**3GPP TSG-RAN WG4 Meeting # 106 R4-23XXXXX**

**Athens, Greece, 27 February –03 March, 2023**

**Agenda item:** 6.2.7

**Source:** Moderator (Huawei)

**Title:** Topic summary for [106][304] NR\_exto71GHz\_BSRF

**Document for:** Information

# Introduction

This summary covers BS RF aspects of FR2-2 requirements introduction for agenda item 6.2.2 (BS RF requirements maintenance) and 6.2.3 (BS RF conformance testing).

The following contributions were submitted to the above AIs:

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2302462 | Huawei, HiSilicon | CR to TS 38.104: NR-ARFCN table reference correction for band n263, Rel-18 |
| R4-2300185 | Nokia, Nokia Shanghai Bell | CR to TS 38.104 on table references for OTA operating band unwanted emission limits |
| R4-2301914 | NEC | Draft CR to 38.104: Correction on Rx intermodulation requirements for FR2-2 (Rel-18) |
| [R4-2302461](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2302461.zip) | Huawei, HiSilicon | CR to TS 38.104: NR-ARFCN table reference correction for band n263, Rel-17 |
| [R4-2300184](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2300184.zip) | Nokia, Nokia Shanghai Bell | CR to TS 38.104 on table references for OTA operating band unwanted emission limits |
| [R4-2302260](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2302260.zip) | Nokia, Nokia Shanghai Bell | CR to TS 38.104 on table references for OTA operating band unwanted emission limits |
| [R4-2301913](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2301913.zip) | NEC | Draft CR to 38.104: Correction on Rx intermodulation requirements for FR2-2 (Rel-17) |
| [R4-2302233](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2302233.zip) | Ericsson | On general aspects relevant for FR2-2 conformance testing |
| [R4-2300186](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2300186.zip) | Nokia, Nokia Shanghai Bell | Proposals on measurement uncertainty of BS OTA transmitter requirements for extending current NR operation to 71 GHz |
| [R4-2302226](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2302226.zip) | Ericsson | Draft CR to TR 37.941: Addition of aspects related to EIRP measurement in CATR relevant for FR2-2 in sub-clause 7.3, 8.3, 9.2.3, 9.2.7, 9.2.8, 9.3.3, 9.3.4 and 9.3.5 |
| [R4-2302231](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2302231.zip) | Ericsson | On aspects related to FR2-2 transmitter conformance testing |
| [R4-2302230](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2302230.zip) | Ericsson | Draft CR to TS 38.141-2: Addition of radiated transmit power requirement for FR2-2 in subclause 6.2 |
| [R4-2300640](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2300640.zip) | ROHDE & SCHWARZ | Update to FR2-2 Test model |
| [R4-2302463](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2302463.zip) | Huawei, HiSilicon | Big CR to TS 38.141-2: FR2-2 BS RF test requirements introduction, Rel-17 |
| [R4-2302229](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2302229.zip) | Ericsson | Draft CR to TS 38.141-2: Addition of radiated transmit power requirement for FR2-2 in subclause 6.2 |
| [R4-2300187](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2300187.zip) | Nokia, Nokia Shanghai Bell | Proposals on measurement uncertainty of BS OTA receiver requirements for extending current NR operation to 71 GHz |
| [R4-2300580](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2300580.zip) | CATT | Draft CR for 37.941, On FR2-2 RX directional requirements in clauses 10.1-10.5 and respective MU and TT summary |
| [R4-2302227](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2302227.zip) | Ericsson | Draft CR to TR 37.941: Addition of aspects related to EIS measurement in CATR relevant for FR2-2 in sub-clause 10.2.3 and sub-clause 10.2.7 |
| [R4-2302235](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2302235.zip) | Ericsson | Draft CR to TR 37.941: Addition of technical background information related to test of receiver out-of-band blocking in a general chamber in subclause 14.2 |
| [R4-2302232](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2302232.zip) | Ericsson | On aspects related to FR2-2 receiver conformance testing |
| R4-2301916 | NEC | Draft CR to 38.141-2: Correction on Rx intermodulation requirements for FR2-2 (Rel-18) |
| [R4-2301915](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2301915.zip) | NEC | Draft CR to 38.141-2: Correction on Rx intermodulation requirements for FR2-2 (Rel-17) |
| [R4-2302268](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2302268.zip) | Keysight Technologies UK Ltd | DraftCR to 37.941: 71 GHz Extension TE MU update |
| [R4-2302228](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2302228.zip) | Ericsson | Draft CR to TR 37.941: Addition of aspects related to TRP measurement in RC relevant for FR2-2 in subclause 11.2.5, 11.3.5, 11.4.5 and 12.2.4 |
| [R4-2300581](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2300581.zip) | CATT | Discussion on MU for adjacent channel selectivity, in-band blocking, in-channel selectivity for FR2-2 |
| [R4-2300188](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2300188.zip) | Nokia, Nokia Shanghai Bell | Draft CR to TS 38.141-2 in clauses 6.3 to 6.5 for extending current NR operation to 71GHz |
| [R4-2302265](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2302265.zip) | Keysight Technologies UK Ltd | FR2-2 Test equipment MU update for BS conformance testing |
| [R4-2302266](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2302266.zip) | Keysight Technologies UK Ltd | FR2-2 BS conformance test system, Test system consideration |
| [R4-2302267](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_106/Docs/R4-2302267.zip) | Keysight Technologies UK Ltd | draftCR to 38.141-2: 71 GHz Extension BS EVM Clause 6.6.3 (6.6.3) |

