**3GPP TSG-RAN WG4 Meeting # 98-bis-e R4-2115773**

**Electronic Meeting, 12th – 20th April, 2021**

**Agenda item:** 5.1.4, 5.2.2.1, 6.1.9.1

**Source:** Moderator (Ericsson)

**Title:** Email discussion summary for [100-e][301] BSRF\_Maintenance

**Document for:** Information

# Introduction

The thread covers all BS RF maintenance agenda items. Topics are divided according to the agenda, with one of the Rel-16 topics as a separate topic:

1. BS RF maintenance for NR Rel-15 (5.1.4)
2. BS RF maintenance for LTE Rel-15 (5.2.2.1)
3. BS RF maintenance for NR/LTE Rel-16 (6.1.9.1)
4. Relative calibration approach for OTA measurements

# Topic #1: BS RF maintenance for NR Rel-15 (5.1.4)

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Title** |
| R4-2113314 | Ericsson | CR to TR 38.921: Addition of array antenna model extension in subclause 8.1 |
| R4-2113315 | Ericsson | CR to TR 38.820: Addition of array antenna model extension in subclause 7.2 |
| R4-2113077  R4-2113083 | Huawei, HiSilicon | OTA transmitter intermodulation 38.104 R15  OTA transmitter intermodulation 37.105 R15 |
| R4-2113068 R4-2113069 | Huawei, HiSilicon | Correction on the test configuration for NC operation 37.141 R15/R16 |
| R4-2114400 | Huawei | Draft CR to TS 37.104: addition of the missing note in applicability table for BC2 WA BS OBUE, Rel-16 |
| R4-2113918 | ZTE | TP to TR 38.921: MR/LA BS UEM requirements [new in 2nd round] |

## Companies views’ collection for 1st round

### CRs/TPs comments collection

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2113315 | Nokia: no need to update this TR as extended AAS model is agreed for operating within 1710 to 4990 MHz, which is outside the 7 -24 GHz scope of this TR. |
| Huawei: agree with Nokia, no need for the update since it is not within the range 1710 to 4990 MHz |
| Ericsson (TE): The applicability of the sub-array model is not limited to the range 1710 to 4990 MHz, which was the scope of the previous work. TR 38.820 have figures and text related to antenna geometries using sub-arrays. It would therefore be natural to show how the antenna model can be extended to support such antenna structures. Relevant parameter sets for a base station operating in 7-24 GHz with sub-arrays will need further study. |
| Qualcomm: Agree with Nokia and Huawei, the extended AAS model was agreed for operating only within 1710 to 4990 MHz. Further analysis would be required for the 7-24 GHz band.  ZTE: similar view as Nokia, Huawei and Qualcomm. |
| Ericsson (TE): In current version of TR 38.820, subclause 7.2 relevant antenna array topologies for the frequency range 7 to 24 GHz are captured. Sub-arrays structures are described in sub-clause 7.2.3. In the following section the antenna model for single elements is described and how parameters are determined. It would therefore be reasonable to also add the extended antenna model supporting sub-arrays to complete the technical background. Since the parameter values required by the extended model is not yet determined for the case using sub-arrays, we can add additional information in the CR saying that the parameter values is still under discussion. A revision of the CR can be prepared to add additional information on the situation on parameters and supported deployment scenarios. |
| R4-2113314 | Huawei: same comment as above, no need for the update since it is not within the range 1710 to 4990 MHz  ZTE: similar as before. |
| R4-2113077  R4-2113083 | Nokia: not clear how is the maximum of 40dBm determined. |
| Huawei: for the same topic, it is discussed also in thread 302, we can have the discussion in one thread firstly, e.g. thread 302.  Response to Nokia:  For conducted requirement the 46 dBm TX power is assumed, and for AAS 8 columns are normally assumed in RAN4, hence for the closest column the TX power for two polarizations will be 46-9+3=40 (dBm). We think it is important to define a feasible power level for the test, otherwise the requirements can not be tested in the test chamber. |
| Ericsson (JS): Introducing a cap on the power is a good idea. The scenario leading to 40 dBm as proposed is however not what was considered for doing the work in AAS. The main principle should be that the victim and aggressor have the same power capability in terms of TRP, in the same fashion as for the blocking requirement. The same interferer level as used for co-location blocking should be re-used, i.e. 46 dBm (TS 38.104, table 10.6.2.2-1). |
| Huawei (LH):  For single column system, 46 dBm is a reasonable value which is the same as co-location blocking requirement. Meanwhile for multi-column system it might be higher than that in the closest column. However, we agree to introduce a fixed value for all AAS systems. Hence we are ok to 46 dBm as the power cap. What is the view from other companies on 46 dBm? If it is agreeable I can revised the CR. |
| R4-2113068 R4-2113069 | Ericsson (JS): The reason for change is not clear. NTC3 supports more than two carriers, the 4th bullet describes how 4 carriers are set up. This is also accounted for in the now deleted text: “If the reduced number of supported carriers is 4 or more”. Further motivation for the change is needed and the text should rather be revised than deleted. |
| Huawei (LH):  Response to Ericsson:  The 4th bullet is talking about receiver test. For TX, NTC3 test configuration is constructed with fixed two carriers.  “- For single-band operation receiver tests, if the remaining gap is at least 20 MHz plus the channel BW of the E-UTRA carrier used in the previous step and the BS supports at least 2 UTRA and 2 E-UTRA carriers, place a E-UTRA carrier of this BW adjacent to the carrier at the lower Base Station RF Bandwidth edge and UTRA carrier adjacent to the carrier at the upper Base Station RF Bandwidth edge. The nominal carrier spacing defined in clause 4.5.1 shall apply. The UTRA FDD carrier may be shifted maximum 100 kHz towards higher frequencies to align with the channel raster.” |
| Ericsson (JS): We agree that there is a problem with the respective text, as only two carriers are considered in the Tx testing in the description of the test configuration. However, in case the declared PRated,t,TABC is much higher than double of the declared power per carrier the test configuration does not stress the BS at all. As this issue is present in other specs as well, we might want to double check that we do not need more clarifications in the description of the test configuration.  (This topic is also under [302]) |
| R4-2113918 | Nokia: is this proposed to be sent to ITU-R WP5D also, or only for future RAN4 reference? |

