conformance testing

**Document for:** Information

# Introduction

This un-official summary covers contributions submitted to agenda item 5.2.9.2 and 5.2.9.3 for the FR2-2 BS RF requirements.

# Topic #1: MU contributors, total MU derivation

Discussion topics related to the MU contributors, and open issues related to the expanded MU vales derivation are captured here.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2307223 | Nokia, Nokia Shanghai Bell | Proposals on measurement uncertainties of BS OTA transmitter requirements for extending current NR operation to 71 GHz  Proposal 1: To use 0.9 dB for UID C1-1 for in-band TRP for BS output power.  Proposal 2: To use 0.9 dB for UID C1-7 and UID C1-8 for ACLR.  Proposal 3: To use 0.9 dB for UID C1-7 for OBUE.  Proposal 4: To use 0.9 dB for UID C1-7 for spurious emission for 71 to 110 GHz and 110 to 142 GHz.  Proposal 5: Not to use 1.5 dB additional LNA MU UID for low level requirements.  Proposal 6: To take the maximum total MU value of the two methods (CATR and RC) for the final OOB EM total MU.  Proposal 7: To use 0.4 for UID A2-5a, 0.51 for UID A2-5b.  Proposal 8: To use EVM MU value of 1.0%. |
| R4-2309102 | Keysight Technologies UK Ltd | FR2-2 TE MU and various update for BS conformance testing   * Proposal-1, UID C1-1 term for in-band TRP is 2.00 (1-sigma) * Proposal-2, UID C1-7 and C1-8 for ACLR absolute and relative, both are 2.26 (1-sigma) rather 2.36 * Proposal-3, UID C1-7 for OBUE is 2.26 (1-sigma) * Proposal-4, UID C1-7 for spurious emission for frequency 71 G ~ 110 G is 2.26 and for 110 G ~ 142 G is 2.38 * Proposal-5a, Yes, LNA is required because of link budget. LNA MU needs to be added to MU budget for TxOff, ACLR, OBUE and spurious measurement. * Proposal-5b, Take LNA MU value proposed in our other contribution [3] (R4-2309101) * Proposal-6, For OOB EM MU, take larger number from CATR or Reverb Chamber, currently two numbers are shown as FFS. Previously, number from CATR is taken because CATR considered as provider of larger value. * Proposal-7, For mismatch value, A2-5a as 0.4 and A2-5b as 0.40 for frequency up to 110 GHz. For 110 GHz to 142 GHz, use 0.51 for both A2-5a and A2-5b. * Proposal-8, EVM MU for FR2-2, we propose 1.1%. 0.1% increase from existing number for FR2-1. |
| R4-2307696 | Ericsson | Final touch on remaining open issues related to FR2-2 conformance testing  **Proposal 1:** For FR2-2 MU evaluation use SA MU of 2.00 dB for 71<f<110 GHz and 2.30 dB for 110<f<142 GHz and for PM MU use 1.50 dB for 71<f<110 GHz.  **Proposal 6:** No UID is required for additional LNA.  **Proposal 7:** To allow for using multiple test methods for a specific requirement, set TT based on maximum MU.  **Proposal 8:** Use EVM MU of 1.0 % for spectrum/signal analyzer. |

## Open issues summary

### Sub-topic 1-1: UID C1-1 (RF power measurement equipment)

* Proposals
  + Option 1: To use 0.9 dB for UID C1-1 for in-band TRP for BS output power (R4-2307223, Nokia)
  + Option 2: UID C1-1 term for in-band TRP is 2.00 (1-sigma) (R4-2309102, Keysight)
* Recommended WF: discuss offline

### Sub-topic 1-2: UID C1-7 for absolute ACLR (RF power measurement equipment)

* Proposals
  + Option 1: 0.9 dB for UID C1-7 for ACLR (R4-2307223, Nokia)
  + Option 2: UID C1-7 for absolute ACLR is 2.26 (1-sigma) rather 2.36 (R4-2309102, Keysight)
* Recommended WF: discuss offline

### Sub-topic 1-3: UID C1-8 for relative ACLR (RF power measurement equipment)

* Proposals
  + Option 1: 0.9 dB for UID C1-8 for ACLR (R4-2307223, Nokia)
  + Option 2: UID C1-8 for relative ACLR is 2.26 (1-sigma) rather 2.36 (R4-2309102, Keysight)
* Recommended WF: discuss offline

### Sub-topic 1-4: UID C1-7 for OBUE (RF power measurement equipment)

* Proposals
  + Option 1: 0.9 dB for UID C1-7 for OBUE (R4-2307223, Nokia)
  + Option 2: UID C1-7 for OBUE is 2.26 (1-sigma) (R4-2309102, Keysight)
* Recommended WF: discuss offline