# Topic #1: OTA measurement procedures

Aspects related to the measurement procedures itself as captured in this section.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2302233 | Ericsson | On general aspects relevant for FR2-2 conformance testing  Proposal 1: For FR2-2, Radiated transmit power requirement based on EIRP and OTA reference sensitivity requirement based on EIS, adopt the concept of using a power meter as reference for absolute power level measurements as described in sections 2.1.1 and 2.1.2.  Proposal 2: Include a description of the additional power calibration in TR 37.941 for EIRP in CATR for radiated transmit power and EIS measured in CATR for OTA reference sensitivity.  Proposal 10: For extreme condition testing adopt the absolute power calibration described in section 2.1 (see proposal 1 above). |
| R4-2302266 | Keysight Technologies | FR2-2 BS conformance test system, Test system consideration  Proposal 1, we propose to accept use of Spectrum analyzer for EIRP measurement test system MU budget.  Proposal 2, For EIRP measurement, remove LNA from MU budget table so that total system MU to be smaller  Proposal 3   * Use power sensor as monitoring and controlling equipment of generator (up converter) to reduce generator MU. This technique can be used for both wanted signal as well as interfering signal (modulated and CW) * Uncertainty of the RF Signal generator with power leveling by power sensor (modulated and CW) up to 75 GHz (in-band frequency)   + 0.98 (~75 GHz for in-band and interfere near carrier) (1 sigma) * Uncertainty of the RF Signal generator with power leveling by power sensor (CW) up to 110G, 142G   + 0.98 up to 142 GHz (1 sigma)   Proposal 4: We propose to use power sensor to control generator signal level for wanted and interferer signal so that power sensor and additional components MU can be used as replacement of generator MU. |
| R4-2302232 | Ericsson | On aspects related to FR2-2 receiver conformance testing  Proposal 3: For FR2-2 receiver spurious emission adopt the same test methods and corresponding MU evaluation as defined for transmitter spurious emissions in the companion contribution [5].  Proposal 4: For out-of-band blocking focus MU evaluation work on the test method based on the general chamber, where test distance between the test object and interferer signal test range antenna is adjustable. |

## Open issues summary

### Sub-topic 1-1 TX: EIRP measurement

* Proposals
  + Proposal 1: accept use of Spectrum analyzer for EIRP measurement test system MU budget (R4-2302266, Keysight Technologies)
  + Proposal 2: remove LNA from MU budget table so that total system MU to be smaller (R4-2302266, Keysight Technologies)
  + Proposal 3: For FR2-2, Radiated transmit power requirement based on EIRP and OTA reference sensitivity requirement based on EIS, adopt the concept of using a power meter as reference for absolute power level measurements as described in sections 2.1.1 and 2.1.2. (R4-2302233, Ericsson)
  + Proposal 4: Include a description of the additional power calibration in TR 37.941 for EIRP in CATR for radiated transmit power and EIS measured in CATR for OTA reference sensitivity. (R4-2302233, Ericsson)
* **Recommended WF**:
  + The main issues is to continue the ongoing discussion on Proposal 1 vs. Proposal 3, which have significant impact on the MU budget. Depending on this decisions, Proposal 4 may be straightforward to decide.
  + Clarify if proposal 2 may, or may not improve the alignment of the proposed MU budgets from companies.

### Sub-topic 1-2 Extreme test conditions – calibration procedure

* Proposals
  + Proposal 1: For extreme condition testing adopt the absolute power calibration described in section 2.1 (R4-2302233, Ericsson)
  + Proposal 2: Other
* **Recommended WF**: decide on related sub-topic 1-1 first, and align the decision on Extreme test conditions, with the Normal test conditions in 1-1.