## Summary for 1st round

### CRs/TPs

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2113314 | Proposed to be not pursued. |
| R4-2113315 | To be revised, Revised to R4-2115649. |
| R4-2113077 R4-2113083 | To be revised, Revised to R4-2115648  R4-2115654 |
| R4-2113068 R4-2113069 | Return to. |
| R4-2114400  R4-2114401 | The CR is agreeable.  The corresponding Cat A CR is agreeable. |
| R4-2113918 | Return to. (For 2nd round discussions only) |

## Discussion on 2nd round (if applicable)

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| **CR/TP number** | **Comments collection** |
| R4-2115649 | Huawei: As comment in 1st round, there is no need to update the TR for 7-24GHz. Except the related parameters, further study would be required also for the applicability of the sub-array model to 7-24 GHz band, since the sub-array model was only agreed for operation within 1710 to 4990 MHz. |
| Ericsson (TE): Based on all comments in [301, 302 and 318] it seems difficult to find a place where to put the information in RAN4 TRs. To stimulate further discussion for 7 to 24 GHz it is always beneficial to have the technical background for 1710-4990 included. We have a clear statement at the end that further discussions are required for 7 to 24 GHz. Regarding the applicability of the model for 7 to 24 GHz, it is hard to argue that the model is not applicable. The main question is whether we can find proper and relevant parameters for the model to make it usable. There is no physical limitation to the model as such regarding frequency support. |
| ZTE: if necessary, when going to 7-24GHz WID, then we could further discuss that antenna model |
| R4-2115648 R4-2115654 |  |
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| R4-2113068 R4-2113069 | Ericsson: We agree that the present text is not correct. If it is removed however, the power allocation at the end of NTC3 may be in conflict with the allocation of 2 carriers only. As we have proposed, a revision of the text may be needed rather than a deletion. Perhaps this can be looked into until the next RAN4 meeting. |
| Huawei: we are ok to come back next RAN4 meeting. |
|  |
| R4-2113918 | Huawei: we are ok to discuss the UEM for Micro and Pico. We require some time to check the mask if it is not urgent. |
| Ericsson: We agree that this may be better looked into until next meeting, since it was also brought into the thread at late stage. |
| Nokia: is this proposed to be sent to ITU-R WP5D also, or only for future RAN4 reference? |
| ZTE: we could further discuss this next meeting.and regarding whether reply to ITU-R WP5D, I don’t have strong opinions on that. If necessary, we could do that. |