### Sub-topic 1-5: UID C1-7 for spur in 71-142GHz (RF power measurement equipment)

* Proposals
  + Option 1: 0.9 dB for UID C1-7 for spurious emission for 71 to 110 GHz and 110 to 142 GHz. (R4-2307223, Nokia)
  + Option 2: UID C1-7 for spurious emission for frequency 71 G ~ 110 G is 2.26dB and for 110 G ~ 142 G is 2.38dB (R4-2309102, Keysight)
  + Option 3: For FR2-2 MU evaluation use SA MU of 2.00 dB for 71<f<110 GHz and 2.30 dB for 110<f<142 GHz and for PM MU use 1.50 dB for 71<f<110 GHz (R4-2307696, Ericsson)

|  |  |  |
| --- | --- | --- |
|  | 71 – 110 GHz | 110 - 142 GHz |
| Nokia | 0.9 dB | 0.9 dB |
| Keysight | 2.26 dB | 2.38 dB |
| Ericsson (SA) | 2 dB | 2.3 dB |
| Ericsson (PM) | 1.5 dB |  |

* Recommended WF: discuss offline

### Sub-topic 1-6: UID A2-19 (Uncertainty of the LNA)

* Proposals
  + Option 1: Not to use 1.5 dB additional LNA MU UID for low level requirements. (R4-2307223, Nokia)
  + Option 2: LNA is required because of link budget. LNA MU needs to be added to MU budget for TxOff, ACLR, OBUE and spurious measurement (R4-2309102, Keysight)
  + Option 3: It is reasonable to assume ±10℃ temperature variation on amplifier, then use this for calculating LNA MU values (R4-2309101, Keysight)
  + Option 4: Proposed LNA MU values (1 sigma) (R4-2309101, Keysight)
    - @71 GHz, ±0.34 dB
    - 71G ~ 110 GHz, ±0.51 dB
    - 110G ~142 GHz, ±0.51 dB
  + Option 5: No UID is required for additional LNA (R4-2307696, Ericsson)
* Recommended WF:
  + Discuss if Option 3 can be used as assumption.
  + Further discuss among Option 1/5 vs. 3.

### Sub-topic 1-7: UID A2-5a (Mismatch of RX chain between RX antenna and measurement receiver)

* Proposals
  + Option 1: 0.4 for UID A2-5a (R4-2307223, Nokia)
  + Option 2: A2-5a as 0.4dB for frequency up to 110 GHz. For 110 GHz to 142 GHz, use 0.51dB (R4-2309102, Keysight)
* Recommended WF: discuss offline

### Sub-topic 1-8: UID A2-5b (Mismatch of receiver chain for low power receiver)

* Proposals
  + Option 1: 0.51 for UID A2-5b (R4-2307223, Nokia)
  + Option 2:A2-5b as 0.4dB for frequency up to 110 GHz. For 110 GHz to 142 GHz, use 0.51dB (R4-2309102, Keysight)

|  |  |  |
| --- | --- | --- |
|  | Up to 110 GHz | 110 – 142 GHz |
| Nokia | 0.51 dB | 0.51 dB |
| Keysight | 0.4 dB | 0.51 dB |

* Recommended WF: discuss offline

### Sub-topic 1-9: Total MU selection procedure

* Proposals
  + Option 1: take the maximum total MU value of the two methods (CATR and RC) for the final OOB EM total MU (R4-2307223, Nokia)
  + Option 2: For OOB EM MU, take larger number from CATR or Reverb Chamber, currently two numbers are shown as FFS. Previously, number from CATR is taken because CATR considered as provider of larger value (R4-2309102, Keysight)
  + Option 3: To allow for using multiple test methods for a specific requirement, set TT based on maximum MU (R4-2307696, Ericsson)
* Recommended WF: Confirm option 3

### Sub-topic 1-10: EVM MU

* Proposals
  + Option 1: To use EVM MU value of 1.0% (R4-2307223, Nokia)
  + Option 2: EVM MU for FR2-2, we propose 1.1%. 0.1% increase from existing number for FR2-1 (R4-2309102, Keysight)
  + Option 3: Use EVM MU of 1.0 % for spectrum/signal analyser (R4-2307696, Ericsson)
* Recommended WF: discuss offline

# Topic #2: TR 37.941 Excel spreadsheets

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2307223 | Nokia, Nokia Shanghai Bell | TX Excel spreadsheet |
| R4-2309102 | Keysight Technologies UK Ltd | FR2-2 TE MU and various update for BS conformance testing  Propose calculated test system MU values in Table 3 and 4 above |
| [R4-2309631](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309631.zip) | Huawei, HiSilicon | FR2 TX Excel spreadsheet update for TR 37.941 |
| [R4-2309632](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309632.zip) | Huawei, HiSilicon | FR2 RX Excel spreadsheet update for TR 37.941 |
| R4-2307696 | Ericsson | Final touch on remaining open issues related to FR2-2 conformance testing  **Proposal 2:** For RC, adopt the described additional absolute power calibration for TRP BS output power MU evaluation.  **Proposal 3:** Adopt MU evaluation for BS output power measured in RC according to Table 2.1.3-1 (Expanded uncertainty of 2.93 dB).  **Proposal 4:** Adopt MU evaluation for ACLR and OBUE measured in RC according to Table 2.2-1 (Expanded uncertainty of 4.50 dB).  **Proposal 5:** Adopt MU evaluation for transmitter spurious emission measured in RC according to Table 2.3-1 (Expanded uncertainty of 5.35 dB for 71<f<110 GHz) and Table 2.3-2 (Expanded uncertainty of 5.89 dB for 110<f<142 GHz). |