### Sub-topic 1-3 RX: EIS measurement

Proposals

* Proposals 1: Use power sensor as monitoring and controlling equipment of generator (up converter) to reduce generator MU. This technique can be used for both wanted signal as well as interfering signal (modulated and CW) (R4-2302266, Keysight Technologies)
  + - Uncertainty of the RF Signal generator with power leveling by power sensor (modulated and CW) up to 75 GHz (in-band frequency): 0.98 (~75 GHz for in-band and interfere near carrier) (1 sigma)
    - Uncertainty of the RF Signal generator with power leveling by power sensor (CW) up to 110G, 142G): 0.98 up to 142 GHz (1 sigma)
* Proposal 2: adopt the concept of using a power meter as reference for absolute power level measurements as described in sections 2.1.1 and 2.1.2. (R4-2302233, Ericsson)
* Proposal 3: Include a description of the additional power calibration in TR 37.941 for EIRP in CATR for radiated transmit power and EIS measured in CATR for OTA reference sensitivity. (R4-2302233, Ericsson)

**Recommended WF**: Proposals 1 and 2 are proposing similar solution based on power meter and power sensor, while the underlying MU values in MU budgets differ. Continue discussion to clarify remaining differences.

### Sub-topic 1-4 RX: Other requirements

Proposals

* Proposals 1: use power sensor to control generator signal level for wanted and interferer signal so that power sensor and additional components MU can be used as replacement of generator MU (R4-2302266, Keysight Technologies)
* Proposal 3: For FR2-2 receiver spurious emission adopt the same test methods and corresponding MU evaluation as defined for transmitter spurious emissions in the companion contribution [5] (R4-2302232, Ericsson)
* Proposal 4: For out-of-band blocking focus MU evaluation work on the test method based on the general chamber, where test distance between the test object and interferer signal test range antenna is adjustable (R4-2302232, Ericsson)

**Recommended WF**: Alignment of Rx requirements measurement is a reasonable approach. Follow decision for EIS.

# Topic #2: TX MU budget

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2210186 | Nokia, Nokia Shanghai Bell | Proposals on measurement uncertainties of BS OTA transmitter requirements for extending current NR operation to 71 GHz  Proposal 1: For the frequency range, currently the frequency band allocations for mobile service within the FR2-2 (52.6 < f ≤ 71 GHz) are not clear yet, so we propose not to divide FR2-2 into two sub-ranges at 60 GHz breakpoint as this would create complexity for equipment testing if the operating band cross over 60 GHz.  Proposal 2: For UID which have values in the ‘43.5 < f ≤ 60 GHz’ column (i.e., C1-3, C1-7, A2-20, C1-2, MUOOBint, A2-5a, A2-19, MUPA), we propose to use the values also for 57 < f ≤ 71 GHz, as the values are either already relaxed compared to the ones in the ‘37 < f ≤ 43.5 GHz’ column or the same values are used for different frequency ranges in FR2.  Proposal 3: For UID which do not have values in the ‘43.5 < f ≤ 60 GHz’ column (i.e., C1-1, C1-7, C1-8, C1-9, A2-5b, B2-5), we propose to apply the same step size comparing the values in the ‘24.25 < f ≤ 29.5 GHz‘ and ‘37 < f ≤ 43.5 GHz’ columns for 43.5 < f ≤ 60 GHz and then for 57 < f ≤ 71 GHz, based on the general trend of implementation complexity as the target frequency increases in FR2-2.  Proposal 4: Note that the uncertainty of the mixer value in A2-20 is included also in obtaining the values in other uncertainty values (i.e., C1-1, C1-2, C1-7, C1-8, C1-9) in R4-2220205. However, we assume the measurement equipment should be designed to cover the target (FR2-2) frequency range, so the mixer should only be needed for spurious domain measurements but not for in-band or out-of-band domain measurements. |
| R4-2302231 | Ericsson | On aspects related to FR2-2 transmitter conformance testing  Proposal 1: For FR2-2 EIRP measurements in CATR in normal condition adopt MU evaluation presented in Table 2.1-1.  Proposal 2: For FR2-2 EIRP measurements in CATR in normal condition use expanded uncertainty of 1.74 dB for radiated transmit power requirement in normal condition.  Proposal 3: For FR2-2 EIRP measurements in CATR in extreme condition adopt MU evaluation presented in Table 2.1-1.  Proposal 4: For FR2-2 EIRP measurements in CATR in extreme condition use expanded uncertainty of 3.05 dB for radiated transmit power requirement in normal condition.  Proposal 5: For FR2-2 TRP OTA BS output power measurements in RC adopt MU evaluation presented in Table 2.2-1.  Proposal 6: For FR2-2 TRP measurements in RC use expanded uncertainty of 1.75 dB for OTA BS output power requirement.  Proposal 7: For FR2-2 TRP ACLR and OBUE measurements in RC adopt MU evaluation presented in Table 2.3-1.  Proposal 8: For FR2-2 TRP measurements in RC use expanded uncertainty of 2.42 dB for ACLR requirement and OBUE requirement.  Proposal 9: For FR2-2 TRP spurious emission measurements in RC adopt MU evaluation presented in Table 2.4-2 for 71 to 110 GHz and Table 2.4-3 for 110 to 142 GHz.  Proposal 10: For FR2-2 TRP measurements in RC, use expanded uncertainty of 4.67 dB for spurious emission requirements defined within 71 to 110 GHz, and 5.91 dB for spurious emission requirements defined within 110 to 142 GHz. |
| R4-2302233 | Ericsson | On general aspects relevant for FR2-2 conformance testing  Proposal 9: For FR2-2, focus on CATR, RC and general chamber.  Proposal 11: For extreme condition MU evaluation use standard uncertainties for A2-13, A2-14, A2-15 and A2-16 as listed in Table 2.4-2. |