# Topic #1: BS RF maintenance for LTE Rel-15 (5.2.2.1)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Title** |
| R4-2112294  R4-2112297 | Ericsson | Draft CR to 36.104: Correction In-band blocking for multi-band Base Stations  Draft CR to 36.141: Correction In-band blocking for multi-band Base Stations |

## Companies views’ collection for 1st round

### CRs/TPs comments collection

No comments.

## Summary for 1st round

### CRs/TPs

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| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2112294 R4-2112297  R4-2112295 R4-2112296 R4-2112298 R4-2112299 | The CRs are agreeable.  The corresponding Cat A CRs are agreeable. |

# Topic #1: BS RF maintenance for NR/LTE Rel-16 (6.1.9.1)

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2112269 | Nokia, Nokia Shanghai Bell | Draft CR to TS 38.141-1: Clarification of power boosted NB-IoT RB placement |
| R4-2112290  R4-2112292 | Ericsson | Draft CR to 37.104: MSR band table update  Draft CR to 37.141: MSR band table update |
| R4-2113028 | Keysight Technologies UK Ltd | Draft CR to 37.941: BS OTA test, FR2 Rx OOB test MU value Math correction (14.2.4, 17) |
| R4-2113030 | Keysight Technologies UK Ltd | about BS conformance test FR2 Rx out of band test MU calculation |
| R4-2114398 | Huawei | Draft CR to TR 37.941: correction of the FR2 upper frequency (43.5 GHz), Rel-16 |

## Companies views’ collection for 1st round

### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| R4-2112290  R4-2112292 | Nokia: prefer option 2, can further make the frequency range columns narrower by moving ‘MHz’ into the heading and use space instead of tab around ‘-‘. |
| Huawei: prefer option 2 |
| NEC: prefer option 2. |
| Ericsson (JS): Prefer to go forward with option 2. Ericsson volunteers to revise and produce complete Draft CRs in the 2nd round. |
| R4-2113028  R4-2113030 | Nokia: result according to formula is 3.6499 so it should be rounded to either 3.6 or 3.65 but not 3.64. |
| keysight: For Nokia, reason of showing one decimal point or two are simply because aligning original text. It is correct that actual value is 3.6499 so that number for MU is rounded as 3.6 |
| NEC: For FR1, OTA OOB blocking MU depends on both fwanted and finterferer. Is it true OTA OOB blocking MU does not depend on finterferer for FR2? |
| Keysight: additional response to Nokia,  Regarding with 3.64, because it is intermediate number towards 3.6 actual MU value, with showing 3.65 is mis-leading, it leaves impression as final value seems 3.7 which is not correct. |
| Keysight: for NEC, FR2 OOB test uses Wanted signal and OOB interferer (CW blocker). Short answer is OOB interferer is in calculation after correction. So MU from interferer is calculated.  This correction is to remove TE-MU (modulated signal) which doesn’t represent any used signal during OOB test. In defined equation, RSS (EIS, TE, OOB-interferer, PA) and broadband noise added. However, EIS includes Wanted signal MU inside EIS number and OOB-interferer added in equation. Then TE MU dones’t represent any used signal. So this correction removed TE-MU which doesn’t represent any signal used in this test. |
| R4-2114398 | Nokia: should spreadsheet 3 and spreadsheet 4 also be updated from 40GHz to 43.5GHz to align with the main content in the TR? |
| Huawei (MS): This should be done in the revision to update Excels |
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## Summary for 1st round

### CRs/TPs

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2112269  R4-2112270 | The CRs are agreeable.  The corresponding Cat A CRs are agreeable. |
| R4-2112290 R4-2112292 | To be revised, Revised to R4-2115650  R4-2115651 |
| R4-2113028 | To be revised, Revised to R4-2115652 |
| R4-2113030 | Proposed to be Noted. |
| R4-2114398 | To be revised, Revised to R4-2115653 |