## Open issues summary

### Sub-topic 2-1: TX Excel spreadsheet

* Proposals
  + Option 1: Proceed with R4-2307223, Nokia
  + Option 2: Proceed with R4-2309102, Keysight
  + Option 3: Proceed with [R4-2309631](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309631.zip), Huawei
* Recommended WF:
  + discuss offline
  + coordinate work-split with topic 3-1 and 4-1

### Sub-topic 2-2: RX Excel spreadsheet

* Proposals
  + Option 1: Proceed with [R4-2309632](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309631.zip), Huawei
  + Option 2: other
* Recommended WF:
  + Proceed with Option 1 as baseline for updates based on Topic #1 decisions.
  + coordinate work-split with topic 3-1 and 4-1

# Topic #3: CRs to the TR 37.941

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2307387 | CATT | Draft CR for 37.941, On FR2-2 RX directional requirements in clauses 10.1-10.5 and respective MU and TT summary |
| R4-2309103 | Keysight Technologies UK Ltd | CR to 37.941: 71 GHz Extension TE MU update |
| [R4-2309633](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309633.zip) | Huawei, HiSilicon | CR to TR 37.941: FR2-2 MU budget calculations implementation for TX requirements |
| [R4-2309634](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309634.zip) | Huawei, HiSilicon | CR to TR 37.941: FR2-2 MU budget calculations implementation for RX requirements |
| [R4-2307697](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2307697.zip) | Ericsson | CR to 37.941: Addition of technical background information for EIRP and EIS  Moderator: CATR updaates, of up/down converters within FR2, background for EIRP, EIS and RX OOB blocking. |
| [R4-2307698](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2307698.zip) | Ericsson | CR to TR 37.941: Improvement of BS output power, ACLR, OBUE and Spurious emission MU for RC in subclause 8.8, 11.2.5, 11.3.5, 11.4.5, 12.2.4 and 12.2.5  Moderator: additional absolute power calibration for RC (BS output power (TRP), ACLR, OBUE, spurious). |

## Open issues summary

### Sub-topic 3-1: aggrage work-split for revisions preparation

* Recommended WF:
  + Assign authors for the revisions (preferably as package, considering TR Excels, TR37.941 TX/RX, and TS 38.141-2 TX/RX)
  + Consider email approval, if needed

# Topic #4: CRs to the TS 38.141-2

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2307221 | Nokia, Nokia Shanghai Bell | CR to TS 38.141-2 on completion of measurement uncertainties for extending current NR operation to 71GHz  Moderator: Corrects some of the MU values for RX and TX. Values still in [] |
| R4-2309635/  R4-2309636 | Huawei, HiSilicon | CR to TS 38.141-2: Removal of [] from FR2-2 TX test requirements, Rel-17  Moderator: Removal of [] from MU, TT and related TX requirements for FR2-2 from the whole specification. |
| R4-2309637/  R4-2309638 | Huawei, HiSilicon | CR to TS 38.141-2: Removal of [] from FR2-2 RX test requirements, Rel-17  Moderator: Removal of [] from MU, TT and related RX requirements for FR2-2 from the whole specification. |
| R4-2309099/  R4-2309100 | Keysight Technologies UK Ltd | CR to 38.141-2: 71 GHz Extension BS conformance test Test Model clarification  Moderator: Related to sub-topic 5-1 on TM content |
| R4-2309104/  R4-2309105 | Keysight Technologies UK Ltd | CR to 38.141-2: 71 GHz Extension BS conformance test MU update  Moderator: MU updates |
| R4-2307699 | Ericsson | CR to TS 38.141-2: Clean-up of FR2-2 in Clause 4, 6, 7 and Annex C |

## Open issues summary

### Sub-topic 4-1: aggrage work-split for revisions preparation

* Recommended WF:
  + Assign authors for the revisions (preferably as package, considering TR Excels, TR37.941 TX/RX, and TS 38.141-2 TX/RX)
  + Consider email approval, if needed

# Topic #5: Data content of phy channels for TM

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2309098 | Keysight Technologies | FR2-2 BS conformance, about Test Model text clarification  Proposal 1: propose Definition A, which maintain Phy definition from TS38.211 for test model, not to create test model specific Phy. 80 slot repetition is for payload data only, and clarification to add on PDCCH and PDSCH. |

## Open issues summary

### Sub-topic 5-1: Data content of phy channels for TM

* Proposals
  + Option 1: which maintain Phy definition from TS38.211 for test model, not to create test model specific Phy. 80 slot repetition is for payload data only, and clarification to add on PDCCH and PDSCH (R4-2309098, Keysight)
  + Option 2: Other (please specify)
* Recommended WF: proceed with Option 1