## Open issues summary

### Sub-topic 2-1 MU

Proposals from R4-221018, R4-2302231, R4-2302233 were captured in the related Excel spreadsheet for the purpose of MU budget alignment.

**Recommended WF**:

* Refer to Tx MU Excel sheet aiming to align MU contributor values for CATR, as well as for RC.
* Due to WI timeline, prioritize discussion on the FR2-2 (52.6-71 GHz). Discussion on MU for the intermediate range of 43.5-60GHz if time allows.
* Discuss the Test Equipment MU as a separate sub-topic.
* Proposals 9 from R4-2302233 on the considered chambers seems to be agreeable, in general.

# Topic #3: RX MU budget

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2302232 | Ericsson | On aspects related to FR2-2 receiver conformance testing  **Proposal 1:** For FR2-2 EIS measurements in CATR adopt MU evaluation presented in Table 2.1-1.  **Proposal 2:** For FR2-2 adopt expanded uncertainty of 1.88 dB for OTA reference sensitivity requirement in normal condition.  **Proposal 5:** For FR2-2 set total expanded MU for receiver out-of-band blocking to 5.72 dB. Based on the below:  ,  where *σEIS*, *σI* and *σPA*are the standard uncertainties of the wanted signal related to reference sensitivity, interferer signal, and theadditional power amplifier, respectively. Moreover, *n* is a factor to account for additional broadband noise.  **Table 2.3-3: Additional MU values for receiver out-of-band blocking**   | **Parameter** | **Standard Uncertainty**  **(dB)** | **Note** | | --- | --- | --- | | *EIS* | 0.96 | EIS MU value derived for FR2-2 measurement in CATR (see section 2.1). | | *i* | 2.40 | Interferer signal MU is set to SG MU at 142 GHz, see Table 2.2-2 in [9]. | | *PA* | 0.40 | This MU value considers external PA amplifier to be used for the interferer signal. | | *n* | 0.30 | This MU value capture effects related to SG broadband noise. | |
| R4-2300581 | CATT | Discussion on MU for adjacent channel selectivity, in-band blocking, in-channel selectivity for FR2-2  Proposal 1: Define MU for EIS for 52.6<f ≤71.0 GHz as 4.9dB.  Proposal 2: Define MU for ACS, IBB and ICS for 52.6<f ≤71.0 GHz as 7.3dB.   |  |  |  |  | | --- | --- | --- | --- | | **Test System Uncertainty** | **Standard uncertainty ui (dB)** | | | | **24.25 GHz < f ≤ 29.5 GHz  and 37 GHz < f ≤ 43.5 GHz** | **43.5 GHz < f ≤ 48.2 GHz** | **52.6 GHz < f ≤ 71 GHz** | | MUEIS (Expanded uncertainty) | 2.4 | 3.5 | 4.9 | | MUTestEquipment (Uncertainty of the RF signal generator) | 0.9 | 1.6 | 1.99 | | MUPA (Uncertainty due to use of PA) | 0.2 | 0.2 | 1.5 | | ACLReffect (Impact of interferer leakage) | 0.4 | 0.4 | 0.4 | | **Combined standard uncertainty (1σ)** | **1.74** | **2.61** | **3.73** | | **Expanded uncertainty (1.96σ - confidence interval of 95 %)** | **3.4** | **5.1** | **7.3** | |
| R4-2210187 | Nokia, Nokia Shanghai Bell | Proposals on measurement uncertainties of BS OTA receiver requirements for extending current NR operation to 71 GHz  1. For the frequency range, currently the frequency band allocations for mobile service within the FR2-2 (52.6 < f ≤ 71 GHz) are not clear yet, so we propose not to divide FR2-2 into two sub-ranges at 60 GHz breakpoint as this would create complexity for equipment testing if the operating band cross over 60 GHz.  2. For UID which have values in the ‘43.5 < f ≤ 60 GHz’ column (i.e., C1-3, C1-7, A2-20, C1-2, MUOOBint, A2-5a, A2-19, MUPA), we propose to use the values also for 57 < f ≤ 71 GHz, as the values are either already relaxed compared to the ones in the ‘37 < f ≤ 43.5 GHz’ column or the same values are used for different frequency ranges in FR2.  3. For UID which do not have values in the ‘43.5 < f ≤ 60 GHz’ column (i.e., C1-1, C1-7, C1-8, C1-9, A2-5b, B2-5), we propose to apply the same step size comparing the values in the ‘24.25 < f ≤ 29.5 GHz‘ and ‘37 < f ≤ 43.5 GHz’ columns for 43.5 < f ≤ 60 GHz and then for 57 < f ≤ 71 GHz, based on the general trend of implementation complexity as the target frequency increases in FR2-2.  4. Note that the uncertainty of the mixer value in A2-20 is included also in obtaining the values in other uncertainty values (i.e., C1-1, C1-2, C1-7, C1-8, C1-9) in [2]. However, we assume the measurement equipment should be designed to cover the target (FR2-2) frequency range, so the mixer should only be needed for spurious domain measurements but not for in-band or out-of-band domain measurements. |