## Discussion on 2nd round (if applicable)

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| **CR/TP number** | **Comments collection** |
| R4-2115650 R4-2115651 | Comments provided on revised CRs directly. |
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| R4-2115652 | Comments provided on revised CRs directly. |
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| Revised to R4-2115653 |  |
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# Topic #4: 4. Relative calibration approach for OTA measurements

In RAN4#98e, there was proposal about “Relative calibration approach” and WF agreed is to continue to discuss in future meetings. Two proposals were received at RAN4#100-e.

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2112235 | ROHDE & SCHWARZ | Proposal: A relative calibration approach is proposed as an alternate method to the more typical “absolute” approach so labs can optimize their MU assessment in cases where the maximum accepted test system uncertainty could not be reached. |
| R4-2113294 | Keysight Technologies UK Ltd | Conclusion: Relative approach is already in consideration of existing MU Budget table calculation because no duplicated terms related with cabling etc. are listed in both calibration measurement stage and BS (DUT) measurement stage.  Proposal: There is no need to change MU budget for relative approach. |

Proposed CR (for 2nd round, if agreed as WF):

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| --- | --- | --- |
| **T-doc number** | **Company** | **Title** |
| R4-2112236 | ROHDE & SCHWARZ | Draft CR to TR 37.941: Relative calibration approach |

## Open issues summary

### Sub-topic 4-1

A relative calibration approach is proposed for MU assessment in one paper, but another paper argues it is not necessary.

**Issue 4-1: Introduction of relative calibration approach**

* Proposals
  + Option 1: Introducing relative calibration approach for MU assessment (CR in R4-2112236).
  + Option 2: There is no need to change MU budget for relative approach (No CR).

## Companies views’ collection for 1st round

### Open issues

Sub topic 4-1

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| **Company** | **Comments** |
| Keysight | As we wrote in our document, with using relative approach, which can cancel duplicated entry but can’t totally cancel equipment needed which is power measurement equipment (for EIRP) and signal generator (for EIS). Relative approach indeed already taken in consideration of original budget table. So that it won’t get additional gain. |
| R&S | In our understanding, KS interpretation in R4-2113294 of the relative calibration proposal is missing some key points:   * The reductions described in Observation 1 with respect to the wording in CTIA Test Plan are mostly related to cabling, thus related to contributors like insertion loss variation or mismatch. This is actually a good practice to reduce those MU components, but the relative calibration approach described in R&S contributions are more related to the absolute uncertainty contributors for the receiving device and the signal generator (G.4 and G.5 sections on CTIA Test Plan). * The concept of a “reference receiver” was introduced to differentiate from a more general receiver considered when deriving **C1-1 Uncertainty of the RF power measurement equipment** assuming extended capabilities (frequency selectivity, demodulation capabilities for EVM measurements, etc.) in order to cover the majority of measurements. Of course, the potential improvement of such a relative calibration approach depends on the absolute accuracy of the selected “reference receiver”. * From equipment point of view, the relative approach has not been considered in the current MU budget tables since separate equipment is considered for each stage (i.e. VNA for Stage 1 and Receiver/Generator for Stage 2).   A very simplistic description of the foundation for this approach is that Stage 1: Calibration is performed with the same equipment used later on to perform Stage 2: BS measurements. That brings the fact that the path loss obtained in Stage 1 includes the absolute level uncertainty of the receiver/signal generator which is cancelled out during BS measurement just because the reading (Rx/Tx power from the receiver/signal generator) is corrected with the path loss. |
| Keysight | We understand what’s described in CTIA document and not missing any key point.  Here is different way of explaining point.  For example, for the case ACLR relative measurement, equipment absolute uncertainty contribution can be cancelled out (still linearity should be in consideration) because measured result is relative value.  For measuring absolute result such as most of power measurement and receiver measurement, one term of these equipment contribution can’t be cancelled out because measured result is absolute value.  Regarding with “reference receiver”, because TE venders have agreed to use the value we already have for power measurement equipment, R&S equipment should follow previously agreed number for budget calculation even R&S equipment claims better accuracy number. |
| Huawei (MS) | Considering technical concerns among TE vendors, it seems to be premature to proceed with the CR. May we encourage interested parties to continue discussion during the second round to check if there is any consensus possible?  For the proponents: if you have some proposals on the handling of this discussion in future, please share.  For now, we can probably suggest to the Moderator to Return to the related contributions, and come back in 2nd round. |