## Open issues summary

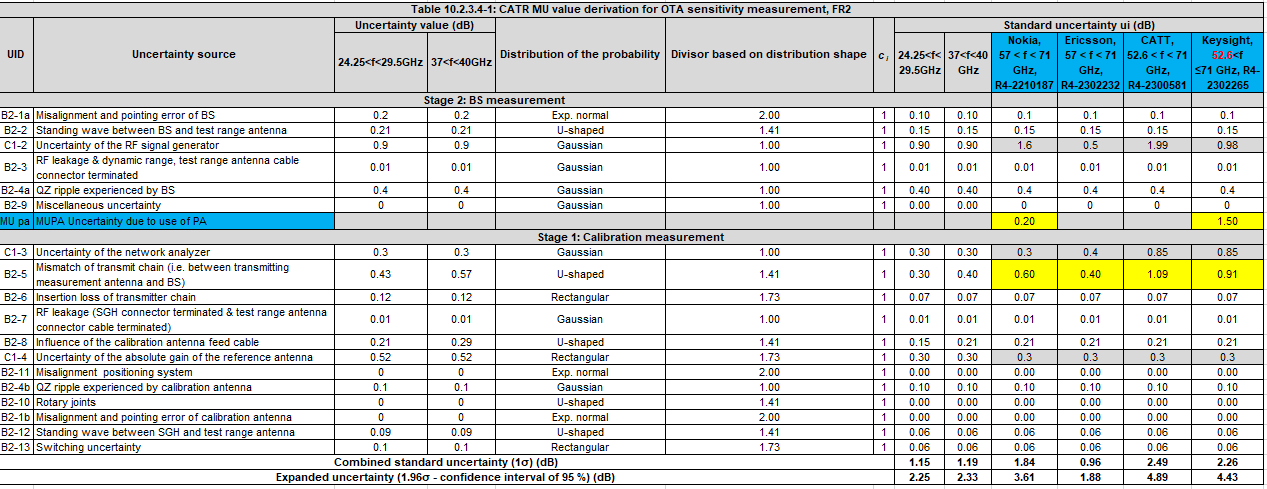
### Sub-topic 3-1 EIS MU

Proposals

* Proposal 1: For EIS measurements in CATR adopt MU evaluation presented in Table 2.1-1 (R4-2302232, Ericsson)
* Proposal 2: adopt expanded uncertainty of 1.88 dB for OTA reference sensitivity requirement in normal condition (R4-2302232, Ericsson)
* Proposal 3: Define MU for EIS for 52.6<f ≤71.0 GHz as 4.9dB (R4-2300581, CATT)
* Proposal 4 (R4-2210187, Nokia, Nokia Shanghai Bell)
  + 1. For the frequency range, currently the frequency band allocations for mobile service within the FR2-2 (52.6 < f ≤ 71 GHz) are not clear yet, so we propose not to divide FR2-2 into two sub-ranges at 60 GHz breakpoint as this would create complexity for equipment testing if the operating band cross over 60 GHz.
  + 2. For UID which have values in the ‘43.5 < f ≤ 60 GHz’ column (i.e., C1-3, C1-7, A2-20, C1-2, MUOOBint, A2-5a, A2-19, MUPA), we propose to use the values also for 57 < f ≤ 71 GHz, as the values are either already relaxed compared to the ones in the ‘37 < f ≤ 43.5 GHz’ column or the same values are used for different frequency ranges in FR2.
  + 3. For UID which do not have values in the ‘43.5 < f ≤ 60 GHz’ column (i.e., C1-1, C1-7, C1-8, C1-9, A2-5b, B2-5), we propose to apply the same step size comparing the values in the ‘24.25 < f ≤ 29.5 GHz‘ and ‘37 < f ≤ 43.5 GHz’ columns for 43.5 < f ≤ 60 GHz and then for 57 < f ≤ 71 GHz, based on the general trend of implementation complexity as the target frequency increases in FR2-2.

**Recommended WF**:

* Due to WI timeline, prioritize discussion on the FR2-2 (52.6-71 GHz). Discussion on MU for the intermediate range of 43.5-60GHz if time allows.
* Refer to Rx MU Excel sheet aiming to align MU contributor values and conclude EIS MU. Despite the Test Equipment MU discussion, there are two particular topics to discuss:
  + Incorporation of the MUPA in the EIS MU budget
  + Alignment of the B2-5 (Mismatch of Tx chain) MU values



### Sub-topic 3-2 Other Rx MU

Proposals

* + **Proposal 1**: Define MU for ACS, IBB and ICS for 52.6<f ≤71.0 GHz as 7.3dB (R4-2300581, CATT)

|  |  |
| --- | --- |
|  | **Standard uncertainty ui (dB)** |
| **52.6 GHz < f ≤ 71 GHz** |
| MUEIS (Expanded uncertainty) | 4.9 |
| MUTestEquipment (Uncertainty of the RF signal generator) | 1.99 |
| MUPA (Uncertainty due to use of PA) | 1.5 |
| ACLReffect (Impact of interferer leakage) | 0.4 |
| **Combined standard uncertainty (1σ)** | **3.73** |
| **Expanded uncertainty (1.96σ - confidence interval of 95 %)** | **7.3** |

* + **Proposal 2**: For FR2-2 set total expanded MU for receiver out-of-band blocking to 5.72 dB. Based on the below:

,

where *σEIS*, *σI* and *σPA*are the standard uncertainties of the wanted signal related to reference sensitivity, interferer signal, and theadditional power amplifier, respectively. Moreover, *n* is a factor to account for additional broadband noise.

**Table: Additional MU values for receiver out-of-band blocking**

| **Parameter** | **Standard Uncertainty**  **(dB)** | **Note** |
| --- | --- | --- |
| *sEIS* | 0.96 | EIS MU value derived for FR2-2 measurement in CATR (see section 2.1). |
| *si* | 2.40 | Interferer signal MU is set to SG MU at 142 GHz, see Table 2.2-2 in [9]. |
| *sPA* | 0.40 | This MU value considers external PA amplifier to be used for the interferer signal. |
| *n* | 0.30 | This MU value capture effects related to SG broadband noise. |

**Recommended WF**: as all other RX requirements depend on the EIS, first conclude EIS discussion. Further discussion to consider the above input tables, as well as Excel sheets for Rx calculations from input tdocs:

* R4-2302265\_71Gext\_RxMU\_Proposal\_for106.xlsx
* R4-2300581\_37941\_FR2-2 RX MU calculation\_v03\_CATT.xlsx