## Summary for 1st round

### Open issues

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|  | **Status summary** |
| **Sub-topic#4-1** | Candidate options: Option 1 and 2 remain, there is still no consensus.  Recommendations for 2nd round: Discussions to continue.  The two discussions paper can be noted. |

### CRs/TPs

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2112236 | Return to. |

## Discussion on 2nd round (if applicable)

Sub topic 4-1

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| **Company** | **Comments** |
| R&S | Considering the feedback provided during the first round and the offline exchange between TE vendors, it does not seem possible to resolve the concerns. Therefore, and in the absence of interest from other companies, we are ok to drop the proposal and note the CR. |

### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| R4-2112236 | R&S: The draft CR can be noted. |
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# Recommendations for Tdocs

## 1st round

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-2113077 | OTA transmitter intermodulation 38.104 R15 | Huawei, HiSilicon | Revised |  |
| R4-2113083 | OTA transmitter intermodulation 37.105 R15 | Huawei, HiSilicon | Revised |  |
| R4-2113314 | CR to TR 38.921: Addition of array antenna model extension in subclause 8.1 | Ericsson | Not pursued |  |
| R4-2113315 | CR to TR 38.820: Addition of array antenna model extension in subclause 7.2 | Ericsson | Revised |  |
| R4-2114400 | Draft CR to TS 37.104: addition of the missing note in applicability table for BC2 WA BS OBUE, Rel-16 | Huawei | Agreeable |  |
| R4-2114401 | Draft CR to TS 37.104: addition of the missing note in applicability table for BC2 WA BS OBUE, Rel-17 | Huawei | Agreeable |  |
| R4-2112294 | Draft R to 36.104: Correction In-band blocking for multi-band Base Stations | Ericsson | Agreeable |  |
| R4-2112295 | Draft R to 36.104: Correction In-band blocking for multi-band Base Stations | Ericsson | Agreeable |  |
| R4-2112296 | Draft R to 36.104: Correction In-band blocking for multi-band Base Stations | Ericsson | Agreeable |  |
| R4-2112297 | Draft CR to 36.141: Correction In-band blocking for multi-band Base Stations | Ericsson | Agreeable |  |
| R4-2112298 | Draft CR to 36.141: Correction In-band blocking for multi-band Base Stations | Ericsson | Agreeable |  |
| R4-2112299 | Draft CR to 36.141: Correction In-band blocking for multi-band Base Stations | Ericsson | Agreeable |  |
| R4-2112269 | Draft CR to TS 38.141-1: Clarification of power boosted NB-IoT RB placement | Nokia, Nokia Shanghai Bell | Agreeable |  |
| R4-2112270 | Draft CR to TS 38.141-1: Clarification of power boosted NB-IoT RB placement | Nokia, Nokia Shanghai Bell | Agreeable |  |
| R4-2112290 | Draft CR to 37.104: MSR band table update | Ericsson | Revised |  |
| R4-2112292 | Draft CR to 37.141: MSR band table update | Ericsson | Revised |  |
| R4-2113030 | about BS conformance test FR2 Rx out of band test MU calculation | Keysight Technologies UK Ltd | Noted |  |
| R4-2113028 | Draft CR to 37.941: BS OTA test, FR2 Rx OOB test MU value Math correction (14.2.4, 17) | Keysight Technologies UK Ltd | Revised |  |
| R4-2114398 | Draft CR to TR 37.941: correction of the FR2 upper frequency (43.5 GHz), Rel-16 | Huawei | Revised |  |
| R4-2112235 | Relative calibration approach using reference receiver | ROHDE & SCHWARZ | Noted |  |
| R4-2113294 | Applying relative calibration approach on BS OTA conformance testing | Keysight Technologies UK Ltd | Noted |  |

## 2nd round

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| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |

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

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|  |  |  |
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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)