# Topic #4: Test equipement MU

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2302233 | Ericsson | On general aspects relevant for FR2-2 conformance testing  Proposal 3: For FR2-2 in-band MU evaluation consider TE MU values presented in Table 2.2-2.  Proposal 4: For FR2-2 out-of-band MU evaluation consider TE MU values presented in Table 2.2-2.   | Test equipment | TE MU (std. dev.)  (dB) | | | | | --- | --- | --- | --- | --- | | Lower  out-of-band  region | In-band  region | Upper  out-of-band  regionNOTE A | | | 43.5 < f < 52.6  (GHz) | 52.6 < f < 71.0  (GHz) | 71 < f < 110  (GHz) | 110 < f < 142  (GHz) | | Vector Network Analyzer (VNA) | 0.30 | 0.40 | 0.80 | 1.00 | | Spectrum/Signal Analyzer (SA) | 0.70 | 0.90 | 1.50 | 2.30 | | Power Meter (PM) | 0.20 | 0.30 | 0.50 | Limited availability | | Signal Generator (SG) | 0.90 | 1.20 | 1.30 | 2.40 | | NOTE A | Including mismatch between instrument and up/down converter. | | | |   Proposal 5: UID C1-1: Uncertainty of the RF power measurement equipment - high power (EIRP, TRP): use power meter MU of 0.30 dB and additional absolute power level calibration stage for measurements related to conformance testing of radiated transmit power requirement.  Proposal 6: UID C1-2: RF signal generator: use power meter MU of 0.50 dB and additional absolute power level calibration stage for measurements related to conformance testing of OTA reference sensitivity requirement.  Proposal 7: UID C1-3: Uncertainty of the network analyser: use VNA MU of 0.40 dB for measurements related to conformance testing of radiated transmit power requirement and OTA reference sensitivity.  Proposal 8: In the MU evaluation for FR2-2 upper spurious region consider TE MU provided as proposals in Table 2.2-4 for UID C1-7, C1-3 and C1-4. |
| R4-2210186 | Nokia, Nokia Shanghai Bell | Proposals on measurement uncertainties of BS OTA transmitter requirements for extending current NR operation to 71 GHz  Proposal 2: For UID which have values in the ‘43.5 < f ≤ 60 GHz’ column (i.e., C1-3, C1-7, A2-20, C1-2, MUOOBint, A2-5a, A2-19, MUPA), we propose to use the values also for 57 < f ≤ 71 GHz, as the values are either already relaxed compared to the ones in the ‘37 < f ≤ 43.5 GHz’ column or the same values are used for different frequency ranges in FR2.  Proposal 3: For UID which do not have values in the ‘43.5 < f ≤ 60 GHz’ column (i.e., C1-1, C1-7, C1-8, C1-9, A2-5b, B2-5), we propose to apply the same step size comparing the values in the ‘24.25 < f ≤ 29.5 GHz‘ and ‘37 < f ≤ 43.5 GHz’ columns for 43.5 < f ≤ 60 GHz and then for 57 < f ≤ 71 GHz, based on the general trend of implementation complexity as the target frequency increases in FR2-2. |

## Open issues summary

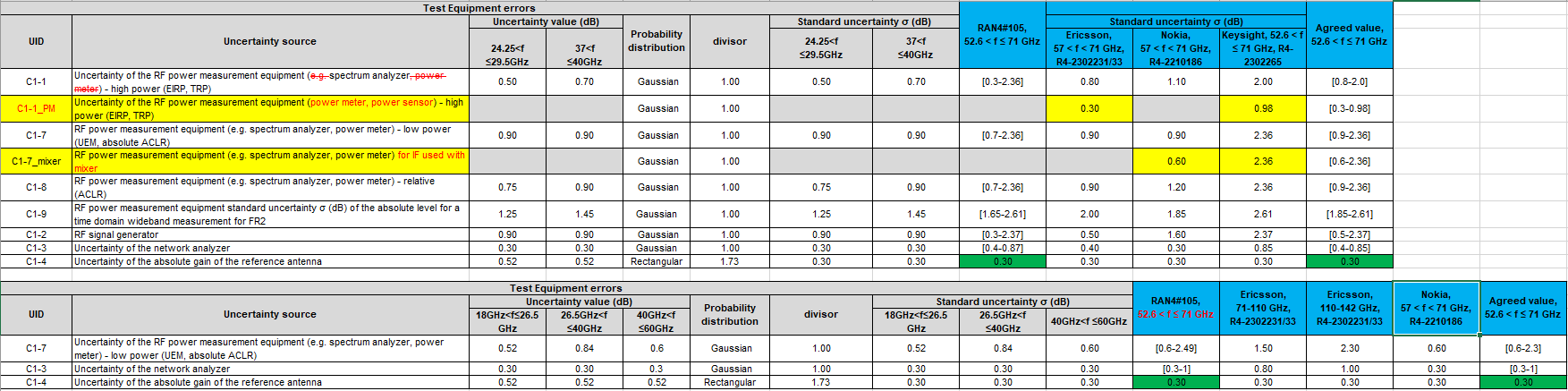
### Sub-topic 4-1 TE MU

Related proposals were captured in Tx and Rx Excel spreadsheet for the purpose of MU budget alignment.

**Recommended WF**:

* Refer to Tx and Rx MU Excel sheets where Test Equipment MU were captured. Continue discussion to further align inputs.
* Follow the decision on issues 1-1 to 1-4.

TX:



RX:



# Topic #5: CRs to core specification TS 38.104

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2301913/14 | NEC | Draft CR to 38.104: Correction on Rx intermodulation requirements for FR2-2  Proposal: Rx intermodulation requirement: Add 400 MHz as an exceptional condition that SCS for the wanted signal and the interference signal is not same.  Related CRs to TS 38.141-2 in R4-2301915/16. |
| R4-2302260, R4-2300185 | Nokia, Nokia Shanghai Bell | CR to TS 38.104 on table references for OTA operating band unwanted emission limits  Proposal: Include table references for OTA operating band unwanted emission limits in FR2-2 in the requirement statements. |
| R4-2302461/62 | Huawei, HiSilicon | CR to TS 38.104: NR-ARFCN table reference correction for band n263  Proposal: Reference to Table 5.4.2.3-3 (Applicable NR-ARFCN for operation in band n263) is corrected. |

## Open issues summary

# Topic #6: CRs to test specification TS 38.141-2

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2302463 | Huawei, HiSilicon | Big CR to TS 38.141-2: FR2-2 BS RF test requirements introduction, Rel-17  Proposal: Introduction of FR2-2 BS test requirements.  **Moderator : Cat A for Rel-18 missing.** |
| R4-2302229/30 | Ericsson | Draft CR to TS 38.141-2: Addition of radiated transmit power requirement for FR2-2 in subclause 6.2  Proposal: In Table 6.2.5-1 a new table entry is added for the freqeuncy range 52.6 to 71.0 GHz.  Moderator: content to be Endorsed and to be added to the revision of big CR in R4-2302463. |
| R4-2300640 | Rohde & Schwarz | Update to FR2-2 Test model  Proposal: Addition of clarifying statement in Sec 4.9.2.2 of the spec (38.141-2)  Moderator: Updates technical content which was Endorsed last meetring in R4-2220307. Once R4-2300640 is technically Endorsed, this draft CR content to be added to the revision of big CR in R4-2302463. |
| R4-2301915/16 | NEC | Draft CR to 38.141-2: Correction on Rx intermodulation requirements for FR2-2 (Rel-17/Rel-18)  Proposal: Add 400 MHz as an exceptional condition that SCS for the wanted signal and the interference signal is not same. |
| R4-2300188 | Nokia, Nokia Shanghai Bell | Draft CR to TS 38.141-2 in clauses 6.3 to 6.5 for extending current NR operation to 71GHz  Proposal: Required changes are made in clauses 6.3 to 6.5 (and related MU and TT in clause 4.1.2.2 and annex C.1) for extending current NR operation to 71GHz  Moderator: modified sections are already captured in big CR in R4-2302463, while the newly introduced MU/TT values are to be agreed. |
| R4-2302267 | Keysight Technologies UK Ltd | draftCR to 38.141-2: 71 GHz Extension BS EVM Clause 6.6.3  Proposal: Remove [] on EVM requirement value for FR2-2. This draftCR is on top of previously endorsed draft CR for FR2-2 (R4-2220204) for removal of [] from clause 6.6.3.  Moderator: modified sections are already captured in big CR in R4-2302463, while the removal of [] is to be agreed. |

## Open issues summary

# Topic #7: CRs to TR 37.941

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2302226 | Ericsson | Draft CR to TR 37.941: Addition of aspects related to EIRP measurement in CATR relevant for FR2-2 in sub-clause 7.3, 8.3, 9.2.3, 9.2.7, 9.2.8, 9.3.3, 9.3.4 and 9.3.5  Proposal: This draft CR adds technical background information relevant for FR2-2 OTA testing relevant for EIRP measureemnt in CATR is provided in sub-clause 7.3, 8.3, 9.2.3, 9.2.7, 9.2.8, 9.3.3, 9.3.4 and 9.3.5. |
| R4-2300580 | CATT | Draft CR for 37.941, On FR2-2 RX directional requirements in clauses 10.1-10.5 and respective MU and TT summary  Proposal: Introduce FR2-2 MU for OTA RX directional requirements in clauses 10.1-10.5. |
| R4-2302227 |  | Draft CR to TR 37.941: Addition of aspects related to EIS measurement in CATR relevant for FR2-2 in sub-clause 10.2.3 and sub-clause 10.2.7  Proposal: Adds technical background information relevant for FR2-2 OTA testing relevant for EIS measurement in CATR is provided in sub-clause 7.3, 8.3, 9.2.3 and 9.2.7. |
| R4-2302235 |  | Draft CR to TR 37.941: Addition of technical background information related to test of receiver out-of-band blocking in a general chamber in subclause 14.2  Proposal: The draft CR modifes the structure for testing receiver out-of-band blocking in the general chamberto handle FR2-2 and add MU evaluation for FR2-2 along side with MU evaluation appllicable for FR2-1. |
| R4-2302268 | Keysight Technologies UK Ltd | DraftCR to 37.941: 71 GHz Extension TE MU update  Proposal: TE MU values in Annex C.1 and C.2 are updated. |
| R4-2302228 |  | Proposal: In this draft CR relevant technical information for FR2-2 is added for RC test method for BS out power power, ACLR, OBUE and spurious emissions for sections 11.2.5, 11.3.5, 11.4.5 and 12.2.4. |